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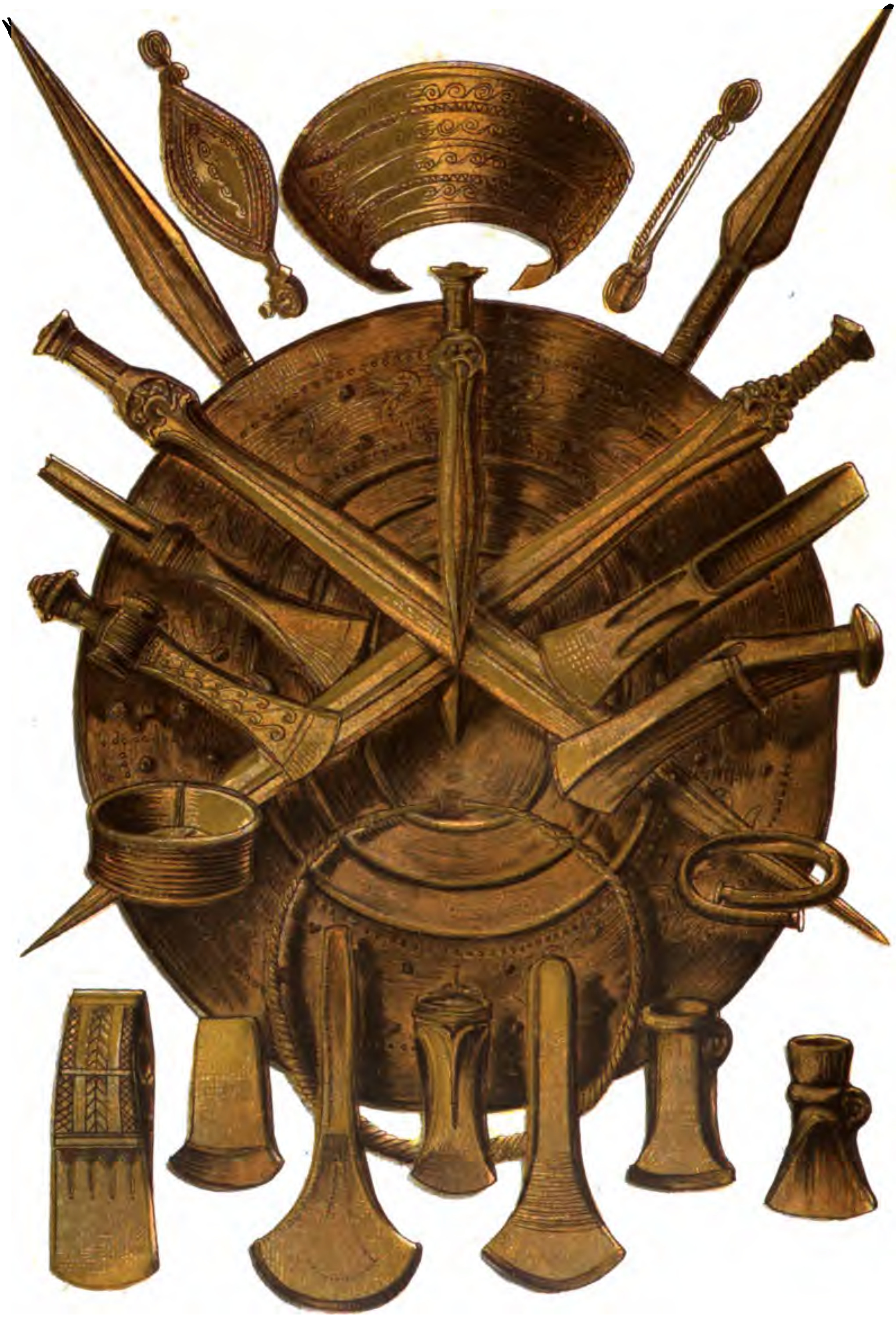

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Vol. XIX.——(PHY—PRO)

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K

ENCYCLOPÆDIA BRITANNICA.

PHY—PHY.

PHYLACTERY (*φυλακτήριον*) is the name given in the New Testament to the תְּפִלִּין (tefillîn) or "prayer-thongs" of the Jews. Every Jew wears at prayer two of these thongs—(1) the hand-tefilla, a leather thong wound round the left arm and supporting a small case containing a parchment strip with the passages Exod. xiii. 1–10, 11–16, Deut. vi. 4–9, xi. 13–21 written in four columns; (2) the head-tefilla, a similar thong with the four passages inscribed on four separate slips of parchment, and worn round the head so that the box with the texts rests on the forehead. The use of these phylacteries is justified by a literal interpretation of expressions in the passages above cited, and they form, together with the צִיצִית (zîzîth) or "fringe" (Numb. xv. 37 *sq.*) and the מְזוּזָה (mezûza) above the door, the three sets of visible signs by which the Israelite is constantly reminded of his duty to God. The zîzîth is no longer placed on the outer garment as in New Testament times (Matt. xxiii. 5), but on the woollen scarfs called טַלִּית (ṭallîth), of which the Jewish man always wears one, while another is wound round the head and neck during prayer. The mezûza is now a longish box fixed over the right doorpost of houses or rooms and containing a parchment with Deut. vi. 4–9, xi. 13–21.

In their origin there can be little doubt that the phylacteries are, according to the proper sense of the Greek word, a kind of amulet, not essentially different from the Aramaic ḳmî'é, and in fact "the Hebrew" of the Hexapla uses the word "phylacteries" for the amulets (*E. V.* pillows) of Ezek. xiii. 18. Phylactery and mezûza were supposed to keep off hurtful demons (Targ. on Cant. viii. 3). For further particulars, see Surenhusius, *Mishna*, i. 9 *sq.*, and Bodenschatz, *Kirch. Verf. d. heutigen Juden*, iv. 9 *sq.*

PHYLLOXERA. See VINE.

PHYSICAL CONSTANTS. See WEIGHTS AND MEASURES.

PHYSICAL GEOGRAPHY. See vol. x. pp. 188–189.

PHYSICAL SCIENCES.[1] According to the original meaning of the word, physical science would be that knowledge which is conversant with the order of nature—that is, with the regular succession of events whether mechanical or vital—in so far as it has been reduced to a scientific form. The Greek word "physical" would thus be the exact equivalent of the Latin word "natural." In the actual development, however, of modern science and its terminology these two words have come to be restricted each to one of the two great branches into which the knowledge of nature is divided according to its subject-matter. Natural science is now understood to refer to the study of organized bodies and their development, while physical science investigates those phenomena primarily which are observed in things without life, though it does not give up its claim to pursue this investigation when the same phenomena take place in the body of a living being. In forming a classification of sciences the aim must be to determine the best arrangement of them in the state in which they now exist. We therefore make no attempt to map out a scheme for the science of future ages. We can no more lay down beforehand the plan according to which science will be developed by our successors than we can anticipate the particular discoveries which they will make. Still less can we found our classification on the order in time according to which different sciences have been developed. This would be no more scientific than the classification of the properties of matter according to the senses by which we have become acquainted with their existence.

It is manifest that there are some sciences, of which we may take arithmetic as the type, in which the subject-matter is abstract, capable of exact definition, and incapable of any variation arising from causes unknown to us which would in the slightest degree alter its properties. Thus in arithmetic the properties of numbers depend entirely on the definitions of these numbers, and these definitions may be perfectly understood by any person who will attend to them. The same is true of theoretical geometry, though, as this science is associated in our minds with practical geometry, it is difficult to avoid thinking of the probability of error arising from unknown causes affecting the actual measurement of the quantities. There are other sciences, again, of which we may take biology as the type, in which the subject-matter is concrete, not capable of exact definition, and subject to the influence of many causes quite unknown to us. Thus in biology many abstract words such as "species," "generation," etc., may be employed, but the only one thing which we can define is the concrete individual, and the ideas which the most accomplished biologist attaches to such words as "species" or "generation" have a very different degree of exactness from those which mathematicians associate, say, with the class or order of a surface, or with the umbilical generation of conicoids. Sciences of this kind are rich in facts, and will be well occupied for ages to come in the co-ordination of these facts, though their cultivators may be cheered in the meantime by the hope of the discovery of laws like those of the more abstract sciences, and may indulge their fancy in the contemplation of a state of scientific knowledge when maxims cast in the same mould as those which apply to our present ideas of dead matter will regulate all our thoughts about living things.

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[1] The paper of the late Professor J. Clerk Maxwell which is presented to the reader under this head was prepared at the time when the ninth edition of the *Encyclopædia Britannica* was being planned, and bore in his MS. the title "Remarks on the Classification of the Physical Sciences."

What is commonly called "physical science" occupies a position intermediate between the abstract sciences of arithmetic, algebra and geometry, and the morphological and biological sciences. The principal physical sciences are as follows.

A. *The Fundamental Science of Dynamics, or the doctrine of the motion of bodies as affected by force.*—The divisions of dynamics are the following. (1) Kinematics, or the investigation of the kinds of motion of which a body or system of bodies is capable, without reference to the cause of these motions. This science differs from ordinary geometry only in introducing the idea of motion,—that is, change of position going on continuously in space and time. Kinematics includes, of course, geometry, but in every existing system of geometry the idea of motion is freely introduced to explain the tracing of lines, the sweeping out of surfaces, and the generation of solids. (2) Statics, or the investigation of the equilibrium of forces,—that is to say, the conditions under which a system of forces may exist without producing motion of the body to which they are applied. Statics includes the discussion of systems of forces which are equivalent to each other. (3) Kinetics, or the relations between the motions of material bodies and the forces which act on them. Here the idea of matter as something capable of being set in motion by force, and requiring a certain force to generate a given motion, is first introduced into physical science. (4) Energetics, or the investigation of the force which acts between two bodies or parts of a body, as dependent on the conditions under which action takes place between one body or part of a body and another so as to transfer energy from one to the other.

The science of dynamics may be divided in a different manner with respect to the nature of the body whose motion is studied. This forms a cross division. (1) Dynamics of a particle; including its kinematics or the theory of the tracing of curves, its statics or the doctrine of forces acting at a point, its kinetics or the elementary equations of motions of a particle, and its energetics, including, as examples, the theory of collision and that of central forces. (2) Dynamics of a connected system, including the same subdivisions. This is the most important section in the whole of physical science, as every dynamical theory of natural phenomena must be founded on it. The subdivisions of this, again, are—*a.* dynamics of a rigid system, or a body of invariable form; *b.* dynamics of a fluid, including the discussion (α) of its possible motion, (β) of the conditions of its equilibrium (hydrostatics), (γ) of the action of force in producing motion (hydro-dynamics, not so unsatisfactory since Helmholtz, Stokes, and Thomson's investigations), and (δ) of the forces called into play by change of volume; *c.* dynamics of an elastic body; *d.* dynamics of a viscous body.

B. *The Secondary Physical Sciences.*—Each of these sciences consists of two divisions or stages. In the elementary stage it is occupied in deducing from the observed phenomena certain general laws, and then employing these laws in the calculation of all varieties of the phenomena. In the dynamical stage the general laws already discovered are analyzed and shown to be equivalent to certain forms of the dynamical relations of a connected system (A, 2), and the attempt is made to discover the nature of the dynamical system of which the observed phenomena are the motions. This dynamical stage includes, of course, several other stages rising one above the other; for we may successfully account for a certain phenomenon, say the turning of a weathercock towards the direction of the wind, by assuming the existence of a force having a particular direction and tending to turn the tail of the cock in that direction. In this way we may account not only for the setting of the weathercock but for its oscillations about its final position. This, therefore, is entitled to rank as a dynamical theory. But we may go on and discover a new fact, that the air exerts a pressure and that there is a greater pressure on that side of the cock on which the wind blows. This is a further development of the theory, as it tends to account for the force already discovered. We may go on and explain the dynamical connection between this inequality of pressure and the motion of the air regarded as a fluid. Finally, we may explain the pressure of the air on the hypothesis that the air consists of molecules in motion, which strike against each other and against the surface of any body exposed to the air.

The dynamical theories of the different physical sciences are in very different stages of development, and in almost all of them a sound knowledge of the subject is best acquired by adopting, at least at first, the method which we have called "elementary,"—that is to say, the study of the connection of the phenomena peculiar to the science without reference to any dynamical explanations or hypotheses. Thus we have—

(1) Theory of gravitation, with discussion of the weight and motion of bodies near the earth, of the whole of physical astronomy, and of the figure of the earth. There is a great deal of dynamics here, but we can hardly say that there is even a beginning of a dynamical theory of the method by which bodies gravitate towards each other.

(2) Theory of the action of pressure and heat in changing the dimensions and state of bodies. This is a very large subject and might be divided into two parts, one treating of the action of pressure and the other of heat. But it is much more instructive to study the action of both causes together, because they produce effects of the same kind, and therefore mutually influence each other. Hence the term "thermodynamics" might be extended to the whole subject were it not that it is already restricted to a very important department relating to the transformation of energy from the thermal to the mechanical form and the reverse. The divisions of the subject are seven. (*a*) Physical states of a substance,—gaseous, liquid, and solid; elasticity of volume in all three states; elasticity of figure in the solid state; viscosity in all three states; plasticity in the solid state; surface-tension, or capillarity; tenacity of solids; cohesion of liquids; adhesion of gases to liquids and solids. (*b*) Effects of heat in raising temperature, altering size and form, changing physical state. (*c*) Thermometry. (*d*) Calorimetry. (*e*) Thermodynamics, or the mutual convertibility of heat and work. (*f*) Dissipation of energy by diffusion of matter by mixture, diffusion of motion by internal friction of fluids, diffusion of heat by conduction. (*g*) Theory of propagation of sound, vibrations of strings, rods, and other bodies.

(3) Theory of radiance. (*a*) Geometrical optics; theory of conjugate foci and of instruments. (*b*) Velocity of light in different media. (*c*) Prismatic analysis of light,—spectroscopy, radiant heat, visible radiance, ultra-violet rays, calorescence, etc., fluorescence, etc. (*d*) Colors of thin plates, diffraction, etc. (*d'*) Proof of the existence of wave-lengths and wave-periods (preparation for dynamical theory). (*e*) Polarized light, radiant heat, etc. (*e'*) The disturbance is transverse to the ray. (*f*) Quantity of energy in the total radiation from a hot body; Prévost's theory of exchanges, etc. (*g*) Theory of three primary colors.

(4) Electricity and magnetism. (*a*) Electrostatics, or distribution and effects of electricity in equilibrium.

(*b*) Electrokinematics, or distribution of currents in conductors. (*c*) Magnetism and magnetic induction (diamagnetism, etc.). (*d*) Electromagnetism, or the effects of an electric current at a distance. Under (*b*) we may discuss electro-chemistry, or the theory of electrolysis; under (*c*) terrestrial magnetism and ship's magnetism; and after (*d*) comes electrokinetics, or electromagnetic phenomena considered with reference to the fundamental science of dynamics. There is also Faraday's discovery of the effects of magnetism on light and the electromagnetic theory of light.

Chemistry is not included in this list, because, though dynamical science is continually reclaiming large tracts of good ground from the one side of chemistry, chemistry is extending with still greater rapidity on the other side into regions where the dynamics of the present day must put her hand upon her mouth. Chemistry, however, is a physical science, and a physical science which occupies a very high rank.

(J. C. M.)

PHYSIOGNOMY. By the Act of Parliament 17 George II. c. 5 all persons pretending to have skill in physiognomy were deemed rogues and vagabonds, and were liable to be publicly whipped, or sent to the house of correction until next sessions.[1] The pursuit thus stigmatized as unlawful is one of great antiquity, and one which in ancient and mediæval times had an extensive though now almost forgotten literature. Physiognomy was regarded by those who cultivated it as a twofold science—(1) a mode of discriminating character by the outward appearance, and (2) a method of divination from form and feature. It was very early noticed that the good and evil passions by their continual exercise stamp their impress on the face, and that each particular passion has its own expression. Thus far physiognomy is a branch of physiology, and from a very early age of human thought it attracted philosophic attention. But in its second aspect it touched astrology, of which Galen[2] says that the physiognomical part is the greater, and this aspect of the subject bulked largely in the fanciful literature of the Middle Ages.

The name originated with the Greeks, who called it *φυσιογνωμία*, *φυσιογνωμονία*, or *φυσιογνωμοσύνη*. According to Principal Blackwell[3] of Aberdeen, Homer wrote upon the lines of the hand; but this is not supported by classical authority. That Homer was a close observer of appearance as correlated with character is shown in his description of Thersites[4] and elsewhere. Hippocrates, writing about 450 B.C., refers to this subject, but not in detail.[5] He believed in the influence of environment in determining disposition, and in the reaction of these upon feature—a view in which he is supported later by Trogus. Galen speaks of it at more length in his work Περὶ τῶν τῆς ψυχῆς ἠθῶν, in which, having discussed the nature and immortality of the soul, he proceeds in chapter vii. to a brief study of physiognomy (ed. Kühn, iv. 795). However, at the end of the chapter he passes over the current physiognomical speculations, saying that he might criticise them but feared to waste time and become tedious over them. In the eighth chapter he quotes with approbation the Hippocratic doctrine referred to above; and in a later work, Περὶ κατακλίσεως προγνωστικά, he speaks of its relations to medicine thus: "Hippocrates igitur, et vetustate admodum notus et scientia admirandus, inquit, 'quocunque exercentes medicinam, physiognomoniæ sunt expertes, horum mens in tenebras devoluta torpida senescit,'" etc.[6] We learn both from Iamblichus[7] and Porphyry[8] that Pythagoras was in the habit of diagnosing the characters of candidates for pupilage before admitting them. However, he seems to have discredited the current physiognomy of the schools, as he rejected Cylo the Crotonian from his discipleship on account of his professing these doctrines, and thereby was brought into considerable trouble.[9] Plato also tells us that Socrates predicted the promotion of Alcibiades from his appearance; and Apuleius[10] speaks of Socrates recognizing the abilities of Plato at first view. On the other hand, it has been recorded by Cicero[11] that a certain physiognomist, Zopyrus, who professed to know the habits and manners of men from their bodies, eyes, face, and forehead, characterized Socrates as stupid, sensual, and dull (*bardus*), "in quo Alcibiades cachinnum dicitur sustulisse." Alexander Aphrodisiensis[12] adds that, when his disciples laughed at the judgment, Socrates said it was true, for such had been his nature before the study of philosophy had modified it. Zopyrus is also referred to by Maximus Tyrius[13] as making his recognitions "intuitu solo."

That one's occupation stamps its impress on the outward appearance was also noticed at an early period. In the curious poem in praise of literature found in the Sallier papyrus (II.) in the British Museum, this is expatiated on, and the effects of divers handicrafts on the workmen are compared with the elevating influences of a literary life by an Egyptian scribe of the XIIth Dynasty, perhaps 2000 years B.C.[14] Josephus tells us that Cæsar detected the pretence of the spurious Alexander by his rough hands and surface.[15]

The first systematic treatise which has come down to us is that attributed to Aristotle,[16] in which he devotes six chapters to the consideration of the method of study, the general signs of character, the particular appearances characteristic of the dispositions, of strength and weakness, of genius and stupidity, of timidity, impudence, anger, and their opposites, etc. Then he studies the physiognomy of the sexes, and the characters derived from the different features, and from color, hair, body, limbs, gait, and voice. He compares the varieties of mankind to animals, the male to the lion, the female to the leopard. The general character of the work may be gathered from the following specimen. While discussing noses, he says that those with thick bulbous ends belong to persons who are insensitive, swinish; sharp-tipped belong to the irascible, those easily provoked, like dogs; rounded, large, obtuse noses to the magnanimous, the lion-like; slender hooked noses to the eagle-like, the noble but grasping; round-tipped retroussé noses to the luxurious, like barn-door fowl; noses with a very slight notch at the root belong to the impudent, the crow-like; while snub noses belong to persons of luxurious habits, whom he compares to deer; open nostrils are signs of passion, etc. Several good editions have been published,[17] and numerous voluminous commentaries written upon it;[1] most subsequent authors have copied from it, with or without acknowledgment. References exist to a work on physiognomy by Theophrastus, but it is not extant; and the next important author is Melampus, the Egyptian hierogrammateus, who lived at the court of Ptolemy Philadelphus, and wrote, about 270 B.C., the work Περὶ παλμῶν μαντική. This, while descriptive, like that of Aristotle, deals largely in omens, in divination from nævi and the twitchings of limbs. It was edited by Camillus Peruscus, and published at Rome (1545) along with those of Polemon and Adamantius.[2] References to physiognomy are to be found in many of the Greek classics.[3] Apion speaks of the metoposcopists who judge by the appearance of the face, and Cleanthes the Stoic says it is possible to tell habits from the aspect (cf. Ecclus. xix. 29, 30). Polemon (c. 150 A.D.) is the next in order who has left a treatise on the subject, similar in character to that of Aristotle; but he excels in graphic descriptions of different dispositions, and differs only from Aristotle in some of his animal comparisons. The best modern edition of his work is contained in Franz's *Scriptores physiognomiæ veteres*. It was translated into Latin and published at Venice by Nicholas Petreius in 1534. This book was referred to by Albertus Magnus, who attributes to its author a second work on the subject. A more important contribution to the literature of physiognomy was added by a converted Jew, Adamantius, about 415. This work is in two books, the first on the expression of the eye, the second on physiognomy in general, mostly Aristotelian in character. He professes to have learned much from the Egyptians, and tells us that nature speaks in the forehead and face and in the silence of the mouth. He follows Aristotle in holding rather a low opinion of the intellect of the female sex, whom he makes the subject of some rather depreciating comparisons. His work was edited with the foregoing by Franz.[4] Artemidorus, Loxus, Philemon, Posidonius,[5] Constantinus,[6] are other early authors frequently quoted by 16th century writers; while Phemonoe, Antiphon, Helenus of Syracuse, and Eumolpius are mentioned as writers by Porta, Albertus Magnus, and others, but their works are not extant.

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[1] The Act 39 Elisabeth, c. 4, declared "all persons fayning to have knowledge of Phisiognomie or like Fantasticall Ymaginacions" liable to "be stripped naked from the middle upwards and openly whipped until his body be bloudye." This was modified by 13 Anne, c. 26, still further by 17 George II., c. 5, which was re-enacted by 5 George IV., c. 83. This last Act only specifies palmistry.

[2] Galen, Περὶ κατακλίσεως προγνωστικά (ed. Kühn, xix. 530).

[3] *Proofs of the Inquiry into the Life and Writings of Homer.* London, 1747.

[4] *Il.*, ii. 214. See also Blackwell's *Inquiry*, 2d ed., 1736, p. 330. A physiognomical study of the Homeric heroes is given by Malalas, *Chronogr.*, ed. Dindorf, v. p. 105.

[5] Περὶ ἀέρων, ὑδάτων, τόπων (ed. Kühn, i. 547).

[6] *Op. cit.*, xix. p. 530.

[7] Περὶ βίου Πυθαγορικοῦ λόγος, i. 17, Amsterdam, 1707, p. 59.

[8] *De vita Pythagoræ*, Amsterdam, 1707, p. 16. This author tells us that he applied the same rule to his friends. See also Aulus Gellius, i. ix.

[9] Iamblichus, p. 49.

[10] *Philosophi Platonici*, i., "De dogmate," Leyden, 1714, p. 34.

[11] *De fato*, Geneva, 1684, iii. p. 303, l. 25.

[12] Περὶ εἱμαρμένης, § 6, London, 1658.

[13] *Diss.*, xv., Cambridge, 1703, p. 157.

[14] *Select Papyri*, pl. xv., xix., and (Anastasi) *ibid.*, cxxviii.-cxxxiii.

[15] *Ant.*, xvii. 12, 2.

[16] Authors differ in their views as to its authenticity, but Diogenes Laertius (v. 22) and Stobæus (*Serm.*, clxxxix.) both believe it to be genuine. The chief difficulty is the reference to a certain sophist, Dionysius, but this is probably an interpolation. There are physiognomic references in other writings of Aristotle (cf. *Anal. pr.*, ii. c. 30; *Hist. anim.*, i. 8, etc.) sufficient to justify the attribution of the treatise to him. On this, see Franz, Preface, p. vi. *sq.*, of his *Scriptores physiognomiæ veteres*, Leipsic, 1780.

[17] That of J. G. Franz (Leipsic, 1780) is the best; Andreas Lacuna published a Latin version, Paris, 1535; Willichius another, at Wittenberg, 1538.

The Latin classics occasionally refer to physiognomy: Juvenal (vi. 383) speaks of the examination of forehead and face, but not with much respect; Suetonius (*Vita Titi*, 2) tells us, "Quo quidem tempore, aiunt, metoposcopum a Narcisso, Claudio liberto, adhibitum, ut Britannicus inspiceret"; and Pliny also refers to it (*H. N.*, xxxv. 10). References also exist in the writings of Clement of Alexandria; and Origen,[7] while speaking of the Jewish fable as to the birth of Christ, asks, Is it possible, if there be any truth in the science taught by Zopyrus, Loxus, and Polemon, that such a soul as Christ's could have been provided with a suitable body in such a way? Sir George Wharton quotes the text Job xxxvii. 7, "He impresseth (יַחְתּוֹם) the hand of every man, that all may know His work," as an authority for chiromancy, and other chiromantists have followed him in so doing.[8]

Hitherto the physiognomy of the schools had been chiefly descriptive; in the succeeding period the astrological side, whose gradual development may be noted, becomes the most important part. Hence in the subsequent or second stage of history chiromancy is specially predictive in character, and attains an importance it had not originally possessed. The treatises also contain occasional digressions on onychomancy, alectoromancy, clidomancy, coscinomancy, podoscopy, spasmatomancy, etc.

Along with the medical science of the period the Arabians took up the study of physiognomy: 'Alí b. Ragel wrote a book on nævi; Rhazes (1040) devoted several chapters of his medical work to it; and Averroes (1165) made many references to it in his *De Sanitate* (p. 82, Leyden, 1537). Avicenna also makes some acute physiognomical remarks in his *De Animalibus*, which was translated by Michael Scott about 1270, but printed subsequently (without date or place). Albertus Magnus (born 1205) devotes much of the second tract of his *De Animalibus* to the consideration of physiognomy. There is, however, nothing original in the treatise, which largely consists of extracts from Aristotle, Polemon, and Loxus. He does not enter so much into the animal comparisons of his predecessors, but occupies himself chiefly with simple descriptive physiognomy as indicative of character; and the same is true of the many scattered notes in the writings of Duns Scotus and Thomas Aquinas. The famous sage of Balwearie, Michael Scott, while court astrologer to the emperor Frederick II., wrote his treatise *De hominis phisiomonia* (c. 1272), much of which is physiological and of curious interest. It was not printed until 1477, and the edition was not illustrated. The physiognomical treatise forms the third part of his work *De secretis naturæ*. In 1335 Petrus de Abano of Padua delivered in Paris a course of lectures on this subject (afterwards edited by Blondus, 1544), a few years before he was burned for heresy. Shortly after the introduction of printing in the 15th century a large number of works on physiognomy were produced; probably the oldest is the block book by Hartlieb, *Die Kunst Ciromantia*. This is an exceedingly rare folio, of which one fine copy is extant in Paris; each page bears a figure of a giant hand from 7 to 10½ inches long, inscribed with characteristic words, and with a small amount of description below; there are twenty-seven such plates. A description of another perfect copy belonging to Earl Spencer occurs in Dibdin's *Bibliographical Decameron* (1817), vol. i. p. 143, and four imperfect copies are known to exist elsewhere. The date of Hartlieb's work is probably 1470. This and Michael Scott's books were the first printed works on the subject.

The 16th century was particularly rich in publications on physiognomy. Not only were the classical works printed, but additions were made to the literature by Cocles, Corvus, Johannes de Indagine, Cornaro, Blondus, Douxciel, Pompeius Ronnseus, Gratarolus, Niquetius, Pomponius Gauricus, Tricassus, Cardan, Tiberius, Thaddæus ab Hayck, Taisnierus, Rizzacasa, Campanella, Hund, Picciolus, Rothman, Johannes Padovanus, and, last and greatest of all, Giambattista della Porta. Several works also appeared in England, the earliest being the anonymous *On the Art of foretelling Future Events by Inspection of the Hand* (London, 1504). A second anonymous work, *A pleasant Introduction to the Art of Chiromancie and Physiognomie*, was published at the same place in 1558. Neither of these is of any merit. The first English work with the author's name is that of Dr. Thomas Hill (1571), *The Contemplation of Mankynde, contayning a singular Discourse after the Art of Physiognomie*. This is rather quaintly written, but is simply an adaptation from the Italian writers of the day. Another anonymous author about this period, but whose work has no date, writes under the name "Merlin Britannicus," upon moles and nævi after the model of 'Alí b. Ragel. The word "physiognomy" had been introduced into England before this century, and from analogy with the Greek, had been used in the sense of the outward appearance, or the face: thus in Udall's translation of the paraphrase of Erasmus on Mark iv. it occurs spelt "phisnomi"; the pugnacious bishop of Ossory, Bale, in his *English Votaries*, spells it "physnomie" (pt. i. ch. ii. p. 44).

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[1] Fontain's *Commentary* (Paris, 1611), Camillus Baldus of Bologna (1621), Sanches of Toulouse (1636).

[2] And later, by Franz (*op. cit.*, p. 470).

[3] See an interesting paper on "Stretching and Yawning as Signs of Madness," by Professor Ridgeway (*Trans. Camb. Philol. Soc.*, vol. i. p. 210), which refers to Aristoph., *Wasps*, 642, with which he compares Plautus, *Menæchmi*, 279. Other references exist to physiognomy in Cassiodorus, Isidorus, Meletius, and Nemesius, but none of any very great importance.

[4] It was edited by Janus Cornaro at Marburg, 1543, by Bonum of Paris ten years later, by Camillus Peruscus, by Petreius, and by Sylburg in the sixth volume of his *Aristotle*.

[5] Περὶ παλμῶν. See Justin Martyr's *Quæst. ad orthodox.*, xix., vol. ii., Paris, 1742, p. 461.

[6] Constantinus Africanus, *De humana natura et principalibus membris corporis humani*, Basel, 1541, folio.

[7] *Contra Celsum*, i. 33.

[8] For other references to Scriptural allusions to physiognomy, see Vecchius, *Observationes in div. script.*, Naples, 1641.

The rise of the study of anatomy served largely to bring physiognomy into discredit by substituting real facts for fictions; hence in the 17th century its literature, while not smaller in quantity, was less important in quality. The principal authors are Goclenius, Fuchs, Timpler, Tischbein, Gallimard, Moldenarius, Septalius, Hertod, Scarlatini, Saunders, Withers, Helvetius, Lebrun, Elsholtius, De la Bellière, Philipp May, Evelyn, Freius, Baldus, Torreblanca, Otto, Bulwer, Rhyne, Merbitzius, Fludd, Zanardus, Finella, Tamburini, Etsler, Vecchius, Prætorius, De la Chambre, and Giraldus.

The 18th century shows a still higher decline of interest in physiognomy. Historians of philosophy, like Meursius and Franz, re-edited some of the classical works, and Fülleborn reviewed the relation of physiognomy to philosophy. Indeed the only name worthy of note is that of LAVATER (*q.v.*). The other authors of this century are Peuschel, Spon, Lichtenberg, Schutz, Wegelin, Pernetty, Girtanner, Grohmann, and several anonymous writers, and from the anatomical side Lancisi, Parsons, and Peter Camper. The popular style, good illustrations, and pious spirit pervading the writings of Lavater have given to them a popularity they little deserved, as there is really no system in his work, which largely consists of rhapsodical comments upon the several portraits. Having a happy knack of estimating character, especially when acquainted with the histories of the persons in question, the good pastor contrived to write a graphic and readable book, but one much inferior to Porta's or Aristotle's as a systematic treatise. With him the descriptive school of physiognomists may be said to have ended, as the astrological physiognomy expired with De la Bellière. The few straggling works which have since appeared are scarcely deserving of notice, the rising attraction of phrenology having given to pure physiognomy the *coup de grâce* by taking into itself whatever was likely to live of the older science. The writers of this century are Hörstig, Maas, Rainer, Cross, Stöhr, Sehler, Diez, Carus, Piderit, Burgess, and Gratiolet.

The physiological school of physiognomy was foreshadowed by Parsons and founded by Sir Charles Bell, as his *Essay on the Anatomy of Expression*, published in 1806, was the first really scientific study of expression. He was one of the first who accurately correlated the motions expressive of the passions with the muscles which produce them, and in the later editions of his work these descriptions are much enlarged and improved. Shortly after the appearance of the first edition of Bell's *Essay* Moreau published his first edition of Lavater along somewhat the same lines (1807). The experiments of Duchenne (*Mécanisme de la Physionomie Humaine*, Paris, 1862) showed that by the use of electricity the action of the separate muscles could be studied and by the aid of photography accurately represented. These tested and confirmed by experimental demonstration the hypothetic conclusions of Bell. The machinery of expression having thus been clearly followed out, the correlation of the physical actions and the psychical states was made the subject of speculation by Spencer (*Psychology*, 1855), and such speculations were first reduced to a system by Darwin (*Expression of Emotions*, 1872), who formulated and illustrated the following as fundamental principles.

(1) Certain complex acts are of direct or indirect service under certain conditions of the mind in order to relieve or gratify certain sensations or desires; and whenever the same state of mind is induced the same set of actions tend to be performed, even when they have ceased to be of use. (2) When a directly opposite state of mind is induced to one with which a definite action is correlated, there is a strong and involuntary tendency to perform a reverse action. (3) When the sensorium is strongly excited nerve-force is generated in excess, and is transmitted in definite directions, depending on the connections of nerve-cells and on habit.

It follows from these propositions that the expression of emotion is for the most part not under the control of the will, and that those striped muscles are the most expressive which are the least voluntary. The philosophy of physiognomy may be formulated upon this definite theoretic basis. (1) The actions we look upon as expressive of emotions are such as at some time were serviceable in relieving or gratifying the desires or sensations accompanying the emotion. (2) Such actions become habitually associated with the mental condition and continue even where their utility is lost. (3) Certain muscles which produce these actions become from habitual action strengthened, and, when the skin diminishes in fulness and elasticity with advancing age, the action of the muscle produces furrows or wrinkles in the skin at right angles to the course of the fibres of the muscle. (4) As the mental disposition and proneness to action are inherited by children from parents, so the facility and proneness to expression are similarly developed under the law of heredity. (5) To some extent habitual muscular action and the habitual flow of nerve-force in certain directions may alter the contour of such bones and cartilages as are thereby acted upon by the muscles of expression. Illustrations of these theoretic propositions are to be found in the works of Bell, Duchenne, and Darwin, to which the student may be referred for further information.

For information on artistic anatomy as applied to physiognomy see the catalogue of sixty-two authors by Ludwig Choulant, *Geschichte und Bibliographie der anatomischen Abbildung*, etc., Leipsic, 1852, and the works of the authors enumerated above, especially those of Aristotle, Franz, Porta, Cardan, Corvus, and Bulwer. An attempt has been made recently to rehabilitate palmistry by D'Arpentigny and Desbarrolles, for summaries of which see the works of Beamish and Craig. For physiognomy of disease, besides the usual medical handbooks, see Cabuchet, *Essai sur l'Expression de la Face dans les Maladies*, Paris, 1801. For ethnological physiognomy, see amongst older authors Gratarolus, and amongst moderns the writers cited in the various text-books on anthropology. (A. MA.)

PHYSIOLOGUS, the most common title of a collection of some fifty Christian allegories much read in the Middle Ages, and still existing in several forms and in about a dozen Eastern and Western languages. As nearly all its imagery is taken from the animal world, it is also known as the *Bestiary*. There can be hardly a doubt about the time and general circumstances of its origin. Christian teachers, especially those who had a leaning towards gnostic speculations, took an interest in natural history, partly because of certain passages of Scripture that they wanted to explain, and partly on account of the divine revelation in the book of nature, of which also it was man's sacred duty to take proper advantage. Both lines of study were readily combined by applying to the interpretation of descriptions of natural objects the allegorical method adopted for the interpretation of Biblical texts. Now the early Christian centuries were anything but a period of scientific research. Rhetorical accomplishments were considered to be the chief object of a liberal education, and to this end every kind of learning was made subservient. Instead of reading Aristotle and other naturalists, people went for information to commonplace books like those of Ælian, in which scraps of folk-lore, travellers' tales, and fragments of misapprehended science were set forth in an elegant style for the enjoyment of the general reader. Theological writers with a merely literary training were not in the least prepared to question the worth of the marvellous descriptions of creatures that were current in the schools on the faith of authorities vaguely known as "the history of animals," "the naturalists," and "the naturalist" in the singular number (*φυσιολόγος*).[1] So they took their notions of strange beasts and other marvels of the visible world on trust and did their best to make them available for religious instruction. In some measure we find this practice adopted by more than one of the fathers, but it was only natural that the Alexandrian school, with its pronounced taste for symbolism, should make the most of it. Clement himself had declared that natural lore, as taught in the course of higher Christian education according to the canon of truth, ought to proceed from "cosmogony" to "the theological idea,"[2] and even in the little that is left of the works of Origen we have two instances of the proceeding in question. And yet the fact that these reappear in the *Physiologus* would not suffice to stamp the work as a series of extracts from Alexandrian writings, as parallels of the same kind can be adduced from Epiphanius (*loc. cit.*) and Ephraem Syrus (*Opp. Syr.*, ii. pp. 17, 130). Father Cahier would even trace the book to Tatian, and it is true that that heresiarch mentions a writing of his own upon animals. Still the context in which the quotation occurs makes it evident that the subject-matter was not the nature of particular species nor the spiritual lessons to be drawn therefrom, but rather the place occupied by animal beings in the system of creation. On the other hand, the opinion of Cardinal Pitra, who referred the *Physiologus* to the more orthodox though somewhat peculiar teaching of the Alexandrians, is fully borne out by a close examination of the irregularities of doctrine pointed out in the *Physiologus* by Cahier, all of which are to be met with in Origen. The technical words by which the process of allegorizing is designated in *Physiologus*, like *ἑρμηνεία*, *θεωρία*, *ἀναγωγή*, *ἀλληγορία*, are familiar to the students of Alexandrian exegesis. It has, moreover, been remarked that almost all the animals mentioned were at home in the Egypt of those days, or at least, like the elephant, were to be seen there occasionally, whereas the structure of the hedgehog, for instance, is explained by a reference to the sea-porcupine, better known to fish-buyers on the Mediterranean. The fables of the phœnix and of the conduct of the wild ass and the ape at the time of the equinox owe their origin to astronomical symbols belonging to the Nile country.[3] In both chapters an Egyptian month is named, and elsewhere the antelope bears its Coptic name of "antholops."

That the substance of the *Physiologus* was borrowed from commentaries on Scripture[4] is confirmed by many of the sections opening with a text, followed up by some such formula as "but the Physiologus says." When zoological records failed, Egypto-Hellenic ingenuity was never at a loss for a fanciful invention distilled from the text itself, but which, to succeeding copyists, appeared as part of the teaching of the original Physiologus. As a typical instance we may take the chapter on the ant-lion,—not the insect, but an imaginary creature suggested by Job iv. 11. The exceptional Hebrew for a lion (*layish*) appeared to the Septuagint translators to call for a special rendering, and as there was said to exist on the Arabian coast a lion-like animal called "myrmex" (see Strabo, xvi. p. 774; Ælian, *N. A.*, vii. 47) they ventured to give the compound noun "myrmekoleon." After so many years the commentators had lost the key to this unusual term, and only knew that in common Greek "myrmex" meant an ant. So the text "the myrmekoleon hath perished for that he had no nourishment" set them pondering, and others reproduced their meditations, with the following result: "The *Physiologus* relates about the ant-lion: his father hath the shape of a lion, his mother that of an ant; the father liveth upon flesh, and the mother upon herbs. And these bring forth the ant-lion, a compound of both, and in part like to either, for his fore part is that of a lion, and his hind part like that of an ant. Being thus composed, he is neither able to eat flesh like his father, nor herbs like his mother; therefore he perisheth from inanition"; the moral follows.

At a later period, when the church had learnt to look with suspicion upon devotional books likely to provoke the scoffing of some and lead others into heresy, a work of this kind could hardly meet with her approval. A synod of Pope Gelasius, held in 496, passed censure, among others, on the "Liber Physiologus, qui ab hæreticis conscriptus est et B. Ambrosii nomine signatus, apocryphus," and evidence has even been offered that a similar sentence was pronounced a century before. Still, in spite of such measures, the *Physiologus*, like the *Church History* of Eusebius or the *Pastor of Hermas*, continued to be read with general interest, and even Gregory the Great did not disdain to allude to it on occasion. Yet the Oriental versions, which had certainly nothing to do with the Church of Rome, show that there was no systematic revision made according to the catholic standard of doctrine. The book remained essentially the same, albeit great liberties were taken with its details and outward form. There must have been many imperfect copies in circulation, from which people transcribed such sections as they found or chose, and afterwards completed their MS. as occasion served. Some even rearranged the contents according to the alphabet or to zoological affinity. So little was the collection considered as a literary work with a definite text that every one assumed a right to abridge or enlarge, to insert ideas of his own, or fresh Scriptural quotations; nor were the scribes and translators by any means scrupulous about the names of natural objects, and even the passages from Holy Writ. *Physiologus* had been abandoned by scholars, and left to take its chance among the tales and traditions of the uneducated mass. Nevertheless, or rather for this very reason, its symbols found their way into the rising literature of the vulgar tongues, and helped to quicken the fancy of the artists employed upon church buildings and furniture.

The history of the *Physiologus* has become entwined from the beginning with that of the commentaries on the account of creation in Genesis. The principal production of this kind in our possession is the *Hexaemeron* of Basil, which contains several passages very like those of the *Physiologus*. For instance, in the seventh homily the fable of the nuptials of the viper and the conger-eel, known already to Ælian and Oppian, and proceeding from a curious misreading of Aristotle (*Hist. An.*, v. 4, p. 540 b, Bekk.), serves to point more than one moral. Notwithstanding the difference in theology, passages of this kind could not but be welcome to the admirers of the Alexandrian allegories. In fact a medley from both Basil and the *Physiologus* exists under the title of the *Hexaemeron* of Eustathius; some copies of the first bear as a title Περὶ φυσιολογίας, and in a Milan MS. the "morals" of the *Physiologus* are ascribed to Basil. The Leyden Syriac is supplemented with literal extracts from the latter, and the whole is presented as his work. Other copies give the names of Gregory Theologus, Epiphanius, Chrysostom, and Isidore.

As far as can be judged, the emblems of the original *Physiologus* were the following: (1) the lion (footprints rubbed out with tail; sleeps with eyes open; cubs receive life only three days after birth by their father's breath); (2) the sun-lizard (restores its sight by looking at the sun); (3) the charadrius (Deut. xiv. 16; presages recovery or death of patients); (4) the pelican (recalls its young to life by its own blood); (5) the owl (or nyktikorax; loves darkness and solitude); (6) the eagle (renews its youth by sunlight and bathing in a fountain); (7) the phœnix (revives from fire); (8) the hoopoe (redeems its parents from the ills of old age); (9) the wild ass (suffers no male besides itself); (10) the viper (born at the cost of both its parents' death); (11) the serpent (sheds its skin; puts aside its venom before drinking; is afraid of man in a state of nudity; hides its head and abandons the rest of its body); (12) the ant (orderly and laborious; prevents stored grain from germinating; distinguishes wheat from barley on the stalk); (13) the sirens and onocentaurs (Isa. xiii. 21, 22; compound creatures); (14) the hedgehog (pricks grapes upon its quills); (15) the fox (catches birds by simulating death); (16) the panther (spotted skin; enmity to the dragon; sleeps for three days after meals; allures its prey by sweet odor); (17) the sea-tortoise (or aspidochelone; mistaken by sailors for an island); (18) the partridge (hatches eggs of other birds); (19) the vulture (assisted in birth by a stone with loose kernel); (20) the ant-lion (able neither to take the one food nor to digest the other); (21) the weasel (conceives by the mouth and brings forth by the ear); (22) the unicorn (caught only by a virgin); (23) the beaver (gives up its testes when pursued); (24) the hyæna (a hermaphrodite); (25) the otter (enhydris; enters the crocodile's mouth to kill it); (26) the ichneumon (covers itself with mud to kill the dragon; another version of No. 25); (27) the crow (takes but one consort in its life); (28) the turtle-dove (same nature as No. 27); (29) the frog (either living on land and killed by rain, or in the water without ever seeing the sun); (30) the stag (destroys its enemy the serpent); (31) the salamander (quenches fire); (32) the diamond (powerful against all danger); (33) the swallow (brings forth but once; misreading of Aristotle, *Hist. An.*, v. 13); (34) the tree called peridexion (protects pigeons from the serpent by its shadow); (35) the pigeons (of several colors; led by one of them, which is of a purple or golden color); (36) the antelope (or hydrippus; caught by its horns in the thicket); (37) the fire-flints (of two sexes; combine to produce fire); (38) the magnet (adheres to iron); (39) the saw-fish (sails in company with ships); (40) the ibis (fishes only along the shore); (41) the ibex (descries a hunter from afar); (42) the diamond again (read "carbuncle"; found only by night); (43) the elephant (conceives after partaking of mandrake; brings forth in the water; the young protected from the serpent by the father; when fallen is lifted up only by a certain small individual of its own kind); (44) the agate (employed in pearl-fishing); (45) the wild ass and ape (mark the equinox); (46) the Indian stone (relieves patients of the dropsy); (47) the heron (touches no dead body, and keeps to one dwelling-place); (48) the sycamore (or wild fig; grubs living inside the fruit and coming out); (49) the ostrich (devours all sort of things; forgetful of its own eggs). Besides these, or part of them, certain copies contain sections of unknown origin about the bee, the stork, the tiger, the woodpecker, the spider, and the wild boar.

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[1] Origen, *Sel. in Jerem*, xvii. 11, "*ἐν τῇ περὶ ζῴων ἱστορίᾳ*"; Epiphan., *Adv. Hær.*, i. 3, p. 274 (ed. D. Petav.), "*ὡς φασιν οἱ φυσιολόγοι*"; Origen, *Hom.* xvii., in Gen. xliv. 9, "nam physiologus de catulo leonis scribit."

[2] *Strom.*, iv. p. 564 (ed. Potter), *ἡ γοῦν κατὰ τὸν τῆς ἀληθείας κανόνα γνωστικῆς παραδόσεως φυσιολογία, μᾶλλον δὲ ἐποπτεία, ἐκ τοῦ περὶ κοσμογονίας ἤρτηται λόγου, ἐνθένδε ἀναβαίνουσα ἐπὶ τὸ θεολογικὸν εἶδος.*

[3] Cp. Leemans on Horapollo, i. 16, 84.

[4] Including the Apocrypha. See the Icelandic account of the elephant, also a decidedly Alexandrian fragment upon the *μάργος*, founded upon 4 Maccab., i. 3, which has got into the scholia upon the *Odyssey*, xviii. 2 (ii. p. 533, ed. Dindorf, Oxford, 1855).

The Greek text of the *Physiologus* exists only in late MSS., and has to be corrected from the translations. In Syriac we have a full copy in a 12th-century Leyden MS., published in J. P. N. Land's *Anecdota Syriaca;* thirty-two chapters with the "morals" left out in a very late Vatican copy, published by Tychsen; and about the same number in a late MS. of the British Museum (Add. 25878). In Armenian Pitra gave some thirty-two chapters from a Paris MS. (13th century). The Æthiopic exists both in London and Paris, and was printed at Leipsic by Dr. Hommel in 1877. In Arabic we have fragments at Paris, of which Renan translated a specimen for the *Spicilegium Solesmense*, and another version of thirty-seven chapters at Leyden, probably the work of a monk at Jerusalem, which Land translated and printed with the Syriac. The Latin MSS. of Bern are, after the Vatican glossary of Ansileubus, the oldest of which we know; there are others in several libraries, and printed editions by Mai, Heider, and Cahier. Besides these a few fragments of an old abridgment occur in Vallarsi's edition of Jerome's works (vol. xi. col. 218). A metrical *Physiologus* of but twelve chapters is the work of Theobaldus, probably abbot of Monte Cassino (1022–1035 A.D.). From this was imitated the Old-English fragment printed by Th. Wright, and afterwards by Maetzner; also the Old-French *Sensuyt le bestiaire d'amours*. The prose *Physiologus* was done into Old High German before 1000, and afterwards into rhyme in the same idiom; since Von der Hagen (1824) its various forms have found careful editors among the leading Germanists. The Icelandic, in a Copenhagen MS. of the 13th century, was printed by Prof. Th. Möbius in his *Analecta norroena* (2d ed., 1877); at the same time he gave it in German in Dr. Hommel's Aethiopic publication. Some Anglo-Saxon metrical fragments are to be found in Grein's *Bibliothek*, vol. i. The Provençal (*c.* 1250), published in Bartsch's *Chrestomathie provençale*, omits the "morals" but is remarkable for its peculiarities of form. Before this there had been translations into French dialects, as by Philippe de Thaun (1121), by Guillaume, "clerc de Normandie," also, about the same period, by Pierre, a clergyman of Picardy. All the Old-French materials have not yet been thoroughly examined, and it is far from improbable that some versions of the book either remain to be detected or are now lost past recovery. A full account of the history of the *Physiologus* should also embrace the subjects taken from it in the productions of Christian art, the parodies suggested by the original work, *e.g.*, the *Bestiaire d'Amour* by Richard de Fournival, and finally, the traces left by it upon the encyclopedical and literary work of the later Middle Ages.

Nearly all the information now obtainable is to be found in the following works, and such as are there quoted: *S. Epiphanius ad Physiologum*, ed. Ponce de Leon, Rome, 1587 (with woodcuts); another edition, Antwerp, 1588 (with copper-plates); *S. Eustathii in Hexahemeron Commentarius*, ed. Leo Allatius, Lyons, 1629 (cp. H. van Herwerden, *Exercitt. Critt.*, Hague, 1862, pp. 180–182); *Physiologus Syrus*, ed. O. G. Tychsen, Rostock, 1795; *Classici Auctores*, ed. Mai, vol. vii., Rome, 1835, pp. 585–596; G. Heider, in *Archiv für Kunde österreich. Geschichtsquellen*, Vienna, 1850, vol. ii. p. 545 *sq.;* Cahier and Martin, *Mélanges d'Archéologie*, etc., vol. ii., Paris (1851), p. 85 *sq.*, vol. iii. (1853) p. 203 *sq.*, vol. iv. (1856) p. 55 *sq.;* Cahier, *Nouveaux Mélanges* (1874) p. 106 *sq.;* J. B. Pitra, *Spicilegium Solesmense*, vol. iii., Paris, 1855, pp. xlvii. *sq.*, 338 *sq.*, 416, 535; Maetzner, *Altengl. Sprachproben*, vol. i. pt. i., Berlin, 1867, p. 55 *sq.;* J. Victor Carus, *Gesch. der Zoologie*, Munich, 1872, p. 109 *sq.;* J. P. N. Land, *Anecdota Syriaca*, vol. iv., Leyden, 1874, p. 31 *sq.*, 115 *sq.*, and in *Verslagen en Mededeelingen der kon. Akad. van Wetenschappen*, 2d series, vol. iv., Amsterdam, 1874; Möbius and Hommel in their publications quoted above. (J. P. N. L.)

PHYSIOLOGY.

PART I.—GENERAL VIEW.

THE word "physiology" may be used either in a general or in a more restricted sense. In its more general meaning it was used largely of old, and is still occasionally used in popular writings, to denote all inquiry into the nature of living beings. A very slight acquaintance, however, with the phenomena of living beings shows that these can be studied from two, apparently very different, points of view.

The most obvious and striking character of a living being is that it appears to be an agent, performing actions and producing effects on the world outside itself. Accordingly, the first efforts of inquirers were directed towards explaining how these actions are carried on, how the effects of a living being upon its surroundings are brought about. And the dissection or pulling to pieces of the material body of a living being was, under the name of ANATOMY (*q.v.*), regarded as simply an analysis preparatory and necessary to the understanding of vital actions. But it soon became obvious that this anatomical analysis gave rise of itself to problems

Morphology.

independent of, or having only distant relations to, the problems which had to do with the actions of living beings. Hence in course of time a distinct science has grown up which deals exclusively with the laws regulating the form, external and internal, of living beings, a science which does not seek to explain the actions of living beings, and takes note of these actions only when they promise to throw light on the occurrence of this or that structural feature. Such a science, which is now known under the name of MORPHOLOGY (*q.v.*), might be carried on in a world in which all living things had, in the ordinary meaning of the word, become dead. Were the whole world suddenly petrified, or were a spell to come over it like that imagined by Tennyson in his "Day Dream," but more intense, so that not only the gross visible movements but the inner invisible movements which are at the bottom of growth were all stayed, the morphologist would still find ample exercise for his mind in investigating the form and structure of the things which had been alive, and which still differed from other things in their outward lineaments and internal build.

Physiology defined.

In its older sense physiology embraced these morphological problems, and so corresponded to what is now called BIOLOGY (*q.v.*); in its more modern sense physiology leaves these matters on one side and deals only with the actions of living beings on their surroundings (the study of these necessarily involving the correlative study of the effect of the surroundings on the living being), and appeals to matters of form and structure only so far as they throw light on problems of action. Looking forward into the far future, we may perhaps dimly discern the day when morphology and physiology will again join hands, and all the phenomena of living beings, both those which relate to form and those which relate to action, will be seen to be the common outcome of the same molecular processes. But that day is as yet most distant; and, though occasionally even now the two sciences cross each other's path, action explaining form and form in turn explaining action, the dominant ideas of the two are so distinct, the one from the other, that each must for a long time yet be developed along its own line. It is proposed to treat in the following pages of physiology in this narrower, more restricted sense.

If any one at the present day, making use of the knowledge so far gathered in, were to attempt a rough preliminary analysis of the phenomena of action of a living being,—for instance of one of the more complex, so-called higher animals, such as man—he might proceed in some such way as the following.

Movements; muscles.

One of the first, perhaps the first and most striking fact about man is that he moves: his body moves of itself from place to place, and one part of the body moves on another. If we examine any one of these movements, such as the bending of the forearm on the arm, we find that it is brought about by certain masses of flesh, called muscles, which from time to time contract, that is, shorten; and these muscles are so disposed that, when they shorten, and so bring their ends nearer together, certain bones are pulled upon and the arm is bent. Upon further examination it will be found that all the gross movements of the body, both the locomotion of the whole body and the movements of parts upon parts, are carried out by the contraction or shortening of muscles. The muscles, together with bones, tendons, and other structures, are arranged in various mechanical contrivances, many of them singularly complex; hence the great diversity of movement of which an animal or man is capable; but in all cases the central fact, that which supplies the motive-power, is the contraction of a muscle, a shortening of its constituent fibres whereby its two ends are brought for a while nearer together.

Nervous system.

When, pushing the analysis farther, we attempt to solve the question, Why do muscles contract? we find that the muscles of the body are connected with what is called the central nervous system by certain strands of living matter called nerves; and we further find that, with some few exceptions, which need not concern us now, the contractions of muscles are brought about by certain occult invisible changes called nervous impulses which travel along these nerves from the central nervous system to the muscles. Hence, when a nerve is severed, the muscle to which the nerve belonged, thus cut adrift from the central nervous system, no longer stirred by impulses reaching it from thence, ceases to contract, and remains motionless and as it were helpless. Pushing the problem still farther home, and asking how these impulses originate in the central nervous system, we find that this central nervous mass is connected, not only with the muscles by means of nerves which, carrying impulses outward from itself to the muscles and so serving as instruments of movement, are called motor or efferent nerves, but also with various surfaces and parts of the body by means of other nerves, along which changes or impulses travel inwards to itself in a centripetal fashion. Moreover, the beginnings or peripheral endings of these other nerves appear to be so constituted that various changes in the surroundings of the body, or internal changes in the body itself, give rise to impulses, which, thus originated, travel inwards to the central nervous system; hence these nerves are spoken of as sensory or afferent. Such sensory impulses reaching the central nervous system may forthwith issue as motor impulses leading to movement; but on many occasions they tarry within the central mass, sweeping backwards and forwards along particular areas of its substance, thus maintaining for a while a state of molecular agitation and leading to movement at some subsequent period only. Moreover, we have reason to think that molecular disturbances may arise within the central nervous system apart from the advent, either past or present, of any impulses along sensory nerves. Lastly, the presence of these molecular agitations in the central nervous system, whether the immediate result of some new afferent impulse, or the much delayed and complicated outcome of some impulse which arrived long ago, or the product of internal changes apparently independent of all disturbance from without and so far spontaneous, may be indicated by corresponding phases of what we speak of as consciousness. We are thus led to conceive of the central nervous system as, chiefly at least, the seat of a molecular turmoil maintained by multitudinous afferent impulses streaming in along the various afferent nerves, a turmoil which makes itself felt within as changes of consciousness, and produces effects without by movements wrought through motor nerves and muscles. And one large part of physiology has for its task the unravelling of the laws which govern this turmoil, which determine, in relation to the advent of afferent impulses and the occurrence of intrinsic changes, the issue of motor impulses, and thus the characters of the resulting movements.

Chemical changes.

The movements of man or of an animal are not, however, the only salient facts of his existence. Equally characteristic of him are the facts (1) that he from time to time eats, and must eat in order to live, and (2) that a supply of fresh air containing a certain quantity of oxygen is indispensable to his remaining alive. Viewed from a chemical point of view, an animal body, whether dead or alive, is a mass of complex unstable chemical substances, combustible in nature, *i.e.*, capable of being oxidized, and of being reduced by oxidation to simpler, more stable substances, with a setting free of energy. Combustible in the ordinary sense of the word an animal body is not, by reason of the large excess of water which enters into its composition; but an animal body thoroughly dried will in the presence of oxygen burn like fuel, and, like fuel, give out energy as heat. The material products of that combustion are fairly simple, consisting of water, carbonic acid, some ammonia or nitrogen compounds, and a few salts. And these same substances appear also as the products of that slower combustion which we call decay; for, whether the body be burnt swiftly in a furnace or rot away slowly in earth, air, or water, the final result is the same, the union of the complex constituent substances with the oxygen furnished from the air, and their reduction thereby to the above-named products, with a development of heat, which either as in the first case is rapid and appreciable, or as in the second is so slow and gradual as to be with difficulty recognized. Moreover, during life also, the same conversion, the same oxidation, the same reduction of complex substances to simpler matters, the same setting free of the energy present in the former but absent in the latter, may be noted. The animal body dies daily, in the sense that at every moment some part of its substance is suffering decay, is undergoing combustion; at every moment complex substances full of latent energy are by processes of oxidation reduced to simpler substances devoid of energy or containing but little.

Source of bodily energy.

This breaking down of complex substances, this continued partial decay, is indeed the source of the body's energy; each act of life is the offspring of an act of death. Each strain of a muscle every throb of the heart, all the inner work of that molecular turmoil of the nervous system of which we spoke above, as well as the chemical labor wrought in the many cellular laboratories of glands and membranes, every throw of the vital shuttle means an escape of energy as some larger compacted molecule splits into smaller simpler pieces. Within the body the energy thus set free bears many shapes, but it leaves the body in two forms alone, as heat and as the work done by the muscles of the frame. All the inner labor of the body, both that of the chemical gland-cells, of the vibrating nerve-substance with its accompanying changes of consciousness, and of the beating heart and writhing visceral muscles, is sooner or later, by friction or otherwise, converted into heat; and it is as heat that the energy evolved in this labor leaves the body. Manifold as seems the body's energy, it has but one source, the decay of living material, *i.e.*, the oxidation of complex substances diversely built up into various living matters, and but two ends, heat and muscular work. The continued setting free of energy which thus marks the living body, entailing as it does the continued breaking up and decay of living substance, constitutes a drain upon the body which must be met by constantly-renewed supplies, or otherwise the body would waste away and its energy flicker out. Hence the necessity on the one hand for that which we call food, which, however varied, is essentially a mixture of complex combustible energy-holding bodies, and on the other hand for that other kind of food which we call breath, and which supplies oxygen whereby the complex oxidizable substances may be oxidized to simpler matters and their potential energy made to do work. Thus food supplies the energy of the body, but in quantity only, not in quality. The food by itself, the dead food, can exhibit energy as heat only, with intervening phases of chemical action; before its energy can be turned into the peculiar grooves of nervous and muscular action it needs to be transmuted into living substance, and in that transmutation there is a preliminary expenditure of part of the food's store of energy.

Here, then, we have a second view of physiological labor. To the conception of the body, as an assemblage of molecular thrills—some started by an agent outside the body, by light, heat, sound, touch, or the like; others begun within the body, spontaneously as it were, without external cause; thrills which, travelling to and fro, mingling with and commuting each other, either end in muscular movements or die away within the body—to this conception we must add a chemical one, that of the dead food continually being changed and raised into the living substance, and of the living substance continually breaking down into the waste matters of the body by processes of oxidation, and thus supplying the energy needed both for the unseen molecular thrills and the visible muscular movements.

Problems of physiology.

Hence the problems of physiology may in a broad sense be spoken of as threefold. (1) On the one hand, we have to search the laws according to which the complex unstable food is transmuted into the still more complex and still more unstable living flesh, and the laws according to which this living substance breaks down into simple, stable waste products, void or nearly void of energy. (2) On the other hand, we have to determine the laws according to which the vibrations of the nervous substance originate from extrinsic and intrinsic causes, the laws according to which these vibrations pass to and fro in the body acting and reacting upon each other, and the laws according to which they finally break up and are lost, either in those larger swings of muscular contraction whereby the movements of the body are effected, or in some other way. (3) And lastly, we have to attack the abstruser problems of how these neural vibrations, often mysteriously attended with changes of consciousness, as well as the less subtle vibrations of the contracting muscles, are wrought out of the explosive chemical decompositions of the nervous and muscular substances, that is, of how the energy of chemical action is transmuted into and serves as the supply of that vital energy which appears as movement, feeling, and thought.

Even a rough initial analysis, however, such as we have just attempted to sketch, simple as it seems with our present knowledge, is an expression of the accumulated and corrected inquiries of many ages; the ideas which it embodies are the results of long-continued investigations, and the residue of many successive phases of opinion.

Animal and vital spirits.

In the natural hierarchy of the sciences, physiology follows after chemistry, which in turn follows physics, molar and molecular; and in a natural development, as indeed is evident from what we have just seen, the study of the two latter should precede that of the former. At a very early age, however, the exigencies of life brought the study of man, and so of physiology, to the front before its time; hence the history of physiology consists to a large extent, especially in its opening chapters, of premature vain attempts to solve physical and chemical problems before the advent of adequate physical or chemical knowledge. But no ignorance of these matters could hide from the observant mind, even in quite early times, two salient points which appear also in the analysis just given, namely, that while some of the phenomena of living beings seem due to powers wholly unknown in things which are not living, other phenomena, though at first sight special to living beings, appear to be in reality the peculiar outcome of processes taking place as well in things not alive. It was further early seen that, while the former are much more conspicuous, and make up a greater part of the life of the individual in those living beings which are called animals, especially in man, and in animals more closely resembling man, than in those which are called plants, the latter are common to both divisions of living things. Both sets of phenomena, however, were at first regarded as the products of certain special agencies; both were spoken of as the work of certain spirits; and the distinction between the two was formulated by speaking of the spirits as being in the former case *animal* and in the latter *vital.*

From the very outset even the casual observer could not fail to be struck with the fact that many of the processes of living beings appear to be the results of the various contrivances or machines of which a living body is largely built up. This indeed was evident even before the distinction between animal and vital spirits was recognized; and, when that differentiation was accepted, it was seen that the part played by these machines and contrivances in determining the actions of living beings was much more conspicuous in the domain of vital than of animal spirits. As inquiry was pushed forward the prominence and importance of this machinery became greater and greater, more especially since the phenomena supposed to be due to the agency of vital spirits proved more open to direct observation and experiment than those attributed to the animal spirits. It was found that the most fruitful path of investigation lay in the direction of studying the structure and independent action of the several constituent machines of the body, and of unravelling their mutual relations.

Organs and functions.

These machines received the names of organs, the work or action of an organ being at a later period spoken of as its function. And, when it became clear that many of the problems concerned with what was supposed to be the work of the vital spirits could be solved by the proper appreciation of the functions of certain organs, it was inferred that the more difficult problems belonging to the animal spirits could be solved in the same way. Still later on it was found that the conception of organs and functions was not only quite separable from, but indeed antagonistic to, the hypothesis of the entities called spirits.

In this way the first great phase, as it may be called, of the science of physiology was evolved,—a phase which lasted till quite recent times. Under this conception every living being, plant or animal, was regarded as a complex of organs, each with its respective function, as an engine built up of a number of intricately contrived machines, each performing its specific work. The whole animal body was parcelled out into organs, each of which was supposed to have its appropriate function; and the efforts of investigators were directed, on the one hand, to a careful examination of the structural features of an organ with the view of determining by deduction what its function must be, and, on the other hand, to confirming or correcting by observation and experiment the conclusions thus reached by the anatomical method. And the fruitfulness of this line of inquiry proved so great that the ideas directing it become absolutely dominant. In many cases the problem to be worked out was in reality a purely mechanical one. This was notably so in the great question of the circulation so brilliantly solved by Harvey. Putting aside for a while the inquiry as to the origin of the force with which the walls of the heart press on the blood contained in its cavities, accepting the fact that the blood is thus pressed at each beat of the heart, all the other truths of the circulation which Harvey demonstrated are simply the outcome of certain mechanical conditions, such as the position and arrangement of the valves, the connection of various patent tubes, and the like. And many other problems —as, for instance, those connected with respiration— proved to be similarly capable of solution by the application of ordinary mechanical principles to anatomical facts.

So fruitful, and consequently so adequate, seemed this conception of living beings as built up of contrivances or organs, in contrast with the lifeless world in whose monotonous masses no such structural disposition could be recognized, that the word "organic" came into use as a term distinctive of living things. The phrase was especially adopted by the chemists, who for a long time classified their material into "organic" substances, *i.e.*, substances found only in living beings, and into inorganic substances, that is, substances occurring in lifeless bodies as well. Indeed, this nomenclature has not even yet been wholly abandoned. Triumphant, however, as was this mode of inquiry in these and similar instances, there remained in every investigation an unsolvable residue, like the question of the origin of the force exerted by the heart referred to above in speaking of Harvey's work; and in many other instances the questions which could not be solved on mechanical principles formed a great part of the whole problem. Thus in the case of the liver careful dissection showed that minute tubes starting from all parts of the liver joined into one large canal, which opened into the small intestine, and observation and experiment taught that these tubes during life conveyed from the liver to the intestine a peculiar fluid called bile, which appeared on the one hand to originate in the liver, and on the other to be used up for some purposes in the intestine. But here the mere mechanical flow of the bile along the gall-ducts, instead of being primary, was merely of secondary importance, and the problem of how the bile was generated and made its way into the small beginnings of the ducts was the greater part of the whole matter. This latter problem was left unsolved, and indeed for a while unattempted. Nevertheless the success in other directions attending the conception of organs and functions encouraged physiologists to speak of the liver as an organ whose function was to secrete bile, and further, led them to ignore to a large extent the great unsolved portion of the problem, and to regard the mere enunciation of the function as the chief end of physiological inquiry.

Moreover, whenever attempts were made to unravel these obscurer problems, the efforts of investigators were mainly confined to a fuller and more complete elucidation of the supposed function of an organ, and the method of inquiry adopted was in most cases one which regarded the finer elements of the part studied as minute organs making up the whole gross organ, and which sought to explain the functions of these smaller organs on the same mechanical principles which had proved so successful in the case of the whole organ. When the improvements in the microscope opened up a new world to the anatomist, and a wholly fresh mechanical analysis of the structure of living bodies became possible, great hopes were entertained that the old method applied to the new facts would soon solve the riddles of life by showing how the mysterious operations of the living substances out of which the grosser organs were built were the outcome of structural arrangements which had hitherto remained invisible, were in fact the functions of minute component organs. A vision of a grand simplicity of organic nature dawned upon the minds of physiologists. It seemed possible to conceive of all living beings as composed of minute organic units, of units whose different actions resulted from their different structural characters, whose functions were explicable by, and could be deduced from, their anatomical features, such units being built up into a number of gross organs, the functions of each of which could in turn be explained by the direction which its mechanical build gave to the efforts of its constituent units. Such a view seemed to have touched the goal, when, in the first half of this century, the so-called "cell-theory" was enunciated as a physiological generalization.

Cell-theory.

Long before, in the previous century, the genius of Caspar Wolff had led him to maintain that the bodies of living beings may be regarded as composed of minute constituent units, which, being in early life all alike and put together as an unformed mass, gradually differentiate and are ultimately arranged into the tissues and organs of the adult being. But, though Wolff was not unaware of the physiological bearing of his conception, his mind was chiefly bent towards morphological views, and his cell-theory is essentially a morphological one. The cell-theory, however, which became famous in the third decade of the present century, and to which the twin names of Schwann and Schleiden will always be attached, was essentially a physiological one. The chief interest which these authors felt in the ideas that they put forth centred in the conviction that the properties of the cell as they described it were the mechanical outcome of its build; and for a time it seemed possible that all physiological phenomena could be deduced from the functions of cells, the anatomical characters of the various kinds of cells determining in turn their special functions. In the cell-theory the conception of organs and functions reached its zenith; but thenceforward its fall, which had been long prepared, was swift and great. Two movements especially hurried on its decline.

It had long been a reproach to physiologists that, while to most organs of the body an appropriate function had been assigned, in respect to certain even conspicuous organs no special use or definite work could be proved to exist. Of these apparently functionless organs the most notorious instance was that of the spleen, a large and important body, whose structure, though intricate, gave no sign of what its labors were, and whose apparent uselessness was a stumbling-block to the theological speculations of Paley. While in the case of other organs a definite function could be readily enunciated in a few words, and their existence therefore easily accounted for, the spleen remained an opprobrium, existing, as it appeared to do, without purpose, and therefore without cause.

The progress of discovery during the present century, by a cruel blow, instead of pointing out the missing use of the spleen, rudely shook the confidence with which the physiologists concluded that they had solved the riddle of an organ when they had allotted to it a special function. From very old times it had been settled that the function of the liver was to secrete bile; and the only problems left for inquiry as touching the liver seemed to be those which should show how the minute structure of the organ was adapted for carrying on this work. About the middle of this century, however, the genius of Claude Bernard led him to the discovery that the secretion of bile was by no means the chief labor of the liver. He showed that this great viscus had other work to do than that of secreting bile, had another "function" to perform, but a function which seemed to have no reference whatever to the mechanical arrangements of the organ, which could never have been deduced from any inspection however complete of its structure, even of its most hidden and minute features, and which therefore could not be called a function in the old and proper sense of that word. By a remarkable series of experiments, which might have been carried out by one knowing absolutely nothing of the structural arrangements of the liver beyond the fact that blood flowed to it along the portal vein, and from it along the hepatic vein, he proved that the liver, in addition to the task of secreting bile, was during life engaged in carrying on a chemical transformation by means of which it was able to manufacture and store up in its substance a peculiar kind of starch, to which the name of *glycogen* was given. Bernard himself spoke of this as the glycogenic function of the liver, but he used the word "function" in a broad indefinite sense, simply as work done, and not in the older narrower meaning as work done by an organ structurally adapted to carry on a work which was the inevitable outcome of the form and internal build of the organ. In this glycogenic function organization, save only the arrangements by means of which the blood flows on from the portal to the hepatic channels in close proximity to the minute units of the liver-substance, the so-called hepatic cells, appeared to play no part whatever; it was not a function, and in reference to it the liver was not an organ, in the old senses of the words. This discovery of Bernard's threw a great flash of light into the darkness hitherto hiding the many ties which bound together distant and mechanically isolated parts of the animal body. Obviously the liver made this glycogen, not for itself, but for other parts of the body; it labored to produce, but they made use of the precious material, which thus became a bond of union between the two.

The glycogenic labors of the simple hepatic substance carried out independently of all intricate structural arrangements, and existing in addition to the hepatic function of secreting bile, being thus revealed, men began to ask themselves the question, May not something like this be true of other organs to which we have allotted a function and thereupon rested content? And further, in the cases where we have striven in hope, and yet in vain, to complete the interpretation of the function of an organ, by finding in the minute microscopic details of its structure the mechanical arrangements which determine its work, may we not have followed throughout a false lead, and sought for organization where organization in our sense of the word does not exist? The answer to this question, and that an affirmative one, was hastened by the collapse of the cell-theory on its physiological side, very soon after it had been distinctly formulated.

Cell-membrane, cell-contents, and nucleus.

The "cell," according to the views of those who first propounded the cell-theory, consisted essentially of an envelope or "cell-membrane," of a substance or substances contained within the cell-membrane, hence called cell-contents, and of a central body or kernel called the "nucleus," differing in nature from the rest of the cell-contents. And, when facts were rapidly accumulated, all tending to prove that the several parts of the animal or vegetable body, diverse as they were in appearance and structure, were all built up of cells more or less modified, the hope arose that the functions of the cell might be deduced from the mutual relations of cell-membrane, cell-contents, and nucleus, and that the functions of an organ might be deduced from the modified functions of the constituent modified cells. Continued investigation, however, proved destructive of this physiological cell-theory. It soon became evident that the possession of an investing envelope or cell-membrane was no essential feature of a cell, and that even the central kernel or nucleus might at times be absent. It was seen in fact that the anatomical unit need have no visible parts at all, but might be simply a minute mass, limited in various ways, of the material spoken of as cell-contents. Under the cell-theory, the cell was supposed to be the first step in organization, the step by which a quantity of formless unorganized plasm became an organized unit; this plasm was further supposed still to form the chief part of the cell-contents, and soon became recognized under the name of protoplasm. Hence the destructive anatomical researches which deprived the cell of its cell-membrane, and even of its nucleus, left nothing except a mass of protoplasm to constitute an anatomical unit. For such a unit the word "cell" was a misnomer, since all the ideas of organization denoted by the word had thus vanished; nevertheless it was retained with the new meaning, and up to the present time the definition of a cell is that of a limited mass of protoplasm, generally but not always containing a modified kernel or nucleus.

Protoplasm.

Protoplasmic theory.

With this anatomical change of front the physiological cell-theory was utterly destroyed. The cell was no longer a unit or organization; it was merely a limited mass of protoplasm, in which, beyond the presence of a nucleus, there was no visible distinction of parts. It was no longer possible to refer the physiological phenomena of the cell to its organization; it became evident that the work done by a "cell" was the result not of its form and cellular structure but simply of the nature and properties of the apparently structureless protoplasm which formed its body. A new idea pressed itself on men's minds, that organization was a concomitant and result of vital action, not its condition and cause; as Huxley in one of his earliest writings put it, "They [cells] are no more the producers of the vital phenomena than the shells scattered in orderly lines along the seabeach are the instruments by which the gravitative force of the moon acts upon the ocean.

Like these, the cells mark only where the vital tides have been, and how they have acted."[1] Hence arose the second of the two movements mentioned above, that which may be called the "protoplasmic" movement, a movement which throwing overboard altogether all conceptions of life as the outcome of organization, as the mechanical result of structural conditions, attempts to put physiology on the same footing as physics and chemistry, and regards all vital phenomena as the complex product of certain fundamental properties exhibited by matter, which, either from its intrinsic nature or from its existing in peculiar conditions, is known as living matter,—mechanical contrivances in the form of organs serving only to modify in special ways the results of the exercise of these fundamental activities and in no sense determining their initial development.

Tissues.

Long before the cell-theory had reduced to an absurdity the "organic" conception of physiology, the insight of the brilliant Bichat, so early lost to science, had led him to prepare the way for modern views by developing his doctrine of "tissues." That doctrine regarded the body as made up of a number of different kinds of living material, each kind of material having certain innate qualities proper to itself as well as certain structural features, and the several kinds of material being variously arranged in the body. Each of these body-components was spoken of as a tissue, muscular tissue, nervous tissue, and the like; and the varied actions of the body were regarded as the result of the activities of the several tissues modified and directed by the circumstance that the tissues were to a great extent arranged in mechanical contrivances or organs which largely determine the character and scope of their actions.

The imperfection of microscopic methods in Bichat's time, and, we may perhaps add, his early death, prevented him from carrying out an adequate analysis of the qualities or properties of the tissues themselves. During the middle portion of this century, however, histological investigation, *i.e.*, inquiry into the minute structure of the tissues, made enormous progress, and laid the basis for a physiological analysis of the properties of tissues. In a short time it became possible to lay down the generalization that all the several tissues arise, as far as structure is concerned, by a differentiation of a simple primitive living matter, and that the respective properties of each tissue are nothing more than certain of the fundamental properties of the primordial substance thrown into prominence by a division of labor running to a certain extent parallel to the differentiation of structure. Developed in a fuller manner, this modern doctrine may be expounded somewhat as follows.

Evolution and characteristics of protoplasm.

In its simplest form, a living being, as illustrated by some of the forms often spoken of as amœbæ, consists of a mass of substance in which there is no obvious distinction of parts. In the body of such a creature even the highest available powers of the microscope reveal nothing more than a fairly uniform network of material, a network sometimes compressed, with narrow meshes, sometimes more open, with wider meshes, the intervals of the meshwork being filled, now with a fluid, now with a more solid substance or with a finer and more delicate network, and minute particles or granules of variable size being sometimes lodged in the open meshes, sometimes deposited in the strands of the network. Sometimes, however, the network is so close, or the meshes filled up with material so identical in refractive power with the bars or films of the network, and at the same time so free from granules, that the whole substance appears absolutely homogeneous, glassy, or hyaline. Analysis with various staining and other reagents leads to the conclusion that the substance of the network is of a different character from the substance filling up the meshes. Similar analysis shows that at times the bars or films of the network are not homogeneous, but composed of different kinds of stuff; yet even in these cases it is difficult if not impossible to recognize any definite relation of the components to each other such as might deserve the name of structure; and certainly in what may be taken as the more typical instance, where the network seems homogeneous, no microscopic search is able to reveal to us a distinct structural arrangement in its substance. In all probability optical analysis, with all its aids, has here nearly reached its limits; and, though not wholly justified, we may perhaps claim the right to conclude that the network in such a case is made up of a substance in which no distinction of parts will ever be visible, though it may vary in places or at times in what may be spoken of as molecular construction, and may carry, lodged in its own substance, a variety of matters foreign to its real self. This remarkable network is often spoken of as consisting of protoplasm, and, though that word has come to be used in several different meanings, we may for the present retain the term. The body of an amœba, then, or of a similar organism, consists of a network or framework which we may speak of as protoplasm, filled up with other matters. In most cases it is true that in the midst of this protoplasmic body there is seen a peculiar body of a somewhat different and yet allied nature, the so-called nucleus; but this we have reason to think is specially concerned with processes of division or reproduction, and may be absent, for a time at all events, without any injury to the general properties of the protoplasmic body.

Now such a body, such a mass of simple protoplasm, homogeneous save for the admixtures spoken of above, is a living body, and all the phenomena which we sketched out at the very beginning of this article as characteristic of the living being may be recognized in it. There is the same continued chemical transformation, the same rise and fall in chemical dignity, the same rise of the dead food into the more complex living substance, the same fall of the living substance into simple waste-products. There is the same power of active movement, a movement of one part of the body upon another giving rise to a change of form, and a series of changes of form resulting eventually in a change of place. In what may be called the condition of rest the body assumes a more or less spherical shape. By the active transference of part of the mass in this or that direction the sphere flattens itself into a disk, or takes on the shape of a pear, or of a rounded triangle, or assumes a wholly irregular, often star-shaped or branched form. Each of these transformations is simply a rearrangement of the mass, without change of bulk. When a bulging of one part of the body takes place there is an equivalent retraction of some other part or parts; and it not unfrequently happens that one part of the body is repeatedly thrust forward, bulging succeeding bulging, and each bulging accompanied by a corresponding retraction of the opposite side, so that, by a series of movements, the whole body is shifted along the line of the protuberances. The tiny mass of simple living matter moves onward, and that with some rapidity, by what appears to be a repeated flux of its semi-liquid substance.

The internal changes leading to these movements may begin, and the movements themselves be executed, by any part of the uniform body; and they may take place without any obvious cause. So far from being always the mere passive results of the action of extrinsic forces, they may occur spontaneously, that is, without the coincidence of any recognizable disturbance whatever in the external conditions to which the body is exposed. They appear to be analogous to what in higher animals we speak of as acts of volition. They may, however, be provoked by changes in the external conditions. A quiescent amœba may be excited to activity by the touch of some strange body, or by some other event,—by what in the ordinary language of physiology is spoken of as a stimulus. The protoplasmic mass is not only mobile but sensitive. When a stimulus is applied to one part of the surface a movement may commence in another and quite distant part of the body; that is to say, molecular disturbances appear to be propagated along its substance without visible change, after the fashion of the nervous impulses we spoke of in the beginning of this article. The uniform protoplasmic mass of the amœba exhibits the rudiments of those attributes or powers which in the initial sketch we described as being the fundamental characteristics of the muscular and nervous structures of the higher animals.

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[1] "The Cell-Theory," in *Brit. and For. Med. Chir. Rev.*, vol. xii. (1853), p. 314.

Constructive and destructive metabolism.

These facts, and other considerations which might be brought forward, lead to the tentative conception of protoplasm as being a substance (if we may use that word in a somewhat loose sense) not only unstable in nature but subject to incessant change, existing indeed as the expression of incessant molecular, that is, chemical and physical change, very much as a fountain is the expression of an incessant replacement of water. We may picture to ourselves this total change which we denote by the term "metabolism" as consisting on the one hand of a downward series of changes (*katabolic* changes), a stair of many steps, in which more complex bodies are broken down with the setting free of energy into simpler and simpler waste bodies, and on the other hand of an upward series of changes (*anabolic* changes), also a stair of many steps, by which the dead food, of varying simplicity or complexity, is, with the further assumption of energy, built up into more and more complex bodies. The summit of this double stair we call "protoplasm." Whether we have a right to speak of it as a single body, in the chemical sense of that word, or as a mixture in some way of several bodies, whether we should regard it as the very summit of the double stair, or as embracing as well the topmost steps on either side, we cannot at present tell. Even if there be a single substance forming the summit, its existence is absolutely temporary: at one instant it is made, at the next it is unmade. Matter which is passing through the phase of life rolls up the ascending steps to the top, and forthwith rolls down on the other side. But to this point we shall return later on. Further, the dead food, itself fairly but far from wholly stable in character, becomes more and more unstable as it rises into the more complex living material. It becomes more and more explosive, and when it reaches the summit its equilibrium is overthrown and it actually explodes. The whole downward stair of events seems in fact to be a series of explosions, by means of which the energy latent in the dead food and augmented by the touches through which the dead food becomes living protoplasm, is set free. Some of this freed energy is used up again within the material itself, in order to carry on this same vivification of dead food; the rest leaves the body as heat or motion. Sometimes the explosions are, so to speak, scattered, going off as it were irregularly throughout the material, like a quantity of gunpowder sprinkled over a surface, giving rise to innumerable minute puffs, but producing no massive visible effects. Sometimes they take place in unison, many occurring together, or in such rapid sequence that a summation of their effects is possible, as in gunpowder rammed into a charge, and we are then able to recognize their result as visible movement, or as appreciable rise of temperature.

Properties of protoplasm.

These various phenomena of protoplasm may be conveniently spoken of under the designation of so many properties, or attributes, or powers of protoplasm, it being understood that these words are used in a general and not in any definite scholastic sense. Thus we may speak of protoplasm as having the power of *assimilation*, *i.e.*, of building up the dead food into its living self; of movement, or of *contractility* as it is called, *i.e.*, of changing its form through internal explosive changes; and of *irritability* or *sensitiveness*, *i.e.*, of responding to external changes, by less massive internal explosions which, spreading through its mass, are not in themselves recognizable through visible changes, though they may initiate the larger visible changes of movement.

Differentiation of protoplasm.

These and other fundamental characters, all associated with the double upward and downward series of chemical changes of constructive and destructive metabolism, are present in protoplasm wherever found; but a very brief survey soon teaches us that specimens of protoplasm existing in different beings or in different parts of the same being differ widely in the relative prominence of one or another of these fundamental characters. On the one hand, in one specimen of protoplasm the energy which is set free by the series of explosions constituting the downward changes of destructive metabolism may be so directed as to leave the mass almost wholly in the form of heat, thus producing very little visible massive change of form. Such a protoplasm consequently, however irritable and explosive, exhibits little power of contractility or movement. In another specimen, on the other hand, a very large portion of the energy similarly set free may be spent in producing visible changes of form, the protoplasm in this instance being exquisitely mobile. Such differences must be due to different internal arrangements of the protoplasm, though, since no vision, however well assisted, can detect these arrangements, they must be of a molecular nature rather than of that grosser kind which we generally speak of as structural. It is true that, as the differences in properties become more and more prominent, as the protoplasm becomes more and more specialized, features which we can recognise as structural intervene; but even these appear to be subsidiary, to accompany and to be the result of the differences in property, or to be concerned in giving special directions to the activities developed, and not to be the real cause of the differences in action. We are thus led to the conception of protoplasm as existing in various differentiated conditions while still retaining its general protoplasmic nature, a difference of constitution making itself felt in the different character of the work done, in a variation of the results of the protoplasmic life. We have a division of physiological labor going hand in hand with a differentiation of material, accompanied ultimately by morphological results which may fairly be spoken of as constituting a differentiation of structure.

Endoderm and ectoderm cells.

Some of the simpler and earlier features of such a division and differentiation may be brought out by comparing with the life of such a being as the amœba that of a more complex and yet simple organism as the hydra or fresh-water polyp. Leaving out certain details of structure, which need not concern us now, we may say that the hydra consists of a large number of units or cells firmly attached to each other, each cell being composed of protoplasm, and in its broad features resembling an amœba. The polyp is in fact a group or crowd of amœba-like cells so associated together that, not only may the material of each cell, within limits, be interchanged with that of neighboring cells, but also the dynamic events taking place in one cell, and leading to exhibitions of energy, may be similarly communicated to neighboring cells, also within limits. These cells are arranged in a particular way to form the walls of a tube, of which the body of the hydra practically consists. They form two layers in apposition, one an internal layer called the *endoderm*, lining the tube, the other an external layer called the *ectoderm*, forming the outside of the tube. And, putting aside minor details, the differences in structure and function observable in the organism are confined to differences between the ectoderm on the one hand, all the constituent cells of which are practically alike, and the endoderm on the other, all the cells of which are in turn similarly alike. The protoplasm of the ectoderm cells is so constituted as to exhibit in a marked degree the phenomena of which we spoke above as irritability and contractility, whereas in the endoderm these phenomena are in abeyance, those of assimilation being prominent. The movements of the hydra are chiefly brought about by changes of form of the ectoderm cells, especially of tail-like processes of these cells, which, arranged as a longitudinal wrapping of the tubular body, draw it together when they shorten, and lengthen it out when they elongate, and it is by the alternate lengthening and shortening of its body, and of the several parts of its body, that the hydra changes its form and moves from place to place. Inaugurating these changes of form, the products of contractility, are the more hidden changes of irritability: these also are especially developed in the ectoderm cells, and travel readily from cell to cell, so that a disturbance originating in one cell, either from some extrinsic cause, such as contact with a foreign body, or from intrinsic events, may sweep from cell to cell over the surface of the whole body. The animal feels as well as moves by means of its ectoderm cells. In the endoderm cells the above phenomena, though not wholly absent, are far less striking, for these cells are almost wholly taken up in the chemical work of digesting and assimilating the food received into the cavity, the lining of which they form.

Thus the total labor of the organism is divided between these two membranes. The endoderm cells receive food, transmute it, and prepare it in such a way that it only needs a few final touches to become living material, these same cells getting rid at the same time of useless ingredients and waste matter. Of the food thus prepared the endoderm cells, however, themselves use but little; the waste of substance involved in the explosions which carry out movement and feeling is reduced in them to a minimum; they are able to pass on the greater part of the elaborated nourishment to their brethren the ectoderm cells. And these, thus amply supplied with material which it needs but little expenditure of energy on their part to convert into their living selves, thus relieved of the greater part of nutritive labor, are able to devote nearly the whole of their energies to movement and to feeling.

Microscopic examination further shows that these two kinds of cells differ from each other to some extent in visible characters; and, though, as we have seen, the differences in activity appear to be dependent on differences in invisible molecular arrangement rather than on gross visible differences such as may be called structural, still the invisible differences involve or entail, or are accompanied by, visible differences, and such differences as can be recognized between endoderm and ectoderm, even with our present knowledge, may be correlated to differences in their work; future inquiry will probably render the correlation still more distinct.

The ectoderm cells together constitute what we have spoken of above as a tissue, whose function in the modern sense of the word is movement and feeling, and the endoderm cells constitute a second tissue, whose function is assimilation; and the phenomena of the whole being result from the concurrent working of these two functions. Of organs, in the old sense of the word, of mechanical contrivances, there is hardly a trace.[1] The performances of the being are, it is true, conditioned by its being moulded in the form of a long tubular sac with a crown of like tubular arms, but beyond this the explanation of every act of the hydra's life is first to be sought in the characters of the endoderm and ectoderm. The physiology of the hydra is, for the most part, a series of problems, dealing on the one hand with the intimate nature of the ectodermic protoplasm and the changes in that protoplasm which give rise to movement and feeling, as well as with the laws whereby those changes are so regulated that movement and feeling come and go as the needs of the organism may require, and on the other hand with the intimate nature of the endodermic protoplasm and the changes in that protoplasm whereby the dead food is, also according to the needs of the economy, transformed into living substance. Whereas the older physiology dealt almost exclusively with mechanical problems, the physiology of to-day is chiefly busied with what may be called molecular problems.

The physiology of the higher animals, including man, is merely a development of the simpler physiology of the hydra, which has been rendered more complex by a greater division of physiological labor, entailing greater differentiation of structure, and been varied by the intercalation of numerous mechanical contrivances.

Differentiation of ectoderm.

In the hydra each ectoderm cell—for, broadly speaking, they are all alike—serves three chief purposes of the body. (1) It is sensitive, that is, it is thrown into peculiar molecular agitations, with expenditure of energy, when acted upon by external agents. In man and the higher animals certain cells of the original ectoderm of the embryo are differentiated from their fellows (which, losing to a large extent this sensitiveness, remain as a mechanical covering to the body) by a more exquisite development of this power of reaction, and moreover are differentiated from each other in their relative sensitiveness to different agents, so that one set of cells becomes peculiarly susceptible to light, another set to pressure, and the like. Thus the uniform ectoderm of the hydra, uniformly susceptible to all agencies, is replaced by a series of special groups of cells forming the basis of sensory organs, each group being specially sensitive to one agent, and having the nature of its constituent cells correspondingly modified. (2) In each ectoderm cell of the hydra the agitations primarily induced by the exciting agent become so modified by changes taking place in the cell that the outcome is not always the same. According to processes taking place in the cell, movement of one kind or another, or no movement at all, may result, and such movement as results may take place immediately or at some other time; it may be at a time so distant that the connection between the exciting disturbance is lost, and the movement appears to be spontaneous. In man and the higher animals these more complex "neural" processes are carried on, not by the simple sensory cells which receive the primary impression, but by a group of cells set apart for the purpose. These cells constitute a central nervous system, in which a still further division of labor and differentiation of structure takes place, the simple neurotic processes of the hydra, with its dim volition and limited scope of action, being developed in a complex manner into processes which range from simple elaboration of the initial additional agitation of the sensory cell into what we speak of as intelligence and thought. (3) Each ectoderm cell, by its tail-like prolongation, or by its whole body, contributes to the movement of the animal while still carrying on the two other actions just described. In man and the higher animals the material of the sensory cell and of the central nervous cells is too precious to be wasted in movements; these accordingly are carried out by groups of cells constituting the muscular tissue, in which both the sensitiveness and the higher neurotic processes of the primitive cell are held in abeyance; indeed, the latter have almost disappeared in order that the energy of the protoplasm may be more completely directed to producing those changes of form which determine the movements of the animal.

Further, the separation in space of these three groups of cells or tissues necessitates the introduction of elements whereby the agitations set up in the sensory cell should be communicated to the central nervous cells, where these agitations are further elaborated, as well as of elements whereby the muscular tissue may receive vibrations from the central nervous cells, so that the movements of the body may be determined by these. Hence strands of irritable protoplasm whose energy is not spent in movement, but wholly given up to the rapid and easy transmission of molecular vibrations, unite, as sensory nerves, the sensory cells with the central nervous cells, and, as motor nerves, these with the muscles.

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[1] The existence of certain minute mechanisms called urticating organs lodged in the ectoderm cells does not affect the present argument.

Lastly, for the adequate carrying out of complex movements, the contractile cells, elongated into specially constructed fibres and constituting the muscles, are arranged with inert tissues such as bones, cartilages, tendons, and the like (tissues of mechanical virtues, manufactured by an active protoplasm, but themselves passive, no longer active), into various mechanical contrivances. Similarly the sensory cells, as notably those of the eye and the ear, set apart to be acted upon by special agents, are provided with special mechanisms in order that the agent may act with more complete precision. Thus the sensory cells constituting the retina of the eye, in which alone sensory, visual impulses are generated, are provided with an intricate dioptric mechanism, formed partly of inert tissues such as the lens, partly of peculiarly arranged muscular and nervous elements.

In this way the simple ectoderm of the hydra is replaced by a complicated system composed of organs, some of them of extremest intricacy. But the whole system may be reduced to two sets of factors. On the one hand there are organs in the old sense of the word, that is, mechanical arrangements, some connected with the muscles and others connected with the sensory cells, organs whose functions have for the most part to be interpreted on mechanical principles, since their most important factors, putting aside intervening muscular and nervous elements, are the inert products of protoplasm doing simple mechanical work. On the other hand there are organs in the later sense of the word, namely, sensory cells differentiated to be sensitive to special influences, central nervous cells differentiated to carry on the inner nervous work, muscles differentiated to contract, and nerves differentiated to bind together these three other factors. The work of these latter organs is dependent on the nature of their protoplasm; mechanical arrangements play but little part in them; and the results of their activity can in no way be explained on simple mechanical principles.

Differentiation of endoderm.

Corresponding with this differentiation of the ectoderm cells runs a somewhat similar differentiation of the endoderm cells. In the hydra each endoderm cell appears to receive some of the food bodily into itself and there to elaborate it into what may be spoken of as prepared nutritive material. Some of this material the cell retains within itself in order to renew its own protoplasm; the rest oozes out to the ectoderm cells, the replenishment of whose protoplasm is thereby effected with a saving of labor. In the higher animals the preparation of food is far more complicated. The endodermic sheet of the alimentary canal is folded and arranged into organs called glands, with the mechanical advantage that a large amount of surface is secured within a small bulk; and the constituent endodermic cells of their glands pour out, or secrete, as is said, divers fluids into the cavity of the canal, so that much preliminary preparation of digestion of the food takes place before the food really enters the body. Further, these secreting glandular cells are so differentiated as to pour out special juices acting on special constituents of a meal, and the food subjected in turn to the action of these several juices becomes thoroughly prepared for reception into the body. This reception is carried out by other endoderm cells, which in receiving the digested food probably act upon it so as still further to heighten its nutritive value; and the absorbed food, before it is presented to the muscular and nervous tissues, for whose use it is largely, though of course not exclusively, intended, is subjected to the action of other cells, such as those forming the lymphatic glands and the liver, in order that it may be still further elaborated, still further prepared for the final conversion into living protoplasm.

Vascular system.

As in the case of the tissues and organs of ectodermic origin, so also here, the wide separation in space of the masses of differentiated cells constituting tissues necessitates the introduction of mechanical contrivances for the carriage of material from place to place. In the simple minute hydra the nutritive material can permeate the whole body by simply oozing from cell to cell. In the higher animal a hydraulic system for the distribution of nutritive material is introduced. A fluid is distributed in a ceaseless flow all over the body by a mechanical arrangement, consisting of a pump with branching tubes, worked on mechanical principles, and capable of being imitated artificially, save that the power which drives the machine is the energy set free by living muscle. As this circulating fluid or blood rushes past the endoderm cells which have gorged themselves from the rich contents of the alimentary canal, it receives from them some of the material which they have absorbed and elaborated, and carries this nutritive supply to muscles, nerves, and all parts of the body. Similarly it carries away from muscles, nerves, and other tissues the waste-products of their activity, those broken fragments of simpler stuffs into which, as we have seen, the complex protoplasm, wherever it exists, is forever splitting up, and bears them back to differentiated endoderm and other cells, whose work has become, so to speak, inverted, since their activity is directed to casting things out of the body, instead of receiving things into the body. And lastly, by a special arrangement, by a peculiar property of those red corpuscles which make blood red, this circulating material at one and the same time carries to each corner of the body, not only the nutritive material required for building up protoplasm, but also the oxygen by which the constructed protoplasm may suffer oxidation, and in being oxidized set free that energy the manifestation of which is the token of life. Blood is in fact the medium on which all the various parts of the body live. Just as an amœba finds in the water which is its home both the food with which it builds itself up and the oxygen with which it breaks itself down, and returns to the water the waste products of its continued disintegration, so each islet of the living substance of the higher animal, be it muscle or nerve or gland, draws its food and its oxygen from the red blood-stream sweeping past it, finding therein all its needs, and sheds into the same stream the particles into which it is continually breaking up, and for which it has no longer any use. Hence the blood becomes, as it were, a chemical epitome of the body: from it each tissue takes something away; to it each tissue gives something back. As it sweeps by each tissue, losing and gaining, it makes the whole body common, and when working aright brings it about that each tissue is never in lack of the things which it wants, never choked up with the things with which it has done.

This vascular system, consisting of a force-pump and branching tubes, constitutes, as we have said, a mechanical arrangement worked on mechanical principles. Nevertheless occult protoplasmic processes intervene as factors in its total work. Not only is the force-pump itself a living muscular organ, not only are the walls of the tubes muscular in nature, so that the mere mechanical working of the system is modified by changes not of mechanical origin taking place in them, but the living material which lines the tubing throughout, especially in the minuter channels, finds work to do, also not of a mechanical nature. The gross phenomena of the flow of blood through the capillary channels may (see VASCULAR SYSTEM) be interpreted on simple hydraulic principles; but no appeal to the ordinary physical laws of dead material will explain the phenomena of the interchange between the blood on the inside of a capillary wall and the tissue-elements on the outside. In every tissue, be it gland, muscle, or nerve, the blood, so far from being actually in contact with the active protoplasmic units of the tissue, is separated by the protoplasmic film of the capillary wall, and by a space or spaces, greater or smaller, filled with the fluid called lymph and lined to a greater or less extent with protoplasmic cells, which lining, often at least, parts the tissue-units from the lymph. Hence the tissue lives upon the lymph, while the lymph is replenished from the blood; and the interchange between the tissue-unit and the blood is determined, not only by the direct action of the tissue-unit on the lymph, but also by the relations of the lymph to the blood, as regulated by the capillary wall and the cellular lining of the lymph-spaces. We may speak of the interchange as broadly one of diffusion or osmosis through filmy membranes; but diffusion is not the lord in the matter; it is rather a humble servant directed hither and thither by occult molecular processes in the protoplasmic structures concerned.

The foregoing rough analysis leads to a conception of the physiology of the animal body which may be expressed somewhat as follows. The body is composed of different kinds of matter; each kind of matter, arranged in units more or less discrete, constitutes a tissue; and the several tissues, though having a common likeness in token of their origin from a common primordial protoplasm, have dissimilar molecular constitutions, entailing dissimilar modes of activity. Nor is each tissue homogeneous, for two parts of the body, though so far alike as to be both examples of the same general tissue, may be different in molecular constitution, more or less distinctly expressed by microscopic differences of structure, and correspondingly different in action. Thus a liver-cell and a kidney-cell, though both examples of glandular tissue, are quite distinct; so also several varieties of muscular tissue exist; and in the dominant nervous tissue we have not only a broad distinction between nerve-fibres and nerve-cells, but the several groups of nerve-cells which are built up into the brain and spinal cord, and indeed probably the single nerve-cells of these, though all possessing the general characters, both in structure and function, of nervous protoplasm, differ most widely from each other. These several tissues of diverse constitution and activity, ranging as regards the rapidity of the molecular changes taking place in them from the irritable, unstable, swiftly-changing nerve-cell to the stable, slowly-changing, almost lifeless tendon or bone, are disposed in the body in various mechanical arrangements constituting organs or machines, whereby the activities of the constituent tissue-elements are brought to bear in special directions. These organs range from those in which the mechanical provisions are dominant, the special activity of the tissue-elements themselves being in the background, and supplying only an obscure or even unimportant factor, as in the organs of respiration, to those in which the mechanical provisions are insignificant, as in the central nervous system, where the chief mechanical factor is supplied by the distribution in space of the nerve fibres or cells.

Nature of physiological problems.

Hence it is obvious that almost every physiological inquiry of any large scope is, or sooner or later becomes, of a mixed nature. On the one hand, investigation has to be directed to the processes taking place in the actual tissue-elements, in the protoplasmic cells and modifications of cells. These are essentially of a molecular, often of a chemical or chemico-physical nature; in the problems thus raised matters of form and structure, other than that of molecular structure, which no microscope can ever reveal, are of secondary moment only, or have no concern in the matter at all. These may be spoken of as the purely physiological or as the molecular problems. On the other hand, the natural results of these tissue-activities are continually being modified by circumstances whose effect can be traced to the mechanical arrangements under which the tissue in question is acting, whence arise problems which have to be settled on simple mechanical principles.

We may take as an illustration the physiology of the kidney. In the old language the function of the kidney is to secrete urine. When we come to inquire into the matter, we find, in the first place, that the secretion of urine—that is the quantity and quality of the urine escaping from the duct of the kidney in a given period—is partly determined by the quantity of blood passing through the kidney and the circumstances of its passage. Now the quantity of blood reaching the kidney at any one time is dependent partly on the width of the renal arteries, partly on the general pressure of the blood in the arterial system. The width of the renal arteries is in turn dependent on the condition of their muscular walls, whether contracted or relaxed; and this condition is determined by the advent of nervous impulses, the so-called vaso-motor impulses, arising in the central nervous system and passing down to the renal arteries along certain nerves. The emission of these vaso-motor impulses from the central nervous system is further determined, on the one hand by the condition of certain parts of the central nervous system, the so-called vaso-motor centres, and on the other by the passage of certain afferent sensory impulses to those vaso-motor centres from sensory surfaces such as the skin. Similarly the general blood-pressure is dependent on the condition, patent or narrowed, of the small arteries generally, this being likewise governed by the vaso-motor system, and on the coincident work done by the heart in driving blood into the great bloodvessels, this work being also governed by the nervous system. Hence in attacking such a problem as to how any particular event, such as the exposure of skin to the cold, influences the flow of blood through the kidney and thus the secretion of urine, the investigator, without staying to inquire into the nature of nervous impulses, or into the nature of changes taking place in vaso-motor centres, etc., directs his attention to determining what impulses are generated under the circumstances, what paths they take, to what extent they are quantitatively modified, how far they and their effects react upon each other, and so on. His inquiry in fact takes on to a large extent the characters of an attempt to unravel an intricate game, in which the counters are nervous impulses, muscular contractions, and elastic reactions, but in which the moves are determined by topographical distribution and mechanical arrangements.

But there are other problems connected with the physiology of the kidney of quite a different nature. The kidney is, broadly speaking, constructed of living protoplasmic cells so arranged that each cell is on one side bathed with blood and lymph, and on the other forms the boundary of a narrow canal, which, joining with other canals, ultimately opens into the urinary bladder. Here the question arises how it is that these protoplasmic cells, having nothing to draw upon but the common blood, which is distributed to other organs and tissues as well, are able to discharge on the other side of them into the canal the fluid urine, which is absolutely distinct from blood, which contains substances wholly unknown in blood, as well as substances which, though occurring in blood, are found there in minute quantities only, and, moreover, are not found to escape from the blood into any other tissues or organs? In attempting to answer this question we come upon an inquiry of quite a different nature from the preceding, an inquiry for the solution of which mechanical suggestions are useless. We have to deal here with the molecular actions of the protoplasmic cell. We must seek for molecular explanations of the questions, why a current sets across the cells from blood-capillary and lymph-space to the hollow canal; why the substances which emerge on the far side are so wholly unlike those which enter in on the near side; why, moreover, the intensity of this current may wax and wane, now flooding the canal with urine, now nearly or quite drying up; why not only the intensity of the current but also the absolute and relative amount of the chemical substances carried along it are determined by events taking place in the cell itself, being largely independent of both the quantity and quality of the blood which forms the cell's only source of supply? These and other like questions can only be solved by looking with the mind's eye, by penetrating through careful inferences, into those inner changes which we call molecular, and which no optical aid will ever reveal to the physical eye.

These two lines of inquiry, which we may call the mechanical and the molecular, obtain in all parts of physiology, sometimes the one and sometimes the other being dominant. A study of the special articles dealing with the several parts of physiology (see "Nervous System" below, NUTRITION, REPRODUCTION, VASCULAR SYSTEM) will perhaps sufficiently show this; but it may be worth while to give a very brief survey of the whole field from this point of view.

Brief survey.

The master tissues and organs of the body are the nervous and muscular systems, the latter being, however, merely the instrument to give effect and expression to the motions of the former. All the rest of the body serves simply either in the way of mechanical aids and protection to the several parts of the muscular and nervous systems, or as a complicated machinery to supply these systems with food and oxygen, *i.e.*, with blood, and to keep them cleansed from waste matters throughout all their varied changes. The physiology of the muscular system is fairly simple. The mechanical problems involved have been long ago for the most part worked out, and the molecular problems which touch on the nature of muscular contractions, their dependence on the blood-supply, and their relations to nervous impulses are being rapidly solved. The physiology of the nervous system, on the other hand, is in its infancy. The mechanical side of the inquiry is here represented, inasmuch as the various actions of the system are conditioned by the distribution and topographical arrangement of the constituent fibres and cells; and even these simple problems, as may be seen from the article "Nervous System" below, are as yet largely unworked. The deeper molecular problems, those which deal with the real nature of the processes taking place in cell and fibre, even the simpler of these, such as the one which asks why the neural protoplasm of one cell, or group of cells, seems quiescent until stirred by some foreign impulse, its own vibrations being otherwise retained and lost within its own substance, while the neural protoplasm of another cell is continually, or from time to time, discharging vibrations, as rhythmic molecular pulses, along adjoining fibres—these, at the present day, can hardly be said to be touched. The physiology of the nervous system is emphatically the physiology of the future.

The rest of the body may, from a broad point of view, be regarded as a complex machinery for supplying these master tissues with adequately-prepared food and oxygen, for cleansing them from the waste products of their activity, and for keeping them at a temperature suitable for the development of their powers. As we have already said, the blood is the agent which not only supplies both food and oxygen but sweeps away all refuse, and, we may add, is the instrument for maintaining an adequate temperature. All the rest of the body may in fact be looked upon as busied in manufacturing food into blood, in keeping up the oxygen supply of the blood, in sifting out from the blood all waste material, and in maintaining the blood at a uniform heat. This work, of which blood is, so to speak, the centre, is, as we have already seen, carried out by protoplasmic cells, many of which are themselves of a muscular nature, often forming part of complicated mechanical contrivances, built up partly of inert tissues, partly of active tissues, such as muscle and nerve. In tracing the food and oxygen into the blood and the waste matters out of the blood, in studying the distribution of the blood itself and the means adopted to maintain its even temperature, we come, as before, on problems partly mechanical or chemical and partly molecular. The changes which the food undergoes in the intestines can be, and have been, successfully studied as a series of purely chemical problems conditioned by anatomical arrangements, such as the existence of an acid fluid in the stomach, succeeded by alkaline fluids in the intestine and the like; but the questions concerned in the discharge of the digestive juices into the alimentary canal, in the secretory activity of the digestive glands, raise up protoplasmic molecular inquiries. In the reception or absorption of the digested food we similarly find the purely physical processes of diffusion and the like overridden by the special protoplasmic activities of the constituent cells of the lining of the canal. In the further elaboration of the digested products the action of cells again intervenes, as it similarly does in the, so to speak, inverted action by which waste matters are cast out of the body, though in both cases the results are in part conditioned by mechanical contrivances. The circulation of the blood is carried on by means of an intricate mechanical contrivance, whose working is determined and whose effects are conditioned by molecular changes occurring in the constituent muscles and other protoplasmic cells; the work done by the heart, the varying width of the channels, the transit of material through the filmy capillary walls, all these are at once the results of protoplasmic activity and factors in the mechanical problems of the flow of blood. The oxygen passes into and carbonic acid out of the blood, through simple diffusion, by means of the respiratory pump, which is merely a machine whose motive-power is supplied by muscular energy, and both oxygen and carbonic acid are carried along in the blood by simple chemical means; but the passage of oxygen from the blood into the tissue and of carbonic acid from the tissue into the blood, though in themselves mere diffusion processes, are determined by the molecular activity of the constituent cells of the tissue. Lastly, the blood, however well prepared, however skilfully driven to the tissue by the well-timed activity of the vascular system, even when it has reached the inner network of the tissue-elements, is not as yet the tissue itself. To become the tissue it must undergo molecular changes of the profoundest kind: it must cross the boundary from dead material to living stuff. The ultimate problems of nutrition are of the molecular kind. All the machinery, however elaborate, is preparatory only, and it is the last step which costs the most.

Of the many problems concerned in the several departments of physiology the one class which we have spoken of as being mechanical in nature is far too varied to be treated of as a whole. The problems falling under it have but few features in common; each stands, as it were, on its own bottom, and has to be solved in its own way. The problems of the other class, however—those which we have spoken of as being molecular in nature—have a certain common likeness; and it may be worth while to consider, in a brief and general manner, some of their most striking characters.

Molecular actions and changes.

For this purpose we may first of all turn to the changes taking place in a secreting cell, for these have of late years been studied with signal success. They illustrate what may be called the chemical aspects of vital actions, just as the changes in a muscular fibre, on the other hand, seem to present, in their simplest form, the kinetic aspects of the same actions. If we examine a secreting gland, such as a pancreas or a salivary gland, we find that it is composed of a number of similar units, the unit being a secreting cell of approximately spheroidal form, one part of the surface of which borders a canal continuous with the duct of the gland, while another part is bathed in lymph. The process of secretion consists in the cell discharging into the canal a fluid which is of a specific character, insomuch as, though it consists partly of water and other substances common to it and other fluids of the body, these are present in it in special proportions; and it also contains substances or a substance found in itself and nowhere else. To enable it to carry on this work the cell receives supplies of material from the lymph in which it is bathed, the lymph in turn being replenished from neighboring capillary bloodvessels. The secreting cell itself consists of a soft protoplasmic "body," of the nature previously described, in the midst of which lies a "nucleus." The consideration of the actions carried out by the nucleus may, for simplicity's sake, be left on one side for the present; and we may regard the cell as a mass of protoplasm consisting, as we have seen, of a network of a particular nature, and of other substances of different nature filling up the meshes or interstices of the network.

Such a cell may exist under two different conditions. At one time it may be quiescent: although the bloodvessels surrounding it are bathing it with lymph, although this lymph has free access to the protoplasm of the cell, no secretion takes place, no fluid whatever passes from the cell into the canal which it borders. At another time, under, for instance, some influence reaching it along the nerve distributed to the gland, although there may be no change in the quantity or quality of the blood passing through the adjacent bloodvessels, a rapid stream of material flows from the protoplasmic cell-body into the canal. How is this secretion brought about?

If we examine certain cells, such, for instance, as those of the pancreas, we find that during a period of rest succeeding one of activity the cell increases in bulk, and further that the increase is not so much an enlargement of the protoplasmic network as an accumulation of material in the meshes of the network; in fact, there appears to be a relative diminution of the actual protoplasm, indicating, as we shall see, a conversion of the substance of the network into the material which is lodged in the interstices of the network. This material may, and frequently does, exist in the form of discrete granules, recognizable under the microscope; and in the pancreas there is a tendency for these granules to be massed together on the side of the cell bordering the lumen of the canal. During activity, while the cell is discharging its secretion into the canal, these granules disappear, so that the protoplasmic network is after prolonged activity left with a very small burden of material in its meshes; at the same time there also appears to be an accompanying absolute increase of growth of the mass of the protoplasm itself. We have further evidence that the substance which is thus stored up in the meshes of the cell, forming the granules, for instance, just spoken of, is not, as it exists in the cells, the same substance as that which occurs in the secretion as its characteristic constituent. Thus the characteristic constituent of pancreatic juice is a peculiar ferment body called "trypsin," and we possess evidence that the granules in the pancreatic cells are not trypsin. But we have also evidence that these granules consist of material which, upon a very slight change, becomes trypsin, of material which is an antecedent of trypsin, and which has accordingly been called "trypsinogen." Thus the cell during rest stores up trypsinogen, and the change which characterizes activity is the conversion of trypsinogen into trypsin, and its consequent discharge from the cell. These are facts ascertained by observation and experiment, viz., that trypsinogen appears in the protoplasm of the cell, and that in the act of secretion this trypsinogen is discharged from the cell in the form of the simpler trypsin. When, however, we come to consider the origin of the trypsinogen we pass to matters of inference and to a certain extent of speculation.

Two views seem open to us. On the one hand, we may adopt an old theory, once generally accepted, and suppose that the cell picks out from the lymph which bathes it particles of trypsinogen, or particles of some substance which is readily transformed into trypsinogen, and deposits them in its substance. This may be called the "selective" theory. On the other hand, we may suppose that the trypsinogen results from the breaking down, from the katabolic or destructive metabolism of the protoplasm, being thus wholly formed in the cell. This may be called the "metabolic" theory. Our present knowledge does not permit us wholly to prove or wholly to disprove either of these theories; but such evidence as we possess is in favor, and increasingly in favor, of the metabolic theory. All efforts to detect in the blood or in the lymph such substances as trypsinogen, or analogous substances in the case of other glands, have hitherto failed; and, although such a negative argument has its weakness, still it is of avail as far as it goes. On the other hand, the diminution of the protoplasm in the pancreatic cell, *pari passu* with the increase of trypsinogen, and its subsequent renewal previous to the formation of new trypsinogen, strongly support the metabolic theory, and a number of other facts drawn from the history of various animal and vegetable cells all tend strongly in the same direction. We have further a certain amount of evidence that trypsinogen arises from an antecedent more complex than itself, as it in turn is more complex than trypsin. So, although clear demonstration is not as yet within our reach, we may with considerable confidence conclude that trypsinogen and other like products of secreting cells arise from a breaking down of the cell-substance, are manufactured by the protoplasm of the cell out of itself.

Mesostates.

We are thus led to the conception that the specific material of a secretion, such as the trypsin of pancreatic juice, comes from the protoplasm of the cell, through a number of intermediate substances, or *mesostates* as they are called; that is to say, the complex protoplasm breaks down into a whole series of substances of decreasing complexity, the last term of which is the specific substance of the secretion. Now the protoplasm is undoubtedly formed at the expense of the material or pabulum brought to it from the blood through the medium of the lymph; the pabulum becomes protoplasm. Here also two views are open to us. On the one hand, we may suppose that the crude pabulum is at once by a magic stroke, as it were, built up into the living protoplasm. On the other hand, we may suppose that the pabulum reaches the stage of protoplasm through a series of substances of increasing complexity and instability, the last stage being that which we call protoplasm. And here, too, no absolute decision between the two views is possible, but such evidence as we do possess is in favor, and increasingly in favor, of the latter view.

Anastates and katastates.

We may therefore with considerable confidence anticipate the future arrival of evidence which will demonstrate the as yet only probable view that in the secreting cell there are two series of events, two staircases, as it were, of chemical transformation,—one an ascending staircase of synthetic, anabolic processes through which the pabulum, consisting of several substances, some of them already complex and unstable, is built up into the still more complex and still more unstable protoplasm; the other a descending staircase, consisting of a series of katabolic processes giving rise to substances of decreasing complexity and increasing stability. The substances or mesostates appearing in the former we we may speak of as "anastates," those of the latter we may call "katastates." At each step of the former, by which a simpler anastate becomes, or by which simpler anastates become, a more complex one, energy is absorbed: at each step of the latter energy is set free. And, since in the animal-cell the initial anastates seem always or at least generally more complex than the final katastates, the total life of the animal-cell is virtually a giving forth of energy.

Molecular changes in muscle.

So far we have spoken of the secreting cell, but we have evidence that in the activity of a muscle a similar series of events takes place. Reduced to theoretical simplicity, the unit a number of which go to form a muscle is a protoplasmic cell, undergoing, like the secreting cell, a continual metabolism, with a change in the results of that metabolism at the moment of functional activity. Put in a bald way, the main difference between a secreting cell and a muscle-cell, or elementary muscle-fibre as it is often called, is that in the former the products of the metabolism constitute the main object of the cell's activity, a change of form being of subordinate importance, whereas in the latter the change of form, an increase of one axis at the expense of another, a shortening with corresponding thickening, is the important fact, the products of the metabolism which thus gives rise to the change of form being of secondary value.

Now we have evidence, which, as in the case of the secreting cell, though not demonstrative, is weighty and of daily increasing weight, that the change of form, the contraction of a muscle, is due to a sudden metabolism, to an explosive decomposition of what may be called "contractile substance," a substance which appears to be used up in the act of contraction, and the consumption of which leads with other events to the exhaustion of a muscle after prolonged exertion. We know as a matter of fact that when a muscle contracts there is an evolution of a considerable quantity of carbonic acid, and a chemical change of such a kind that the muscle becomes acid. This carbonic acid must have some antecedent, and the acidity must have some cause. It is of course possible that the protoplasm itself explodes, and is the immediate parent of the carbonic acid and the direct source of the energy set free in the contraction; but evidence analogous to that brought forward in relation to the secreting cell leads to the conclusion that this is not so, but that the explosion takes place in, and that the energy is derived from, a specific contractile substance. And there is further evidence that this hypothetical substance, to which the name of "inogen" has been provisionally given, is, like its analogue in the secreting cell, a katastate. So that the contracting activity of a muscular fibre and the secreting activity of a gland-cell may be compared with each other, in so far as in each case the activity is essentially a decomposition or explosion, more or less rapid, of a katastate, the inogen in the one instance, the trypsinogen or some other body in the other instance, with the setting free of energy, which in the case of the secreting cell leaves the substance wholly as heat, but in the case of the muscle partly as movement, the activity being followed in each case by the discharge from the fibre or cell of the products, or some of the products, of this decomposition.

In nervous substances.

Further, we may carry on the parallel to nervous substance. As a nervous impulse travels along a nerve fibre or pursues its intricate course along the fibrillar tracts of a nerve-cell, the amount of chemical change is too slight to be satisfactorily appreciated by the methods at present under our command. There is certainly no massive explosion like that of a muscular fibre, and the most striking phenomena attending the passage of a nervous impulse are of an electrical nature. We cannot indeed distinctly prove that any chemical change does really accompany nervous activity; but from many considerations it is extremely probable that a chemical change, an explosive decomposition of more complex into more simple substances, is the basis of a nervous impulse. The energy, however, which is set free by this decomposition is not discharged from the nervous substance to so great an extent as is the case in the muscle-fibre, but is largely consumed in conveying or conducting the decomposition from one particle of the nervous substance to succeeding ones,—that is to say, in carrying out that which is the essential work of the nervous substance. Moreover, even in a muscle, while the explosion of inogen and the consequent shortening and thickening of the muscle-substance travel along the fibre from particle to particle in the form of a wave starting from the junction of the nerve-fibre with the muscular-fibre, or from some other point of stimulation, this wave of visible contraction is preceded by invisible molecular changes also travelling along the fibre in the form of a wave, changes which manifest themselves by no massive explosions, which are indicated by electrical phenomena chiefly, and which are exceedingly like the nervous impulses of proper nervous structures. In the very substance of the muscular fibre there appears to be a material which is not inogen, but which is capable of undergoing changes, probably of the nature of an explosive decomposition, and it is these which in turn induce the more massive decomposition of the inogen. It is possible, indeed probable, that the constituent particles of inogen are not able to communicate their explosions to each other, so that the presence in the muscular fibre of an impulse-carrying material is a necessity. Be this as it may, a change antecedent to the explosion which is the cause of the actual contraction does occur in every particle of the muscle which contracts, and, as we have urged, the change is probably one taking place in a special substance. This substance may be the veritable protoplasm itself of the fibre, but considerations analogous to those urged before would lead us to suppose that it too is a katastate, but a katastate different in qualities from inogen; and we may further suppose that a very similar katastate is manufactured by nervous protoplasm, and by its decomposition gives rise to nervous energy. This katastate is, as it were, the fuse or trigger whose action fires the massive charge of the muscular gun, and might receive the name of "apheter."

Metabolic changes in central nervous system.

If we accept this view as to the nature of the simple nervous impulses which sweep along nerve-fibres—and in this respect motor and sensory nerves would seem wholly alike—there is no great difficulty in extending the conception to the more complicated processes taking place in the central nervous system. An ordinary reflex act, so called, is perhaps one of the simplest labors of that system, and we have evidence that in a reflex act sensory impulses arriving along a sensory fibre at the protoplasm of a nerve-cell induce in that protoplasm changes which, though in certain repects differing from, are fundamentally analogous to, those changes in motor and sensory nerve-fibres which constitute their respective nervous impulses. The chief difference is that, whereas along sensory and motor fibres the impulses pursue an even course, possibly undergoing some augmentation, but one which is not sufficiently marked to be beyond doubt, in the nerve-cell, on the contrary, an unmistakable augmentation accompanied by a systematic dispersion takes place. So great is the augmentation in some cases that a gentle short series of sensory impulses reaching one of a group of nerve-cells along a single sensory fibre may throw the whole group of nerve-cells into such profound agitation that repeated series of even violent impulses may be discharged along a multitude of motor fibres. Allowing for this increase in the energy set free, the changes in the nerve-cells do not seem to differ fundamentally from those in the nerve-fibres (which indeed differ to a certain extent among themselves), and may, like them, be regarded as due essentially to the decomposition of some katastate or katastates.

Further, just as the apheter of the muscular fibre, that which inaugurates the explosion of the contractile inogen, differs from the apheter of the nerve-fibre, so we may suppose that in the various nerve-cells of different parts of the central nervous system difference of function, while partly due to the mere arrangement and distribution of nervous impulses of the same kind, is also and more largely due to difference in the kind of impulses brought about by difference in the composition and mode of decomposition of the nervous material. For instance, certain changes in the nervous system are accompanied by distinct changes of consciousness, while others are not. And, while we may justly refuse to attempt any explanation of consciousness, it is nevertheless within our right to suppose that, in that nervous substance which is the highest development of protoplasm and to whose service the whole body ministers, amid the many substances of increasing complexity and dignity which enter into its composition there should be a substance or some substances the changes in which are, or may be, accompanied by consciousness. The doctrine of evolution compels us to admit that consciousness must be potentially present in the simple protoplasm of the amœba, and must be similarly present in all the tissues of the highly-developed animal, instead of being confined to some limited portion of the nervous system. Evolution refuses to admit a sharp line of demarcation between a "conscious" and a "non-conscious" part, and this decision is increasingly supported as our knowledge of the nervous system advances. But a great deal of the earlier part of this article was directed to show that all the powers of the complex animal are the outcome of the differentiation of a primordial protoplasm, while the discussion concerning the molecular changes of tissues in which we are now engaged is simply an attempt to trace out how that differentiation has taken place. And, as far as we can see, there are no just reasons why the differentiation which sets apart the nervous tissue from other parts of the body should not obtain in the nervous tissue itself, and the obscure rudiments of consciousness present in all nervous material become by differentiation developed, in some particular kinds of nervous substance, into consciousness more strictly so called.

Consciousness.

In the case, then, of secreting cells, of muscular tissue, and of the various forms of nervous tissue the tendency of inquiries into the molecular processes taking place in them is to lead us to regard the varied activities of these tissues as due to molecular disruptive changes in their several katastates, these being various stages of the downward metabolism or katabolism of protoplasm.

Similar considerations might be extended to other tissues of the body which are neither nervous nor muscular, and, though engaged in chemical work, are not distinctly secretory or excretory, such, for instance, as the hepatic cells engaged in the elaboration of glycogen. They might also be extended to those tissues in which the katastates are not exploded and discharged, but retained and massed up in the body for mechanical or other purposes, to cartilage, for instance, the chondrigenous basis or ground-substance which many considerations show to be a product or katastate of protoplasm. We are thus led to the conception, brought forward in an earlier part of this article, that all over the body protoplasm is continually building itself up out of the pabulum supplied by food, and continually breaking down, giving rise in different tissues and different parts of the body to different katastates with different composition and different properties, the various activities of the body being the outcome of the various properties of the various katastates. If this be admitted, it almost inevitably follows that what we have called protoplasm cannot be always the same thing, that there must be many varieties of protoplasm with different qualities and with correspondingly different molecular structure and composition. If this be so, the question naturally arises, why use the word protoplasm at all, since, by the showing, it seems to have no exact meaning? But it has an exact meaning. All the evidence at our disposal goes to show that a katastate of any given degree cannot form a fresh katastate of the same degree; any one katastate can only arise from the decomposition of a preceding more complex katastate, and that in turn from a katastate still more complex. Passing upwards, we come at last to something which, instead of proceeding from a more complex substance, builds itself up out of a less complex, more simple substance, and it is this something, whatever its exact composition, into whatever katastates it is destined to fall asunder, to which the generic name "protoplasm" should be given. Possibly another new name were better, but there are advantages in retaining the old term. It is protoplasm in this sense which is alone *living;* it is its synthetic power which is its token of being alive. That synthetic power is, we must admit, exercised along the ascending series of anastates. But here our knowledge is a blank, and it would be simply waste of time to speculate as to the details of the constructive processes. Using the word "protoplasm" in this sense, it is obvious that the varieties of protoplasm are numerous, indeed almost innumerable. The muscular protoplasm which brings forth a contractile katastate must differ in nature, in composition—that is, in construction—from glandular protoplasm, whose katastate is a mother of ferment. Further, the protoplasm of the swiftly contracting striped muscular fibre must differ from that of the torpid smooth unstriated fibre; the protoplasm of human muscle must differ from that of a sheep or a frog; the protoplasm of one muscle must differ from that of another muscle in the same kind of animal; and the protoplasm of Smith's biceps must differ from that of Jones's.

We may, for a moment, turn aside to point out that this innate difference of protoplasm serves to explain the conclusions to which modern investigations into the physiology of nutrition seem to be leading. So long as we speak of muscle or flesh as one thing, the step from the flesh of mutton which we eat to the flesh of our body which the mutton, when eaten, becomes, or may become, does not seem very far; and the older physiologists very naturally assumed that the flesh of the meal was directly, without great effort and without great change, as far as mere chemical composition is concerned, transformed into the muscle of the eater. The researches, however, of modern times go to show that the substances taken as food undergo many changes and suffer profound disruption before they actually become part and parcel of the living body, and conversely that the constructive powers of the animal body were grossly underrated by earlier investigators. If one were to put forward the thesis that the proteid of a meal becomes reduced almost to its elements before it undergoes synthesis into the superficially similar proteid of muscle, the energy set free in the destruction being utilized in the subsequent work of construction, he might appeal with confidence to modern results as supporting him rather than opposing him in his views. It would almost seem as if the qualities of each particle of living protoplasm were of such an individual character that it had to be built up afresh from almost the very beginning; hence the immense construction which inquiry shows more and more clearly every day to be continually going on as well in the animal as in the vegetable body.

Taking into consideration all the fine touches which make up the characters of an individual organism, and remembering that these are the outcome of the different properties or activities of the several constituent tissues of the body, working through a delicately-balanced complicated machinery, bearing in mind the far-reaching phenomena of heredity by which the gross traits and often the minute tricks of the parents' body are reproduced in the offspring, if there be any truth at all in the views which we have urged, tracing the activities of the organism to the constitution of its protoplasm, this must be manifold indeed. The problems of physiology in the future are largely concerned in arriving, by experiment and inference, by the mind's eye, and not by the body's eye alone, assisted as that may be by lenses yet to be introduced, at a knowledge of the molecular construction of this protean protoplasm, of the laws according to which it is built up, and the laws according to which it breaks down, for these laws when ascertained will clear up the mysteries of the protean work which the protoplasm does.

And here we may venture to introduce a word of caution. We have, in speaking of protoplasm, used the words "construction," "composition," "decomposition," and the like, as if protoplasm were a chemical substance. And it is a chemical substance in the sense that it arises out of the union or coincidence of certain factors, which can be resolved into what the chemists call "elements," and can be at any time by appropriate means broken up into the same factors, and indeed into chemical elements. This is not the place to enter into a discussion upon the nature of so-called chemical substances, or, what is the same thing, a discussion concerning the nature of matter; but we may venture to assert that the more these molecular problems of physiology, with which we are now dealing, are studied the stronger becomes the conviction that the consideration of what we call "structure" and "composition" must, in harmony with the modern teachings of physics, be approached under the dominant conception of modes of motion. The physicists have been led to consider the qualities of things as expressions of internal movements; even more imperative does it seem to us that the biologist should regard the qualities (including structure and composition) of protoplasm as in like manner the expression of internal movements. He may speak of protoplasm as a complex substance, but he must strive to realize that what he means by that is a complex whirl, an intricate dance, of which what he calls chemical composition, histological structure, and gross configuration are, so to speak, the figures; to him the renewal of protoplasm is but the continuance of the dance, its functions and actions the transferences of figures. In so obscure a subject it is difficult to speak otherwise than by parables, and we may call to mind how easy it is to realize the comparison of the whole body of man to a fountain of water. As the figure of the fountain remains the same though fresh water is continually rising and falling, so the body seems the same though fresh food is always replacing the old man which in turn is always falling back to dust. And the conception which we are urging now is one which carries an analogous idea into the study of all the molecular phenomena of the body. We must not pursue the subject any further here, but we felt it necessary to introduce the caution concerning the word "substance," and we may repeat the assertion that it seems to us necessary for a satisfactory study of the problems on which we have been dwelling for the last few pages to keep clearly before the mind the conception that the phenomena in question are the result not of properties of kinds of matter, in the vulgar sense of these words, but of kinds of motion.

In the above brief sketch we have dealt chiefly with such well-known physiological actions as secretion, muscular contractions, and nervous impulses. But we must not hide from ourselves the fact that these grosser activities do not comprise the whole life of the tissues. Even in the simple tissues, and more especially in the highly-developed nervous tissues, there are finer actions which the conception outlined above wholly fails to cover.

Finer activities of protoplasm.

Two sets of vital phenomena have hitherto baffled inquirers,—the phenomena of spontaneous activity, rhythmic or other, and the phenomena of "inhibition." All attempts to explain what actually takes place in the inner working of the tissues concerned when impulses passing down the pneumogastric nerve stop the heart from beating, or in the many other analogous instances of the arrest of activity through activity, have signally failed; the superficial resemblance to the physical "interference of waves" breaks down upon examination, as indeed do all other hypotheses which have as yet been brought forward. And we are wholly in the dark as to why one piece of protoplasm or muscular fibre or nervous tissue remains quiescent till stirred by some stimulus, while another piece explodes into activity at rhythmic intervals. We may frame analogies and may liken the phenomena to those of a constant force rhythmically overcoming a constant resistance, but such analogies bring us very little nearer to understanding what the molecules of the part are doing at and between the repeated moments of activity.

Hering's speculations.

Further, if the ingenious speculations of Hering, that specific color-sensations are due to the relation of assimilation (anabolism) to dissimilation (katabolism) of protoplasmic visual substances in the retina or in the brain, should finally pass from the condition of speculation to that of demonstrated truth, we should be brought face to face with the fact that the mere act of building up or the mere act of breaking down affects the condition of protoplasm in other ways than the one which we have hitherto considered, viz., that the building up provides energy to be set free and the breaking down lets the energy forth. In Hering's conception the mere condition of the protoplasm, whether it is largely built up or largely broken down, produces effects which result in a particular state of consciousness. Now, whatever views we may take of consciousness, we must suppose that an affection of consciousness is dependent on a change in some material. But in the case of color-sensations that material cannot be the visual substance itself, but some other substance. That is to say, according to Hering's views, the mere condition of the visual substance as distinct from a change in that condition determines the changes in the other substance which is the basis of consciousness. So that, if Hering's conception be a true one (and the arguments in favor of it, if not wholly conclusive, are at least serious), we are led to entertain the idea that, in addition to the rough propagation of explosive decompositions, there are continually passing from protoplasm to protoplasm delicate touches compared with which the nervous impulses which with such difficulty the galvanometer makes known to us are gross and coarse shocks. And it is at least possible, if not probable (indeed present investigations seem rapidly tending in this direction), that an extension of Hering's view, with such modifications as future inquiry may render necessary to other processes than visual sensations, more especially to the inner working of the central nervous system, may not only carry us a long way on towards understanding inhibition and spontaneous activity but may lay the foundation of a new molecular physiology. This, however, is speculative and dangerous ground. But it seemed desirable to touch upon it since it illustrates a possible or probable new departure. What we have said of it and of the more manageable molecular problems of physiology will perhaps show that, vast and intricate as is the maze before the physiologist of to-day, he has in hand a clue which promises, at least, to lead him far on through it.

Methods of physiology.

Space forbids our entering upon a discussion concerning the methods of physiology; but, accepting the truth of the preceding discussion as to the nature of physiological problems, the means of solving these problems speak for themselves.

From the earliest times the methods of physiological inquiry have belonged to one of two categories: they have been anatomical or experimental. And the same distinction holds good to-day, though both methods are often joined together in one inquiry, and indeed at times may be said to merge the one into the other. By the anatomical method the observer ascertains the gross outlines, the minute structure, and if necessary the physical characters and the chemical composition of an organism or part of an organism; and by comparison of these with those of different organisms, or of the same organism placed by nature—that is, not by himself—in different circumstances, he draws conclusions as to the actions taking place in it while it was alive. In early times the comparison of gross structures gave important results, but they have now been to a great extent exhausted; and the most valuable conclusions reached at the present day by the anatomical method are those arrived at by histological investigation of minute structures and by chemical analysis. The marks of this method are that on the one hand it deals for the most part with things which are no longer alive, and hence must necessarily fail to make touch with the inner workings of which we have spoken above, and on the other hand in its comparison of organisms under different conditions it has to wait till Providence brings about what it requires, and has to be satisfied with such differences as the chapter of accidents provides. In the experimental method the observer places the organism or part of the organism under conditions of his own choosing, and applies to the organism under those conditions the same analysis as in the former methods. He ascertains changes in the gross features, minute structures, physical characters, and chemical composition as before. So that in reality the two methods are in part identical, and differ chiefly by the fact that in the latter the observer chooses the conditions in which to place the organism. But an important corollary follows, viz., that by choosing his own conditions the observer is able to bring his analysis to bear on an organism or part of an organism while still alive.

The history of physiology, especially in recent times, shows that this method is the one not only of the greatest fertility but one becoming more and more essential as inquiry is pushed deeper and deeper into the more abstruse parts of physiology. If there be any truth in the sketch given above of the modern tendencies of molecular physiology, it will be clear to every mind that the experimental method alone can in the future give adequate results. It might indeed be urged that when molecular physics has advanced far enough the molecular problems of physiology will be interpreted by its light without recourse to experiment. It will be a long waiting till that comes. Meanwhile, all the power over not only the body but, what is more important, the mind of man which the physiology of the future unmistakably promises must lie unused. Nor is it simply a matter of waiting, for it is at least within the range of possibility that when the molecular problems of physiology are fairly grasped conclusions may be reached which will throw back a light on the molecular processes of inanimate masses, revealing features of what we call "matter" which could not be discovered by the examination of bodies which had never lived.

Value of experimental method.

It would not be a hard task to give chapter and verse for the assertion that the experimental method has, especially in these later times, supplied the chief means of progress in physiology; but it would be a long task, and we may content ourselves with calling attention to what is in many respects a typical case. We referred a short time back to the phenomena of "inhibition." It is not too much to say that the discovery of the inhibitory function of certain nerves marks one of the most important steps in the progress of physiology during the past half-century. The mere attainment of the fact that the stimulation of a nerve might stop action instead of inducing action constituted in itself almost a revolution; and the value of that fact in helping us on the one hand to unravel the tangled puzzles of physiological action and reaction, and on the other hand to push our inquiries into the still more difficult problems of molecular changes, has proved immense. One cannot at the present time take up a physiological memoir covering any large extent of ground without finding some use made of inhibitory processes for the purpose of explaining physiological phenomena.

Now, however skilfully we may read old statements between the lines, no scientific—that is, no exact—knowledge of inhibition was possessed by any physiologist until Weber, by a direct experiment on a living animal, discovered the inhibitory influence of the pneumogastric nerve over the beating of the heart. It was of course previously known that under certain circumstances the beating of the heart might be stopped; but all ideas as to how the stoppage was or might be brought about were vague and uncertain before Weber made his experiment. That experiment gave the clue to an exact knowledge, and it is difficult, if not impossible, to see how the clue could have been gained otherwise than by experiment; other experiments have enabled us to follow up the clue, so that it may with justice be said that all that part of the recent progress of physiology which is due to the introduction of a knowledge of inhibitory processes is the direct result of the experimental method. But the story of our knowledge of inhibition is only one of the innumerable instances of the value of this method. In almost every department of physiology an experiment or a series of experiments has proved a turning-point at which vague nebulous fancies were exchanged for clear decided knowledge, or a starting-point for the introduction of wholly new and startling ideas. And we may venture to repeat that not only must the experimental method be continued, but the progress of physiology will chiefly depend on the increased application of that method. The more involved and abstruse the problems become, the more necessary does it also become that the inquirer should be able to choose his own conditions for the observations he desires to make. Happily, the experimental method itself brings with it in the course of its own development the power of removing the only valid objection to physiological experiments, viz., that in certain cases they involve pain and suffering. For in nearly all experiments pain and suffering are disturbing elements. These disturbing elements the present imperfect methods are often unable to overcome; but their removal will become a more and more pressing necessity in the interests of the experiments themselves, as the science becomes more exact and exacting, and will also become a more and more easy task as the progress of the science makes the investigator more and more master of the organism. In the physiology of the future pain and suffering will be admissible in an experiment only when pain and suffering are themselves the object of inquiry. And such an inquiry will of necessity take a subjective rather than an objective form. (M. F.)

PART II.—NERVOUS SYSTEM.

To supplement the foregoing general sketch some detailed account must be given of the physiology of the several functions. NUTRITION (*q.v.*) has received separate treatment; a sketch of the "Nervous System" is now appended; and RESPIRATION and REPRODUCTION will be dealt with in their places.

However complex may be the anatomical arrangements in man and the higher animals, the nervous system consists essentially of three portions: (1) *central* masses of nervous matter or *ganglia*, constituting the brain and spinal cord, and containing invariably nerve-cells; (2) *peripheral* or *terminal* arrangements, existing in the organs of sense, in muscle, and in electric organs; and (3) *nerves*, or internuncial cords connecting the central with the peripheral organs. The nerves may be regarded as conductors of a mode of energy which, for want of a better term, is termed "nerve-force," originating either in the nerves themselves on the application of a stimulus or in the terminal organs or in the central organs. Thus, if a nerve be irritated at any point of its course, a change is set up in the nerve-fibres at the point of irritation, and this change is propagated along the nerve-fibres to a central or terminal organ, thus producing a characteristic phenomenon—it may be a sensation of pain or of pleasure, an involuntary movement, the contraction of a muscle, or a discharge of electricity. Again, the stimulus may act on a terminal organ, such as the retina, setting up a change which is then propagated or conveyed to the brain by the optic nerve, there giving rise to a sensation of light or color. Finally, the nervous action may originate in a central organ, as is the case when a voluntary movement is made. The voluntary impulse, in this instance, originates in the brain; a change passes along nerve-fibres from the brain to the muscles, and as a result the muscles contract. We have therefore to discuss the general properties and modes of action of nerves, terminal organs, and central organs.

1.—NERVES.

Structure of nerves.

Structure of Nerves.—A general description of the structure of nerves and of nerve-fibres will be found in vol. i. p. 753 *sq.*; but there are a few points of physiological importance still to be noticed. Two kinds of nerve-fibres exist in the body, white or medullated fibres, so called because each fibre has a sheath indicated by a double contour (see Fig. 1), and the pale or non-medullated. The medullated nerve-fibres form the white part of the brain, spinal cord, and nerves. They vary in diameter from the $\frac{1}{1500}$th to the $\frac{1}{12000}$th of an inch, and when of very small size often show varicosities or swellings. Each fibre consists of three parts: (1) an external sheath or primitive sheath; (2) within this the medullary sheath or white substance of Schwann; and (3) in the centre an axial fibre, the cylinder-axis of Purkinje, or band of Remak. The axis-cylinder in a fresh nerve seems to be homogeneous; but with high powers and proper illumination, and more especially by the action of perosmic acid, it is seen to be formed of extremely fine fibrillæ. It is continuous from end to end of the nerve. The medullary sheath shows at certain intervals interruptions called the "nodes of Ranvier" (see Fig. 2). In the middle of each internode an oval nucleus is found in the medullary sheath. The pale or non-medullated fibres, sometimes called the "fibres of Remak," are found chiefly in branches of the sympathetic nerve. They have no double contour, and they often give off branches which anastomose, a condition never found in the course of medullated nerves. If the axis-cylinder of a nerve-fibre be traced inwards to a nerve-centre it is found to end in the pole or process of a nerve-cell, whilst in the periphery it ends in a terminal organ, in muscle, bloodvessel, gland, skin, or electric organ. It may therefore be presumed that the axis-rod is the conducting and so far the essential constituent of the nerve-fibre.

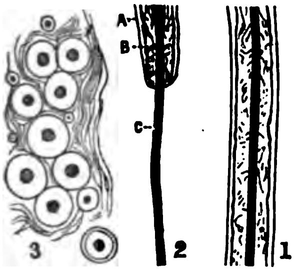

FIG. 1.

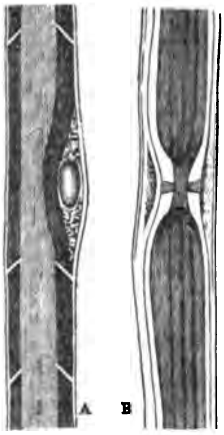

FIG. 2.

FIG. 1.—(1) Medullated nerve-fibres, showing double contour; (2) a similar fibre in which A is primitive membrane, B medullary sheath, C axial cylinder protruding beyond the broken end of the fibre; (3) transverse section through medullated fibres of a nerve, showing axial cylinder in each fibre. Between the fibres is the interfibrous connective tissue.

FIG. 2.—Medullated nerve-fibres. A, medullated nerve-fibre, showing subdivision of medullary sheath into cylindrical sections imbricated with their ends; a nerve-corpuscle with an oval nucleus is seen between neurilemma and medullary sheath; B, medullated nerve-fibre at a node or constriction of Ranvier; the axis-cylinder passes uninterruptedly from one segment into the other, but the medullary sheath is interrupted (Key and Retzius).

Chemical constitution.

Chemical Constitution.—Little is known of the chemical constitution of the nerve-fibre. The medullary matter contains fatty substances such as lecithin ($C_{44}H_{90}NPO_9$). The axis-rod appears to contain albuminous substances. Cholesterin ($C_{26}H_{44}O+H_2O$) and creatin ($C_{44}H_9N_3O_2$) have been obtained from nerves along with a small amount of gelatin and a horny matter, neurokeratin (Hermann). Nerves contain about 30 per cent. of water. Their reaction to test paper is neutral. Nothing is known regarding the chemical changes occurring in a nerve-fibre during a state of activity, nor of the chemical products formed at that time. It has been stated that a nerve becomes acid after death (Funke).

As to the micro-chemistry of the nervous elements, it may be stated that the axis-cylinder contains an albuminous substance different from myosin; it gives a red color on boiling with Milton's reagent (an acid nitrate of mercury); it is dissolved in weak solutions of ammonia, caustic potash, and chloride of sodium; it is hardened by solution of chromic acid, bichromate of potash, and corrosive sublimate; it reduces the chloride of gold; and it shows transverse markings on the action of nitrate of silver. The white substance of Schwann is blackened by perosmic acid and is soluble in alcohol, ether, and oil of turpentine, thus showing its fatty character. The primitive sheath is of a collagenous nature,—that is, it yields gelatin on boiling. According to some, digestion in gastric or pancreatic juice leaves an insoluble matter like that found after the digestion of corneal or epidermic tissues, and hence called "neurokeratin."

Excitability.

Excitability.—The special property of a nerve-fibre is termed "excitability." Every kind of living protoplasmic matter is irritable,—that is, it responds in some way to a stimulus. Thus, if a morsel of protoplasm, such as an amœba or a cartilage-cell or a white blood-corpuscle, be stimulated mechanically or by shocks of electricity, it will contract or change its form. Again, if living muscular fibre be thus stimulated it also will contract. This property of responding to a stimulus is termed "irritability;" and in the structures mentioned the property is manifested by movement as the obvious phenomenon, but it is well known that more obscure phenomena follow the application of the stimulus. In the case of living nerve there is irritability also,—that is, the nerve responds to a stimulus; but in a portion of isolated nerve no change is visible. If, however, the nerve be connected at one end with its appropriate central or terminal organ we may have evidence of something having been transmitted along the nerve. Thus there may be sensation or movement, or both. Nerves are more irritable than contractile matter, and the term "excitability" is applied to the special irritability of nerve. The same strength of stimulus will act more powerfully on a nerve than on a muscle (Rosenthal). The use of the term "property" in physiology does not imply the idea of any kind of inherent force or entity, but simply that, in the case of muscle and nerve, irritation is followed by certain phenomena seen only in living matter.

(1.) The excitability of nerves is affected by certain conditions. Injury to the nerve, the application of caustics, and drying quickly destroy it. When a nerve is divided the excitability is increased for a short time, then rapidly diminishes, and finally disappears near the point of section. The end of the nerve still connected with central organs undergoes these changes in excitability more quickly than the portion cut off. As shown by Augustus Waller, when a nerve is separated from its central organ, such as the gray matter of the spinal cord for the motor roots, and the ganglia on the posterior roots for the sensory roots, the end of the nerve separated from the centre undergoes fatty degeneration. If, however, the cut ends of the nerve be brought into accurate contact, union soon takes place. Surgeons have frequently observed a return of sensibility to a part within a few days after the sensory nerve had been divided and the cut ends again brought into contact. Continued or excessive activity of a nerve soon lowers and may abolish excitability, thus producing exhaustion. On the other hand, a lengthened period of absolute repose lowers excitability, and if the nerve be inactive beyond a certain time it wastes, becomes thinner, and fatty degeneration occurs in its substance. Heat increases, whilst cold diminishes, excitability. In the case of frogs' nerves temperatures above 45° C. destroy excitability the more rapidly as they approach 70°, at which point it is almost instantaneously destroyed. Below 45° a rise of temperature first increases and then diminishes excitability, and it has been observed that whilst increasing its intensity it diminishes its duration (Afanasieff, Hermann). Finally, a diminished supply of blood quickly causes a fall of excitability.

Stimuli of nerves.

(2.) Nerves may be excited by various kinds of stimuli; (*a*) mechanically, as by intermittent pressure, beating, section, pricking, etc.; (*b*) thermally, by variation of temperature; (*c*) chemically, by the application of such substances as acids, alkalies, or metallic salts; (*d*) electrically, by continuous or induced currents; and (*e*) normally, by changes in the central or terminal organs. Mechanical irritation is applied during life when the trunk of a nerve is pressed upon.

Radiant heat acts on the nerves of the skin, or heat may be applied by conduction from a hot body in contact with the surface. Little is known as to the specific effects of heat on the nerves of the human being. In the frog it has been found that a temperature of from 34° to 45° C. stimulates the motor nerves; about 40° C. sudden alterations of temperature may cause twitching of the connected muscles (Hermann). Many chemical substances in sufficient concentration will quickly destroy a nerve; but if they are in weak solutions the result may be stimulation. Thus, concentrated solutions of the mineral acids, alkalies, alkaline salts, concentrated lactic acid, and concentrated glycerin may act as strong stimulants (Kühne).

(3.) The influence of electrical stimulation of nerves demands more elaborate description. The effects, as already indicated, can be observed only when the nerve is connected with a muscle or with a central organ. In the first case electrical stimulation is followed by contraction of the muscle, in the second by a sensation if the central organ is the brain. Consequently we have to consider the phenomena following electrical stimulation (*a*) of a motor nerve and (*b*) of a sensory nerve.

Electrical stimulation of motor nerves.

(*a.*) *Electrical Stimulation of a Motor Nerve.*—A perfectly constant current of electricity, of moderate quantity and intensity, flowing through a portion of nerve produces no evident effect on the muscle, but any variation in the intensity or density of the current causes irritation, and the muscle gives a twitch. The effect is more apparent when the current is allowed to flow into the nerve and when it is suddenly cut off, or, in other words, at the moment of opening and of closing the circuit. The rapidity with which the variation in the density of the current is effected also has an important influence. Thus the shocks of frictional electricity stimulate strongly, because, although the amount of electricity is small, the currents are extremely rapid in appearing and disappearing. In like manner the quick shocks from induction-coils produced by rapidly opening and closing the primary circuit are strongly stimulating. Again, a very powerful current may pass through a nerve without exciting it, if it pass gradually. Occasionally, a very weak current sent through a portion of nerve will cause a contraction, whilst a very strong current may fail to do so. In fact, the phenomenon of contraction of a muscle is influenced (α) by the direction and (β) by the strength of the current sent through the nerve. When the current is transmitted from the muscle in the direction of the spinal cord it is called an "upward" or "centripetal" current, when from the cord in the direction of the muscle it is called a "downward" or "centrifugal" current. Its strength is graduated by employing small Grove's cells, one cell giving a weak current, two or three giving a medium current, and four to six or seven a strong current. To graduate its amount more precisely resistance-coils may be introduced into the circuit, or we may employ a rheochord, by which a portion of the current is shunted back to the battery, whilst the remainder is allowed to pass to the nerve. In the circuit a key or interrupter is interposed, and so arranged that when the key is opened the current is broken or interrupted, and when the key is closed the circuit is completed and the current passes to the nerve. With these arrangements, and employing the sciatic nerve of a frog attached to the limb, the following results are readily obtained.

Current Strength.	*Key.*	*Upward Current.*	*Downward Current.*
Weak.	Close.	Contraction.	Contraction.
Weak.	Open.	Rest.	Rest.
Medium.	Close.	Strong contraction.	Strong contraction.
Medium.	Open.	Strong contraction.	Strong contraction.
Strong.	Close.	Rest.	Rest.
Strong.	Open.	Very strong contraction.	Contraction.

That is to say, on beginning with a very feeble current neither opening nor closing causes a contraction, but on strengthening it up to a certain point contraction appears first on closing, whilst opening produces no effect. By increasing the strength of the current a contraction is obtained both on opening and on closing the key, and by and by, when a certain strength of current is reached, the closing contraction becomes weaker and finally disappears, leaving only a contraction on opening the key. Thus the effects of a strong current are usually the reverse of those caused by a weak current. These facts, usually included under the term "Pflüger's Law of Contraction," have been specially investigated by Pflüger, and the following is the explanation offered by him and generally accepted by physiologists.

Suppose the sciatic nerve of a frog connected with the isolated limb is stretched over two wires passing from the positive and negative poles of a combination of Grove's elements, with the distance of an inch and a half between the wires. If a key be interposed in the circuit a current will thus pass along one and a half inches of nerve when the key is closed, and be cut off when the key is opened. By having also a commutator or reverser in the circuit we can send the current up or down the nerve at pleasure. Arrangements can also be made for irritating the nerve by another couple of wires coming from an induction-machine, either near the negative or near the positive pole of the current coming from the Grove's elements. It will then be found that near the negative pole the excitability of the nerve is increased, whilst near the positive pole it is diminished,—that is to say, a stimulus from the induction-coil, not sufficient to excite the nerve so much as to cause a muscular contraction, if applied near the positive pole, will at once do so if applied near the negative pole; or, a stimulus so strong as to cause tetanus in the muscle when applied near the negative pole may produce no effect when applied near the positive pole. In other words, the nerve near the negative pole is more excitable than in the normal state, whilst near the positive pole it is less so, indicating that at least one of the physiological properties of the nerve has been changed by the action of the continuous current. But a nerve-fibre has also the property of conducting the effects of an impression, or the nerve-force travels with a certain velocity long a nerve, as will be shown lower down. It has been ascertained that near the negative pole the rate of conductivity is increased, whilst near the positive it is diminished. Finally, a piece of living nerve, when connected with the terminals of a galvanometer, so that the one terminal touches the surface whilst the other touches the transverse section of the nerve, shows the existence of a current of electricity travelling from the surface of the nerve through the galvanometer to the transverse section,—that is, the surface is positive to the transverse section. This condition is also modified by the transmission through the nerve of a continuous current, so that the difference of potential is increased near the positive pole and diminished near the negative. These results are thus summed up.

State of Nerve.	Functions of Nerve.		
	Electromotive force.	*Conductivity.*	*Excitability.*
Near positive pole.	Increased.	Diminished.	Diminished.
Near negative pole.	Diminished.	Increased.	Increased.

The properties of the nerve, therefore, are altered by the passage through it of a continuous current, and the altered condition is termed the "electrotonic state," the condition in the neighborhood of the positive pole, or anode, being termed "anelectrotonic," whilst that near the negative pole or katode is called "katelectrotonic." A certain portion of nerve near each pole is thrown during the passage of a continuous current into these conditions of anelectrotonus and of katelectrotonus, whilst the amount of nerve thrown into the one condition or the other depends on the strength of the current. Further, there is always between the two poles a point of indifference, in which the properties of the nerve seem to be unaltered, and the position of this point depends on the strength of the current. Thus, with a current of medium strength the point is midway between the poles; with a weak current the point is near the positive pole,—that is, a large portion of the nerve near the negative pole is in the katelectrotonic state in which the excitability is increased; and with a strong current the point is near the negative pole,—that is, a large portion of the nerve near the positive pole is in the anelectrotonic state in which the excitability is diminished. Now, according to Pflüger, the stimulating effect of closing the current occurs at the katode only, whilst the stimulating effect of opening the current occurs at the anode only, or a nerve is stimulated by a current on the appearance or increase of katelectrotonus, on closing the circuit, or by the disappearance or diminution of anelectrotonus on opening the circuit. If we suppose that this depends on the modification of excitability near the negative pole, by the molecules of the nerve becoming more mobile, the matter is intelligible. Thus the passage of the molecules from the normal stable condition to the katelectrotonic less stable condition acts as a stimulus, whilst the passage backwards has no effect. On the other hand, the passage from the more stable condition in anelectrotonus to the normal stable condition acts as a stimulus, whilst, again, the reverse action has no effect. This explains why it is that a weak currrent gives contraction on closing, because on closing a large portion of the nerve near the negative pole passes from the normal into the katelectrotonic state, and this acts as a stimulus. On the other hand, a strong current causes contraction on opening, because on opening a large portion of nerve near the positive pole passes back from the anelectrotonic state into the normal state, and this acts as a stimulus. Again, with currents of medium strength, as both states are equally produced, there is contraction both on opening and on closing. Thus Pflüger's theory accounts for most of the facts; but its weak point is that no reason can be given why a nerve is stimulated only by the appearance of katelectrotonus and by the disappearance of anelectrotonus. It remains only to add that currents passing transversely through nerves produce no stimulating effect. In ascending currents the shorter the piece of nerve between the electrodes the greater the stimulating effect, whereas in descending currents the reverse holds good (Hermann).

(*b.*) *Electrical Stimulation of Sensory Nerves.*—The effect of stimulating sensory nerves as distinguished from the direct stimulation of sensory or terminal organs has not been sufficiently studied, but, so far as is known, the laws seem to be the same as those relating to motor nerves. When a sensory nerve is stimulated the test must be the resulting sensation. As stimulation of the motor nerve in the condition of anelectrotonus or of katelectrotonus may or may

Electrical stimulation of sensory nerves.

not be followed by a contraction, so stimulation of the sensory nerve may or may not be followed by a sensation, or the character of the sensation may vary just as the muscular contraction may be weak or strong. Further, Donders has shown that electrical stimulation of the vagi or pneumogastric nerves is attended by analogous phenomena, so far as the movements of the heart are concerned. In this case, however, as will be shown lower down in discussing the phenomena of nervous inhibition, the result is not movement but arrest of movement.

Unipolar excitation.

(c.) *Chauveau's Researches on Unipolar Excitation.*—Chauveau has studied the comparative influence of the two poles of any arrangement supplying a continuous current,—that is, he has tried the stimulating effect, supposing either the positive or the negative pole be applied to the nerve whilst the other is in contact with another part of the body. He has found, amongst other more abstruse and less practical results, that there is in each case a certain intensity of current corresponding to the physiological condition of the nerve by which the influence of one pole is the same as that of the other. If the intensity of the current be below this medium strength the effect of the negative pole on motor nerves is greater than that of the positive; but, if the intensity be above, the reverse is the case,—that is, the positive pole is the stronger excitant. In the case of sensory nerves Chauveau found that application of the negative pole with a moderately strong current was more painful than application of the positive pole. Thus the influence of unipolar excitation with a strong current on motor nerves is the reverse of that on sensory nerves,—that is, the positive pole is the more powerful on motor nerves, the negative pole on sensory nerves.

Production of tetanus.

(d.) *Production of Tetanus.*—Tetanus or cramp of a muscle is produced when its nerve is stimulated by successive irritations at intervals so short that the muscle has no time to relax between them, and consequently it passes into a state of more or less firm contraction. A single muscular contraction may be called a twitch of the muscle, but in tetanus or cramp the individual contractions are fused together so as to maintain a rigid state of the muscle for some time. A rapid series of induction shocks, each of short duration, always produces tetanus, even if they are sent to the muscle at the rate of 15 per second. A continuous current, on the other hand, usually causes contraction only at the moment of opening and closing the circuit, but occasionally tetanus may be seen *during* the passage of the current. Tetanus during the passage of a constant current has been attributed to electrolytic changes in the nerve. Pflüger holds that this is a normal production of tetanus and may be seen even with feeble currents; but certainly it is very difficult to demonstrate. Long ago Ritter showed that, if a constant current of sufficient intensity be sent up a nerve for a considerable time, say half an hour, and then be suddenly interrupted, tetanus lasting for eight or ten seconds may be seen, which disappears on again closing the current. Ritter's tetanus, according to Pflüger, is really due to the stimulation caused by the disappearance of anelectrotonus, which occurs, as we have seen, when the current is opened, and the proof he offers is that the tetanus disappears when the muscle is cut off from the anelectrotonic portion. Tetanus may also be caused by the mechanical irritation of the nerve, or by heat, or by chemical substances.

Nervous conductivity.

Nervous Conductivity.—When a nerve is irritated at any point in its course a change is produced which is propagated along the nerve,—that is, the nerve conducts, and the phenomenon is called the "nerve-current." The velocity of transmission can be measured only by the use of delicate apparatus, as the time occupied is too short to directly affect consciousness. For example, when the tip of the finger is touched the mind apparently perceives the contact without any loss of time. But it can be shown that an appreciable interval of time elapses between the instant the finger is touched and the instant the mind perceives the impression. During this time a change passes along the nerve from the point touched to the brain. The method usually employed for determining the velocity of the nerve-current consists in preparing the gastrocnemius muscle of a frog with the sciatic nerve attached, and connecting it with a recording apparatus, so that if the muscle be caused to contract by irritating the nerve the record of the contraction may be made on a rapidly-moving surface. If, then, the nerve be irritated in two consecutive experiments, first close to the muscle, and secondly at a distance from it, and the muscle be caused to contract in each case, it will be found that it does not contract so soon when the nerve is irritated at a distance from the muscle as when it is irritated close to it; in other words, if the nerve be irritated at a distance from the muscle the transmission of the nervous impression from the point irritated to the muscle occupies an appreciable time. If, then, we know the length of nerve between the two points irritated, we can determine the length of time the nerve-current took in passing along that distance of nerve.

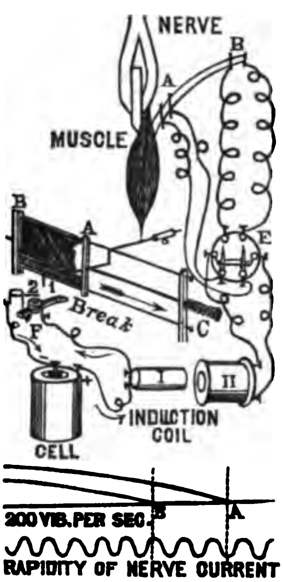

FIG. 8.—Diagram showing arrangement of apparatus in measuring rapidity of nerve-current.

Measurement of velocity in nerves.

(1.) *Measurement of Velocity in Motor Nerves.*—Many ingenious methods have been devised for this purpose, but the simplest is the use of the "spring myographion" of Du Bois-Reymond (see Fig. 8). The apparatus consists of a smoked-glass plate, which is driven in front of the recording stylet of the myograph by the recoil of a steel spring C. Underneath the frame carrying the glass plate are two binding screws 1 and 2, to one of which is attached a rectangular arm of brass 1, which can so move horizontally as to establish metallic connection between the two binding screws (marked *Break*, F). By means of these binding screws the myograph is interposed in the circuit of a galvanic element and the primary coil I of an induction-machine, and the brass arm is so placed as to connect both binding screws, thus completing the circuit. From underneath the frame carrying the smoked-glass plate there descends a small flange, which (when the glass plate, by releasing a catch not seen in the figure, but close to C, is driven across by the spiral spring from left to right) pushes the brass arm aside and thus interrupts the circuit of the primary coil. When this occurs an opening shock is transmitted from the secondary coil II to a commutator E, an instrument by which electric currents may be transmitted to the nerve either at a point close to the muscle at A, or at a distance from it at B. Suppose the apparatus all arranged so as to send the shock to the nerve at a point close to the muscle A, the muscle stimulated contracts, and draws by means of the stylet, on the smoked surface of the glass, the curve seen in the lower part of it at A. This leaves the horizontal line (which would be drawn by the stylet were the muscle at rest) at A. Arrangements are then made for another experiment, in which the nerve will be stimulated at a distance from the muscle, at the point B in the upper part of the diagram. This is done by again placing the smoked-glass plate in proper position, closing the primary circuit by the brass arm at the binding screws, as already described, and reversing the commutator so as to send the shock along the wires to B. The muscle again contracts when the primary circuit is opened, and this time it describes on the smoked surface the curve B, seen to the left of the curve A. It will be perceived that this curve leaves the horizontal line at B,—that is, a little *later* than when the nerve was stimulated close to the muscle. It follows, therefore, that the distance on the horizontal line from A to B represents the time occupied by the transmission of the nervous impulse from B to A of the nerve. With suitable arrangements the rate of movement of the glass plate can be measured by bringing into contact with it a marker on one of the prongs of a vibrating tuning-fork. The waves thus recorded enable the experimenter to measure with accuracy the rate of movement of the glass plate, and consequently the minute interval of time between A and B. In the diagram it will be observed that there are 2½ waves between A and B; each represents $\frac{1}{200}$th of a second; therefore, the $\frac{1}{80}$th of a second is the time represented by the distance A, B; or, in other words, the $\frac{1}{80}$th of a second was occupied by the nerve-current in passing along the portion of nerve from B to A.

(2.) *Measurement of Velocity in Sensory Nerves.*—Suppose a sensory nerve to be excited in the hand; the theory of nervous conduction is that a change is propagated along the nerve to the brain, and that in the brain the molecular changes occur which result in a sensation. The individual having the sensation may feel it and make no sign by which any one else might be made aware that he has felt it, or the subject of the sensation might, by a muscular movement, such as the motion of an arm, let any one else see that he has felt the sensation. We have no means of knowing whether or not an individual has felt a sensation except by the individual making some kind of gesture or muscular movement. Now it is clear that, if we regard the brain as the seat of the changes resulting in sensation, the nearer any stimulated portion of skin is to the brain the sooner will the brain feel and respond to the stimulus. Thus, if the skin on the big toe of the right foot be stimulated, the effect of the stimulus passes to the brain and there calls forth a sensation; but if the stimulus be applied to the skin at the top of the thigh it is evident the effect has to pass along a shorter length of nerve and that the sensation in the brain will be aroused sooner. If we suppose that in each case the individual who is the subject of the experiment indicates the moment he feels the sensation, and that the instant the stimulus is applied successively to the skin on the toe and on the thigh is also accurately recorded, it is clear that he will signal the sensation of stimulation of the toe a little later than when he signals stimulation of the skin on the thigh, and that the difference will indicate the time required by the change in the nerve to pass along the length of nerve from the toe to the thigh. In the observation it is assumed that the time required for the changes in the brain resulting in sensation and volition, for the transmission along the motor nerve, and for the muscular contraction required to signal is the same in each experiment. Thus, supposing the total time between the moment of stimulating to the moment when the signal that the sensation has been felt and responded to is x, it is clear that this time is composed of a, the time required for the passage of the nerve-current in the first experiment from the toe to the brain, of b, the time required for the changes in the brain involved in sensation and volition, and of c, the time required for the transmission along the motor nerves and for the muscular contraction to move the signal,—that is, $x=a+b+c$. But, if the time between the moment of stimulating the thigh to the moment of signalling be shorter, and supposing that b and c are constant, then a varies according to the length of the nerve. Suppose the difference of time between the registration of stimulating at the toe and at the thigh to be y, then in the second experiment $x=a-y+b+c$,—that is, $y=$ the time occupied by the passage of the nerve-current from the toe to the thigh. This method has also been used to measure the time required for signalling a nervous impression in various circumstances, or what is usually called the "reaction period." The most convenient apparatus for the purpose is a chronograph made by König of Paris, the instrument being fully described in M'Kendrick's *Outlines of Physiology*, pp. 538–542.

The general result of measurements made by these methods is that the nerve-current travels slowly compared with the velocity of electricity or of light. In the motor nerves of the frog the velocity is about 87 feet (26 or 27 metres) per second, and in man and warm-blooded animals somewhat faster, 115 to 130 feet (35 to 40 metres) per second. The results as to velocity in sensory nerves vary from 50 to 100 metres per second. Cold retards, heat accelerates, the velocity. As already stated, the velocity is also retarded in a nerve in an anelectrotonic, and accelerated in a katelectrotonic state. The remarkable point is that the transmission of the nerve-current is slow, and that events appearing to our consciousness instantaneous require a considerable time for their occurrence. It may be laid down as a general truth that all kinds of nervous actions, even those considered as purely physical, require time.

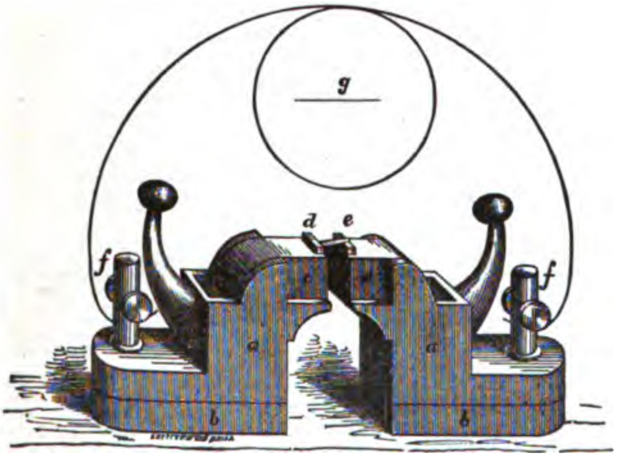

FIG. 4.—Diagram of apparatus of Du Bois-Reymond for experiments on electrical condition of muscle and nerve. a, zinc troughs, mounted on pieces of vulcanite b; c, paper pads; d, e, small pieces of moist clay; f, f, binding screws for attaching terminals of galvanometer g. A small piece of paper connects d and e, and thus completes the galvanometer circuit. (Wundt.)

Heat-production by nerves.

Production of Heat by Nerves.—It is extremely doubtful whether the production of heat by a nerve in action has been detected, although theoretically one would expect heat to be so produced. Schiff observed an increase of temperature on tetanization in the nerves of warm-blooded animals that had been artificially cooled; on the other hand, Helmholtz and Heidenhain's experiments yielded only negative results.

Electrical Phenomena of Nerve.—When a piece of nerve is properly brought into contact with the terminals of a sensitive galvanometer, a current flows through the galvanometer from the surface of the nerve to its transverse section (see Fig. 4).

If metallic conductors, composed (say) of zinc, from the galvanometer were brought into connection with a piece of nerve removed from an animal newly killed, little or no current would be obtained, and even if there were a current it might be due to contact of the metallic conductors with the living tissue exciting electrolytic decomposition. Hence it is necessary to have a fluid interposed between the metal and the animal tissue, say, for example, the zinc wire or plate forming the terminals of the galvanometer is immersed in a saturated solution of sulphate of zinc. But as sulphate of zinc solution would have the effect of irritating the living muscle it is necessary to have an inactive substance between the tissue and the sulphate of zinc solution. All these conditions are fulfilled by the non-polarizable electrodes of Du Bois-Reymond, of which there are various forms. Two zinc troughs, mounted on insulating plates of vulcanite, have the inner surfaces amalgamated. These are filled with a saturated solution of sulphate of zinc, and in each trough is placed a small cushion of clean blotting or filter paper, which quickly becomes permeated with the solution. Finally, a small plate of sculptor's clay, or kaolin, moistened with a half per cent. solution of common salt, or, still better, with saliva, is laid on each paper pad. These clay pads are for guarding the tissue from the irritant action of the sulphate of zinc. Wires are carried from the troughs to the galvanometer, and a key is interposed in the circuit. The object of these careful arrangements is to secure that no current is formed by the apparatus itself. If now a small piece of nerve be so placed on the clay pads that the transverse section touches one pad and the longitudinal surface the other, and the key is opened, a current passes through the galvanometer, as indicated by the swing of the needle. Suppose that the needle is allowed to come to rest, the amount of deflection of course indicating the strength of the current, and the nerve is now irritated so as to call forth its physiological activity, then the needle swings back towards zero. This backward swing is called the negative variation of the nerve-current. The electromotive force of the current obtainable from a frog's sciatic nerve is about .022 of a volt, and somewhat more from the sciatic nerve of a rabbit. This is somewhat less than the electromotive force of a frog's muscle, which varies from .035 to .075 of a volt. According to the views of Hermann, the negative variation-current is a true current indicating, and indeed preceding, the physiological activity of the nerve. He denies that the currents pre-exist in nerve or muscle, and states that the first current observed when the nerve is laid on the pads is simply due to the lower potential of the transverse section, caused by the rapid death of the nerve-substance. The nerve-current excited by a series of irritations, say feeble induction-currents, may be regarded as composed of a wave-like series of momentary currents, each of which is preceded by a negative variation-current. Thus the electrical phenomena of nerve are similar in kind to those manifested by living muscle.

Nutrition of nerves.

Nutrition of Nerves.—Probably nerves are nourished by the plasma reaching the axis-cylinder at the nodes of Ranvier; but it would appear from the researches of Waller that the nutrition of the nerve-fibre is influenced by the nerve-cell with which it is connected. The so-called "law of Waller" is well illustrated in the case of division of the roots of the spinal nerves. Each of these nerves has two roots,—a posterior, sensory, on which there is a ganglion; and an anterior, motor. If the anterior root be divided, in the course of a few days the end of the nerve cut off from the spinal cord is found to be undergoing degeneration, whilst the end attached to the cord is still normal. Again, if the posterior root be divided between the ganglion and the cord, the end remaining in connection with the ganglion remains unaffected, whilst the other end undergoes degeneration. This degeneration, in the case of a motor nerve, affects the nerve to its very terminations. The axis-cylinder disintegrates into drops of fatty matter, and the medullated structure entirely disappears. It is well known that when a nerve is cut the ends may reunite so completely as to insure a return of the normal function in from two to five weeks. According to Ranvier, the axis-cylinders in connection with the central portion play an important part in this regeneration. They become larger, striated and by and by form new axis-cylinders, which pass into the cicatricial tissue and come into contact with the other end of the divided nerve. This is a remarkable confirmation of the view of Waller that the nutritional activity of a nerve-fibre is in the direction of its physiological activity.

Nerve-currents.

Nature of Nerve-currents.—The intrinsic nature of the change in a nerve-fibre effected by a stimulus is quite unknown; but it is important to appreciate clearly the view that a nerve is both a receiver and a conductor of impressions. It can be stimulated in any part of its course, and from the stimulated point some kind of change is propagated along the nerve. This change is analogous to the passage of electricity along a conductor, or to the rapid passage onwards of a series of chemical decompositions, as when a long thin band of gun-cotton properly prepared is seen to slowly burn from end to end, or to the quick transmission of isomeric changes; but the analogy is not complete in any case. Whatever the change may be, however, it does not appear to pass from one nerve-fibre to another running alongside of it. Each fibre conducts only its own impression, and there is nothing analogous to the inductive effect of one electrical conductor upon an adjacent one. Another question much debated is whether sensory and motor nerves act in the same way; or, in other words, is there any essential difference between them? There appears to be no difference in mode of action; the difference in the effect produced depends on the apparatus in which the nerve ends. Thus there may be contraction of a muscle if the nerve terminates in a muscle, change of the calibre of a bloodvessel if the nerve ends in that structure, secretion from a gland if the nerve is in connection either with the vessel or the nerve-cells of a gland, an electrical discharge if the nerve ends in the electrical organ of a *Torpedo* or *Gymnotus*, and a feeling or sensation if the nerve-fibres go to a sentient brain. In all these instances the nature of the change in the nerve and the mode of its transmission are the same, and the results are different because the nerves terminate in different kinds of structure. It would appear from experimental evidence that, when a nerve-fibre is irritated, say about the middle of its length, a change is simultaneously propagated towards each end; but, as only one end is in connection with an apparatus capable of responding, the effect at this end is the only one observed. Thus, if a motor nerve be irritated, there is muscular contraction, in consequence of the stimulus rousing the muscular substance into activity, probably through the agency of the end-plates; but there will be at the same time a backward wave along the nerve to the motor centres in the cord or brain. It is doubtful whether the nerve-energy becomes weaker or gathers intensity as it passes along a nerve; but the balance of evidence is in favor of the view that the so-called "avalanche theory" of Pflüger, according to which the energy gathers intensity as it passes along, is incorrect.

Nerves classified.

Classification of Nerves.—Functionally, nerves may be classified into motor, sensory, vascular, secretory, and inhibitory. The original meaning attached to the term "motor" nerve was a nerve entirely composed of fibres by the excitation of which influences were conveyed to a muscle which caused the muscle to contract. As these influences passed outwards from a nerve-centre towards the periphery of the body they were also termed "efferent" nerves. On the other hand, nerves were found which, when stimulated, gave rise to sensations of pleasure or of pain, and these were called "sensory" nerves. Finally, it was shown that a third class of nerves were composed both of sensory and of motor fibres, and they were called "senso-motor" nerves. Sensory nerves were also subdivided into those of general and those of special sensibility. This was an artificial classification based on the fact that when a nerve of so-called special sensibility, such as the optic, was stimulated in any way the same kind of sensation followed. Thus stimulation of the optic nerve by cutting, pricking, pressure, or electricity is always followed by a luminous sensation. But the progress of research showed that when certain nerve-fibres were stimulated the result was not necessarily a muscular contraction: it might be contraction of a bloodvessel, modified secretion of a gland, or a diminution or arrest of some kind of nervous action. These facts demand another classification of nerves such as the following:

- CENTRIFUGAL, or EFFERENT, or MOTOR, conveying influences outwards from a nerve-centre.
  - 1. *Motor*, sometimes termed *efferent*, to muscles, exciting contraction.
  - 2. *Secretory*, to the cells of glands, causing secretion, possibly a particular kind of secretion.
  - 3. *Vascular*, or *vaso-motor*, to the walls of bloodvessels, so as to cause contraction (*vaso-motor*) or dilatation (*vaso-dilators*, or *vaso-inhibitors*).
  - 4. *Inhibitory*, so affecting other centres of nervous activity as to moderate or neutralize their action.
  - 5. *Electrical*, so affecting a special organ as to call forth electrical discharges, as in electric fishes, *Torpedo*, *Gymnotus*, *Malapterurus*, etc.
- CENTRIPETAL, or AFFERENT, or SENSORY, conveying influences inwards towards a nerve-centre.
  - 1. *Sensory*, causing more or less acute sensations.
    - a. *General*, conveying to nerve-centres in brain influences which cause sensations of a vague character, scarcely perceptible to consciousness, and not permanent, as from lungs, heart, stomach, etc.
    - b. *Special*, conveying to nerve-centres in brain influences which cause visual, auditory, gustatory olfactory, or tactile sensations.
  - 2. *Afferent*, or *reflex*, conveying to nerve-centres influences which usually cause no sensation, and which may or may not be followed by movements, secretions, changes in calibre of vessels, etc.

In addition there are nerve-fibres connecting nerve-cells in the great centres, to which no special functions can be attributed.

2.—TERMINAL ORGANS.

Terminal organs.

Although, as has been shown, a nerve may be stimulated in any part of its course, the stimulus is usually applied to a special structure adapted physiologically for the reception of the particular kind of stimulus. Such a special structure may be termed a "terminal organ." For example, in the mechanism of vision (see EYE, vol. viii. p. 718 *sq.*) there are the retina or terminal organ, the optic nerve or conductor, and the brain or a portion of it, the recipient of the impression. The fibres of the optic nerve are not affected by light, but when they are mechanically or electrically irritated the result is a luminous sensation, because the action of the fibres of the optic nerve is to call forth in the brain the mechanism connected with luminous sensations. But light has a specific action on the retina, and in turn the activity of the retina stimulates the fibres of the optic nerve. The retina is therefore the terminal organ adapted for the reception of rays of light. In like manner, each sense has its appropriate terminal apparatus, and these are described under the headings of the various senses, EAR, EYE, SMELL, TASTE, TOUCH. To understand the true nature of nervous action it is necessary to be clear as to the functions of the terminal organs. They are liberating mechanisms. They do not transform the outer energy into the physiological energy, nervous action; but they call it into action. Thus light acting on the retina is not directly transformed into nervous energy, but it excites changes in the retina, which in turn produce activity of the optic nerve. The structure of each of these terminal organs need not be here described, but it may be stated that they all essentially consist of modified epithelium-cells, or what may be called "nerve-epithelium." In tracing their development throughout the animal kingdom it will be found that the simplest terminal organs are epithelium-cells on the surface of the body; but during evolutionary progress from lower to higher forms these cells become more and more modified and more and more protected by descending deeper into the structure of the animal, until we meet with the complicated organs of special sense in the higher animals. Another class of terminal organs is that comprehending the forms at the ends of motor nerves. Such are the end-plates found in muscle, and described in vol. i. pp. 756, 757. The different modes of nerve-termination may be here briefly classified.

Organ.	*Terminal Organ.*	*Effect.*
Skin (see TOUCH).....	Tactile cells of Merkel, in the epidermis. Tactile corpuscles of Wagner and Meissner, in papillæ of the skin. End-bulbs of Krause, in conjunctiva, penis, and clitoris. Pacinian bodies, attached to nerves of hand or foot, or in the mesentery. Corpuscles of Grandry, found in bills of birds. Network of fibres, as in cornea.	Touch, pressure, or temperature.
Ear (see vol. i. p. 785, and vol. vii. p. 511).	Hair-cells, supported by arches of Corti, and connected with the basilar membrane.	Hearing.
Eye (see vol. i. pp. 778 and 780, and vol. viii. p. 713).	Rods and cones of retina.	Vision.
Nose (see SMELL)....	Rods and olfactory cells.	Smell.
Tongue (see TASTE).	Taste-buds and gustatory cells.	Taste.
Muscles (vol. i. p. 756).	Motorial end-plates of Doyère, Kühne, Krause, Ranvier, etc.	Motion.
Glands.....................	Nerve-endings in secreting cells—Pflüger and Kupffer.	Secretion.
Electric organs (see vol. xii. p. 687).	Laminæ with free cilia-like processes.	Electric discharge.

3.—CENTRAL ORGANS.

A.—General Physiology of Central Organs.

General Structure.—The central organs consist of a special kind of cells called "nerve-cells," of nerve-fibres, both medullated and non-medullated, and of a variety of connective tissue, termed "neuroglia." On cutting into any central nervous organ, such as the spinal cord or brain, two kinds of nervous matter are seen, the white and gray. The gray consists of nerve-cells, nerve-fibres, and neuroglia, whilst the white is composed chiefly of nerve-fibres with a small amount of neuroglia and no nerve cells. Nerve-cells vary much in form, as will be seen by referring to Fig. 5. They may be spheroidal, ovoidal, or irregularly triangular. The cells of the spinal ganglia are usually rounded; those of the

Shapes of nerve-cells.

sympathetic more angular; those of the spinal cord multipolar,—that is, having many processes or poles connected with them; those of the cerebrum triangular or pyramidal; and those of the cerebellum flask-shaped, having processes at each end. A nerve-cell shows a large clear nucleus and a small nucleolus, whilst the cell-substance is very granular. Some observers think they have traced into the substance of the cell a fibrillated structure from the axis-cylinder of the nerve-fibre ending in the pole or process; but this is doubtful, and the appearance may be accounted for by the action of the reagent employed and by the great difficulty of correctly interpreting optical appearances under very high powers. The neuroglia is a delicate interstitial connective substance having small connective-tissue corpuscles imbedded in it.

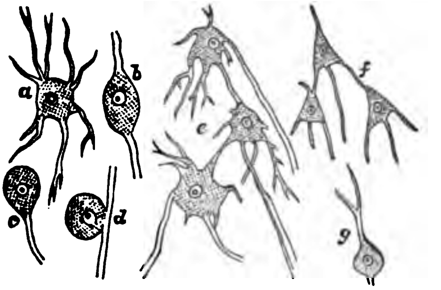

FIG. 5.— Various forms of nerve-cells. *a*, *multipolar*, from gray matter of spinal cord; *b*, *d*, *bipolar*, from ganglia on posterior roots of spinal nerves; *c*, *g*, *unipolar*, from cerebellum; *g* shows indications of a process coming off at lower end; *e*, union of three multipolar cells in spinal cord; *f*, union of three tripolar cells in gray matter of cerebral hemispheres.

Chemical substances in nervous matter.

Chemical Constitution of Gray and White Matter.—This is still imperfectly known, and throws almost no light on the functions of the central organs. By various chemical processes the following substances have been obtained from nervous matter: cerebrin, lecithin, albumin, neurokeratin, cholesterin and fats, creatin, xanthin, hypoxanthin, inosite, lactic acid, volatile fatty acids, salts, and water. The gray matter of the brain is distinguished chemically from the white chiefly by containing more water, albumin, lecithin, and lactic acid, and less cholesterin, fat, and protagon (Hermann). Doubtless many of these substances are derived from the disintegration of a more complex chemical substance not yet isolated in a pure state from nervous matter. Petrowsky gives the composition of gray and white matter as follows:

	Gray matter	White matter.
Water	81.6	68.4
Solids	18.4	31.6
The solids consist of—		
Albumins and gelatin	55.4	27.7
Lecithin	17.2	9.9
Cholesterin and fats	18.7	51.9
Cerebrin	0.5	9.5
Substances soluble in ether	6.7	3.3
Salts	1.5	0.6

The salts found in nervous matter are similar to those in blood, and it would appear that phosphates, or rather combinations in which phosphorus exists, are the most prominent products of analysis. Thus about 40 per cent. of the salt, consist of phosphates of soda and of potash—that is, the ash, on analysis, gives this result; but it must not be inferred that in nervous tissue phosphates of the alkalies exist to this amount, as there is every reason to think that phosphorous compounds, along with alkalies, exist in nervous matter, although not in the form usually called phosphates. The remarkably large amount of water, amounting to no less than from 70 to 80 per cent., indicates matter in a condition suitable for rapid molecular changes, on which, no doubt, the functions of the tissue depend.

Excitability and blood supply.

Excitability of Gray Matter.—As gray matter contains both nerve-fibres and nerve-cells, and as these cannot be separated in any experiment, it is clear that no precise results can be obtained from any effort to distinguish the excitability of gray matter from that of white. The excitability of the gray matter must depend on blood-supply and on the rapid removal of waste-products. If the first be deficient either in quantity or quality, or if the second be not carried on so rapidly as to get rid of the waste-products as they are formed, the activity of the nerve-cells must suffer. The sudden deprivation of blood, as when the heart ceases to beat for even half a second, will cause unconsciousness; the mixture with the blood of a small quantity of bromide of potassium, or of alcohol, or of chloroform or other anæsthetic, or of morphia, will affect the activity of the brain. And it is well known that, when disease of the kidney, or such a disease as an acute fever, affects the body, matters may accumulate in the blood which so contaminate it as to make it unfit to carry on the vital changes on which activity of brain depends, and the result is delirium or unconsciousness. There is every reason to believe that the activity of nerve-cells is delicately attuned to surrounding conditions. A small excess per cent. of carbonic acid, or a small amount of what we call a poison, is sufficient to modify or arrest their action. The rhythmic action of various centres, such as those controlling the movements of respiration, is in favor of the view that the activity of such centres depends on delicate equipoises. If during expiration there is for the moment a deficiency of oxygen in the blood, or an accumulation of carbonic acid, the result will be an attempt at inspiration. This gets rid of the carbonic acid and introduces oxygen, and an expiration ensues. It is not pretended here to state what exactly happens, as these phenomena of respiration are still obscure, but they are brought forward with the view of showing that the actions of the rhythmic centres of respiration depend on the delicate balance established between the external conditions and those centres. If this be the case there is little doubt that a similar effect is produced on other centres by the nature of the blood supplied, and that the quality and quantity of the supply are important factors in the production of all conscious conditions.

Nervous centres.

General Phenomena manifested by Nervous Centres.—Before entering on a detailed description of the functions of the great centres such as spinal-cord and brain, it is well to take a survey of some of the general phenomena manifested by such centres. These may be grouped under the heads of (1) reflex actions, (2) inhibitory actions, (3) accelerating actions, (4) vaso-motor actions, (5) secretory actions, (6) sensations, and (7) intellectual acts.

Reflex actions.

Reflex Actions.—Impressions made on sensory nerves are conveyed to nerve-centres, where they may or may not awaken consciousness. A sensation may be defined as the consciousness of an impression, and may or may not be followed by motion. Either motion may be voluntary, or it may be caused by direct stimulation of the motor nerve distributed to the muscles. The latter kind of action in the living body is not common. Usually motor nerves are acted on by the will or by emotional states; but it not unfrequently happens that physical stimuli occasion motion in an indirect manner, the impressions being carried along sensory nerves to a central organ, where changes are excited which result in a discharge of nervous energy along motor nerves to various muscles. Thus a frog in which the brain and medulla oblongata have been destroyed will draw up its limbs if the foot be pinched. Such actions, taking place without consciousness, are called "reflex actions," and the mechanism required for their performance may be thus described: (1) excitation of a sensory or afferent nerve, (2) excitation of an intermediate nervous or reflex centre, and (3) excitation of a motor or efferent nerve, which causes a muscular contraction. The diagram in Fig. 6 shows the simplest mechanism; but it is rare to find the arrangements so simple, and the mechanism may become more complex (see Fig. 7) either by the existence of a number of cells or groups of cells in the nerve-centre, or by the existence of numerous afferent or efferent nerves. The essence of a reflex action is the transmutation by means of the irritable protoplasm of a nerve-cell of afferent into efferent impulses (Foster). The following is a brief summary of the leading facts relating to reflex action.

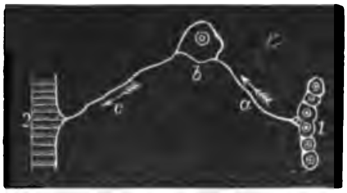

FIG. 6.—Simple reflex action; 1, sensory surface; 2, muscle; *a*, sensory nerve; *b*, nerve-cell; *c*, motor nerve. The arrows indicate the direction in which the influence travels.

(*a*) The inital excitation may occur both in nerves of general sensibility and in those of the special senses; but certain nerves more easily excite reflex actions than others. Thus when light falls on the retina there is contraction of the pupil, the afferent nerve in this case being the optic (see vol. viii. p. 719 *sq.*).

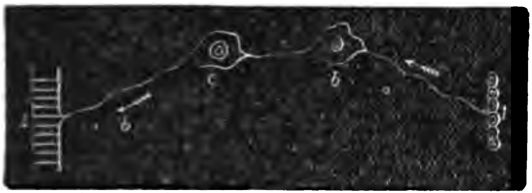

FIG. 7.—Double reflex action, or action in which two or more nerve-cells are involved; 1, 2, as in Fig. 6; *a*, motor nerve; *b*, *c*, nerve-cells.

(*b*) A reflex movement may occur whether we excite a sensory nerve at its commencement or at some point in its course, but in the latter case the action is less intense than in the former.

(*c*) Gray matter containing nerve-cells constitutes the chief proportion of reflex centres, and groups of such reflex centres are frequently associated by internuncial fibres. The excitability is increased when these centres are severed from communication with psychical centres which preside over voluntary movements. Thus, after decapitation, reflex movements occur with greater intensity than in the uninjured animal; they are also more active during sleep. It is evident, therefore, that reflex actions may be restrained or hindered in their development by the action of higher centres. This is termed the "inhibition of reflex action."

(*d*) Reflex movements may occur in one muscle, or in many muscles or groups of muscles. One or more groups of muscles may be involved according to the strength of the stimulus applied to the sensory surface and the degree of excitability of the reflex centre at the time (see Fig. 8). The facts are thus summarized by Pflüger: Unilateral action; if in a decapitated frog we excite the skin of the hind foot *p*, the excitation is transmitted from the centre *a* to the muscles 1 of the foot on the same side. Symmetrical action; if the excitation be more intense, it is transmitted to a centre on the opposite side *b*, and contractions may occur in the muscles of the hind limbs on both sides 1, 2. Irradiation; if the excitation be still increased in intensity, it affects higher centres, *c*, *d*, and there may be contraction of the fore-limbs 3, 4. General action; if the excitation be still further increased, it may pass to a still higher reflex centre *e*, and the result is general convulsions.

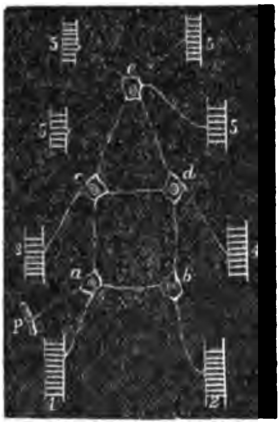

FIG. 8.—*p*, sensory surface; *a*, *b*, *c*, *d*, *e*, nerve-cells; 1, 2, 3, 4, 5, 5, 5, 5, muscles.

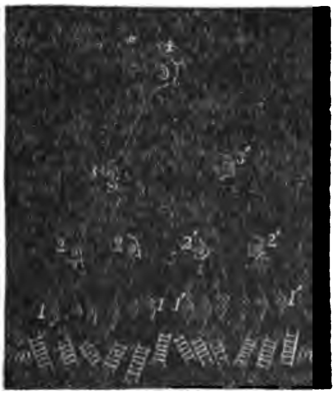

FIG. 9.—Diagram illustrating the superposition of reflexes. *m*, *m*, muscles; 1, 1, series of reflex centres on one side, under the control of 2, 2, which are again governed by 3. There is a corresponding series, 1′, 1′; 2′, 2′; 3′ on the other side. Both sides are presided over by 4. Thus a stimulus reaching 4 might excite the activity of all the muscles *m*, *m*; if it reached 3, only one-half of the muscles; if it reached 2, to the left, only three of the muscles; and, finally, if it affected 1, to the left, only one muscle *m*.

(*e*) Reflex centres may be so arranged in the body as to constitute a series in which those of the cerebrum govern or control others in the deeper ganglia of the brain, while these, in turn, have an influence over still lower centres in the spinal cord. This arrangement is termed the "superposition of reflexes" (see Fig. 9).

(*f*) Stimulation of a sensory surface may simultaneously produce, by a reflex mechanism, movement, secretion, and consciousness. Thus a condiment in the mouth may cause involuntary twitchings of the muscles, secretion of saliva, and a sensation (see Fig. 10).

(*g*) Certain substances, in particular strychnin, increase reflex excitability, so that the slightest external stimulation of the sensory nerves of the skin is sufficient to cause severe convulsions. On the other hand, bromide of potassium, hydrate of chloral, and atropin diminish reflex excitability.

(*h*) Individual stimuli only excite a reflex act when they are very powerful, but stimuli applied at frequent intervals act the more quickly and powerfully the more rapidly they succeed each other. To produce the reflex change in the centre, therefore, a *summation* or addition of centripetal excitations is required. When these reach a certain number the centre responds (Stirling).

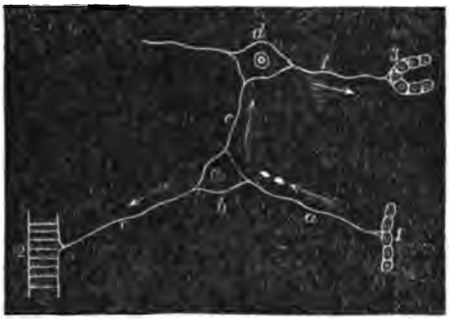

FIG. 10.—Diagram illustrating a complex reflex mechanism. The arrows indicate direction of currents. 1, sensory surface; 2, muscle; 3, gland; *a*, sensory nerve; *b*, reflex centre, connected with another reflex centre *d* by internuncial fibre *e*; *c*, motor or efferent nerve; *f*, secretory nerve passing to gland 3. From the other side of *d* is seen a fibre passing to the brain, and there exciting changes which result in a sensation.

(*i*) Reflex actions involve time. Thus the time between the stimulation and the movement can be measured, and, if we take into consideration the time occupied by the passage of the nerve-current along the nerves involved, and the latent period of muscular contraction, and subtract this from the total time, the remainder will represent the time occupied by the changes in the centre or the reflex-time. This has been found to be from .0555 to .0471 of a second. It is lengthened by cold and shortened by increasing the strength of the stimulus and by strychnia.

(*k*) In compound reflex acts the initial excitation may occur in psychical centres, as when the recollection of an odor causes nausea, or when a feeling of ennui is followed by a yawn.

(*l*) Some reflex movements are the result of inherited peculiarities of structure, as those made by a new-born child when it seizes the breast. Other reflex movements are acquired during life. Such are at first voluntary, but they become automatic by repetition.

Examples of reflex action.

The following are some of the more common examples of reflex movements. Motions of the muscles in any part of the limbs or trunk under the influence of sensory impressions on the skin, such as tickling, pricking, etc.; shuddering from cold, shuddering caused by grating noises, etc.; contraction of the pupil under the influence of light on the retina; winking from irritation of the sensory nerves of the conjunctiva; sneezing, from irritation of the Schneiderian membrane, or by a glaring light on the eye; spasm of the glottis and coughing, from irritation of the larynx or trachea; laughing, caused by tickling the skin; the first respiration of the child at birth, from the impression of cold upon the nerves of the skin, and especially those of the chest; respiratory movements in the adult, from the impression caused by the afferent nerves of the lungs (sympathetic or vagus), by the presence of carbonic acid in the air cells and passages, or in those of the general system—also, occasional modifications of the respiratory movements from impressions of cold, etc., on the surface of the body; sucking in infancy; deglutition or swallowing, with all the complicated movements then occurring in the tongue, fauces, larynx, and gullet; vomiting, caused by irritation in stomach, or in fauces, or following nausea; forced contractions of sphincter muscles of the anus, urinary bladder, and vagina, under local irritation; erection and emission under the influence of irritation of the nerves of the penis and other parts in the vicinity; rhythmic movements of lymphatic hearts in reptiles; rhythmic movements of the heart by the action of cardiac ganglia; peristaltic motions of the stomach and alimentary canal, in digestion and in defecation, etc., under the influence of impressions conveyed to the ganglia by the splanchnic and intestinal nerves; action of the bladder in expelling urine; expulsive action of the uterus in parturition; contractions and dilatations of the bloodvessels under the influence of the vaso-motor system of nerves, or any obscure and complex morbid actions, such as palpitations of the heart, cramps in the limbs caused by irritation in the stomach or intestinal canal, fainting from concussion or from peculiar odors, dilatation of the pupil and grinding of the teeth from the irritation of worms, and the convulsive seizure sometimes occurring during teething.

Inhibitory and accelerating actions.

Inhibitory and Accelerating Actions.—As we have seen, stimulation of a nerve may cause a sensation, a reflex action, or the direct contraction of a muscle; but in some instances when the nerve is stimulated movements may be arrested. This occurs where rhythmic and apparently spontaneous or automatic actions are restrained or inhibited by the activity of certain nerves. The most striking instance of inhibition is offered by the heart. The subject will be readily understood with the aid of Fig. 11, which illustrates the innervation of the heart and bloodvessels and especially the inhibition and action of the depressor nerve.

It is well known that the heart of a warm-blooded animal ceases to beat almost immediately after removal from the body, but the heart of a cold-blooded animal, such as the frog, will beat for hours or even days, especially if it be supplied with defibrinated blood. The rhythmic beat depends to some extent on the existence in the heart of ganglia or small nerve-centres (Fig. 11, I, A, R). It is quite true, however, that rhythm may go on in a portion of the heart containing no ganglionic structure. Now the heart receives nerves from two sources, from the vagus or pneumogastric nerve and from fibres derived from the spinal cord through the sympathetic. If the vagus be cut and the lower end stimulated by feeble induction-shocks, the heart beats more slowly, and will probably be brought to a stand-still in a dilated condition. A strong stimulation of the vagus will invariably arrest the action of the heart, and the organ will be found dilated, or, as it is said, in a state of diastole. On removal of the stimulus the heart will soon resume its beats. It is clear that the vagus cannot be regarded as the motor nerve of the heart, because, if so, stimulation would have arrested the action of the heart in a state of contraction or systole. The question, then, is whether the fibres of the vagus possessing this remarkable power of inhibiting or restraining the action of the heart terminate in the muscular fibres, or in some intermediate structures, such as ganglia. The influence of various poisons has shed light on this question. A minute dose of atropin injected into the blood paralyzes this inhibitory action. After such a dose stimulation of the vagus is followed by no effect, and the heart beats as usual.

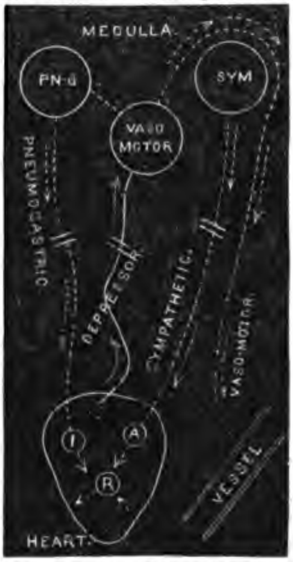

FIG. 11.—The origins of pneumogastric and vaso-motor systems are in medulla, that of the sympathetic in upper portion of cord. The arrows indicate direction of nerve-currents. In the heart R represents a reflex centre, I an inhibitory centre, and A an accelerating centre.

"Again, in slight urari poisoning the inhibitory action of the vagus is still present; in the profounder stages it disappears, but even then inhibition may be obtained by applying the electrodes to the sinus. In order to explain this result, it has been supposed that what we may call the inhibitory fibres of the vagus terminate in an inhibitory mechanism (probably ganglionic in nature) seated in the heart itself, and that the urari, while in large doses it may paralyze the terminal fibres of the vagus, leaves this inhibitory mechanism intact and capable of being thrown into activity by a stimulus applied directly to the sinus. After atropin has been given inhibition cannot be brought about by stimulation either of the vagus fibres or of the sinus, or indeed of any part of the heart. Hence it is inferred that atropin, unlike urari, paralyzes this intrinsic inhibitory mechanism. After the application of muscarin or pilocarpin the heart stops beating, and remains in diastole in perfect standstill. Its appearance is then exactly that of a heart inhibited by profound and lasting vagus stimulation. This effect is not hindered by urari. The application, however, of a small dose of atropin at once restores the beat. These facts are interpreted as meaning that muscarin (or pilocarpin) stimulates or excites the inhibitory apparatus spoken of above, which atropin paralyzes or places *hors de combat*" (Foster, *Text-Book of Physiology*, 4th ed., p. 186).

Thus physiologists are satisfied that, when the vagus is stimulated, currents of nerve-energy pass along its fibres to some of the intrinsic ganglia of the heart and inhibit or restrain these, so that the heart beats more slowly or is arrested altogether. But the centres in the heart may also be stimulated. After division of both vagi in a mammal, say a rabbit, the heart's beat may be quickened or accelerated by stimulation of the cervical spinal cord. Fibres having this power of accelerating the action of the heart have been traced from the cervical spinal cord through the last cervical and first thoracic ganglia of the sympathetic. Stimulation of these *accelerator* nerves causes a quickening of the heart's beat, in which, however, "what is gained in rate is lost in force" (Foster). They are referred to here as showing another kind of nervous action, quite different from inhibition. Thus any nerve-centre concerned in reflex movements may have, by impulses reaching it from the periphery, its action inhibited or restrained or accelerated.

Nerves and blood-vessels

Influence of Nerves on Bloodvessels.—If the sympathetic nerve be divided in the neck, there is a dilatation of the vessels and an increase of temperature on the same side; but irritation by weak induction-currents of the cephalic end will cause the vessels to contract and the temperature to fall In the sympathetic, therefore, there are nerve-fibres which influence the contractile coats of the bloodvessels. These fibres, called "vaso-motor," originate from a vaso-motor centre in the medulla oblongata between the point of the calamus scriptorius and the lower border of the corpora quadrigemina, in the floor of the fourth ventricle. From this chief vaso-motor centre nervous influences emanate which tend to keep the smaller vessels in a more or less contracted condition. If it be injured, paralyzed, or destroyed there is at once great dilatation of the vessels, more especially those in the abdominal cavity, and the blood collects in these dilated vessels. This of course diminishes the arterial pressure in the larger vessels. Consequently, by observations on blood-pressure, it has been found possible to study the conditions of vaso-motor action. By connecting a kymograph (a recording manometer) with a large vessel, say the carotid, observing for a time the mean blood-pressure, and afterwards injuring the supposed vaso-centre, Ludwig and his pupil Owsjannikoff at once observed an enormous fall of blood-pressure, to be explained by the paralysis of the smaller and a consequent emptying of the larger vessels.

The vaso-motor centre may be influenced—that is, inhibited, or possibly strengthened—by impulses coming from the periphery. Such impulses may be sent to the centre along any sensory nerve, but in 1866 Cyon and Ludwig discovered a nerve which apparently exercises this function to a remarkable extent. In the rabbit it originates by two roots from the superior laryngeal and from the vagus. Stimulation of the distal end of this nerve produces no effect, but stimulation of the cephalic end causes at once a great fall of blood-pressure in the arterial system and a diminution in the frequency of the pulse. As this nerve, therefore, inhibits, restrains, or depresses the activity of the vaso-motor centre, it has received the name of the "depressor nerve of Cyon and Ludwig." It appears to influence chiefly the vaso-motor arrangements of the abdomen and lower extremities. Thus, after section of the splanchnics, which control the vessels of the abdominal viscera, it is said that excitation of the depressor does not produce nearly the same diminution of pressure in the carotid vessels. By the influence of the depressor a balance is kept up between the central and the peripheric circulations. Imagine the heart to be pumping blood through the vessels. If from some cause the smaller vessels become constricted so as to offer greater resistance to the passage of the blood, the arterial pressure in the larger vessels is increased, and the heart has more work to do to overcome this resistance. When the resistance reached a certain amount the heart would be in danger of exhaustion in endeavoring to overcome it. But by the depressor this danger is removed, as an influence may pass from the heart along the fibres of the depressor to the vaso-motor centre, the effect of which is to inhibit the activity of this centre, and thus allow the smaller vessels to dilate. When this occurs, either locally, as in the abdominal region, or generally, the result is a depletion of the larger vessels, a consequent fall of pressure in them, and therefore less resistance to the efforts of the heart. Thus it would appear that in the heart itself there is an arrangement by which, to a certain extent, it governs its own work, and there is an adjustment between the activity of the heart and distribution of blood throughout the body (see Fig. 11).

The vaso-motor nerves causing contraction of vessels have been called "vaso-constrictors"; but there are other nerve-fibres possessing the property of causing a dilatation instead of a contraction. These have been called "vaso-dilators." Excitation of the chorda-tympani nerve, for example, causes the vessels of the submaxillary gland to dilate (see vol. xvii. p. 691). Erection, as it occurs in the penis, has long been known to depend on dilatation of vessels and consequent increased afflux of blood. Stimulation of the nerves of the sacral plexus may cause erection. But how do such nerve-fibres act? It cannot be that they directly cause relaxation of the muscular fibres in the walls of the vessels. These contain layers of involuntary muscular fibres in the transverse and longitudinal directions, and it is difficult to understand how any contraction of fibres in either of these directions could possibly cause dilatation of the vessel. Probably the effect is brought about by the action of some kind of inhibitory mechanism. Ganglia abound in the walls of the vessels. From these, fibres pass to and from the muscular elements of the vessel. Such ganglia or local reflex centres may be supposed to be under the influence of two sets of nerve-fibres: (1) accelerating or strengthening, corresponding to the accelerating fibres that influence the heart; and (2) inhibitory, like the fibres of the vagus distributed to the heart, having the power of restraining the action of the local ganglia. According to this view, the fibres in the chorda which cause dilatation of the vessels of the submaxillary gland on stimulation are vaso-inhibitory nerves.

Nerves and glands.

Influence of Nerves on Glands.—This has already been described under NUTRITION (vol. xvii. p. 691), but the facts may be here briefly summarized. A secreting gland is supplied with three sets of nerve-fibres—vaso-constrictor, vaso-dilator or vaso-inhibitory, and secretory. The first two regulate the distribution of blood in the gland, whilst the third set directly affects the activity of the secreting cells. According to Heidenhain, in addition to the vascular nerves supplying a gland there are secretory and trophic nerves. "Stimulation of secretory fibres leads to an increased flow of water, stimulation of the trophic to an increased secretion of specific substances and to an increased production of protoplasm" (Gamgee). The vaso-constrictor fibres of a gland are derived from the sympathetic, and the vaso-dilator and secretory form the cerebro-spinal system.

Nerve-centres classified.

Classification of Nerve-Centres.—Although these are usually classified anatomically, according to the organ in which they are situated, they may also be arranged according to their functions, as follows: (1) *receptive* centres, to which influences arrive which may excite sensations (in gray matter of brain), or some kind of activity not associated with consciousness (reflex centres of the cord and of the brain); (2) *psychical* centres, connected with sensation in the sense of conscious perception, emotion, volition, and intellectual acts (in the gray matter of the brain); (3) *discharging* centres, whence emanate influences which, according to structures at the other ends of the nerves connected with them, may cause movements, secretions, or changes in the calibre of vessels (in brain and spinal cord); (4) *inhibitory* centres, which inhibit, restrain, or arrest the actions of other centres.

B.—Special Physiology of Central Organs.

General Physiological Anatomy.—The central organs of the nervous system consist of ganglia or of what is called a "cerebro-spinal axis." The anatomy of the latter is described under ANATOMY, and some account of the gangliated cords in invertebrates and of the rudimentary nervous systems of the lower forms of vertebrates will be found under the articles CRUSTACEA, INSECTS, AMPHIBIA, BIRDS, ICHTHYOLOGY, etc. But, as one of the most effective ways of obtaining an intelligent conception of the complicated nervous system of man and of the higher animals is to trace its various forms in the scale of animal existence, and to observe the close correspondence between complexity of structure and complexity of function, a short introductory review of its comparative anatomy, from the physiological side, will here be given. In the first place, we find that the different forms of nervous systems may be divided into (*a*) those consisting of ganglia or chains of ganglia, as found throughout the invertebrates, and (*b*) those having a great axis of nervous matter forming a brain and spinal cord, the cerebro-spinal axis, as seen in vertebrates.

Nervous system of invertebrates.

Comparative View of Nervous System of Invertebrates.—In the simplest forms of animals the protoplasmic cell is the seat of sensation and of motion; but as the contractile or muscular layers become more marked sensation is relegated to the cells of the ectoderm, or outer layer of the body. As portions of this sensory layer become of higher value to the organism, their protection is accomplished by some of the sensory cells sinking into the body of the organism so as to be covered by less important structures. The portions, originally of the surface, thus differentiated and protected become ganglia, and processes pass from them on the one hand to cells in the periphery, so that they may still be influenced by external energies, and on the other to the contractile parts of the organism by which movements are accomplished. Still higher in the scale of life, the ganglia are connected by internuncial fibres, and the plan of the primitive nervous system bears a relation to the general type or structure of the animal. Thus in radiate animals the gangliated cords show a radiated arrangement, and when the animal form is bilateral and symmetrical the nervous arrangements are on the same type. It is also to be noted that the ganglion specially connected with the rudimentary organs of sense attains a size and importance proportionate to the development of the sense-organs. The nerves of the sense-organs are chiefly connected with the supra-œsophageal ganglion, which thus may be looked on as a rudimentary brain. When the body of the animal becomes more complicated by the development of similar segments (or metameres), we find that by a reduplication, as it were, of the subœsophageal ganglion a ventral chain of ganglia is formed, a pair of ganglia for each segment, the individual ganglia being connected by longitudinal commissures. Such an arrangement is seen in the ringed worms and in arthropods. The next step is a fusion of ganglia into masses, according to the size and importance of the part of the body to be innervated (see vol. vi. pp. 561, 562, Figs. 7 and 9).

No trace of a nervous system can be detected in *Protozoa*. The Scyphomedusoid forms of *Hydrozoa* show nerve-fibres and ganglion-cells (Schäfer) in the sub-umbrella and around the tentaculocysts (see vol. xii. p. 585, Fig. 15), and in the Hydromedusoid forms the nerve-ganglion cells form a ring round the margin of the disk. In some of the *Actinozoa* (anemones, etc.) fusiform ganglionic cells united by nerve-fibres are said to exist (P. M. Duncan). In all the worms (*Vermes*) the most important central organs of the nervous system are placed in the anterior part of the body near the beginning of the alimentary canal. If they have a distinct head the nervous organ is in it and supplies branches to the sense-organs. From thence nerve-trunks radiate to the periphery of the body, often in the form of two longitudinal trunks on the ventral surface. Frequently there is a nervous ring round the œsophagus. Nerve-organs have been found in all the *Platyhelminthes*, *Rotatoria*, and *Bryozoa*. The *Nemathelminthes* show a further advance. The central organ is placed on the œsophagus, surrounding it as a ring, from which nerves radiate forwards and backwards. Often six strands of nerve run forwards, whilst a dorsal and a ventral trunk pass backwards. The size of these trunks depends on the length of the body. The cephalic ganglion is bilateral and is largely developed. In the *Hirudinia* and *Annelida* the cerebral ganglia are connected by commissures with a ventral cord, which, in turn, shows individual ganglia connected by commissures. Each ganglion consists of two equal portions with a transverse commissure, and in the higher forms they are so close as to form almost a single cord. It is also evident that the cerebral ganglia are composed of several ganglia fused together, and acquire functional importance as the sense-organs are more highly developed. In the *Echinodermata* the nervous system consists of a number of trunks placed ventrally and having a radial arrangement. Each of these trunks corresponds to the ventral ganglionic chain of the *Annulata*. In *Asterida* (star-fishes) each radial nerve consists of two bands thickened in the middle, and at the end there is a swelling connected with an optical apparatus placed there. In the *Echinus* (sea-urchin) the nervous ring lies above the floor of the oral cavity, between the œsophagus and the lips of the ossicles of the masticatory apparatus. From this ring lateral branches issue which accompany the branches of the ambulacral vessels. In *Holothuroida* (sea-cucumbers) the nervous ring lies in front and near the mouth, and is thicker than the five nerves which it gives off, thus differing from the *Asteroida* and *Echinoida*. The nervous system of the *Arthropoda* resembles that of the *Annelida*. There is a large ganglion above the œsophagus, the cerebral ganglion, united to a ventral ganglion by two commissures so as to form a nervous ring. From the ventral ganglion a series of ganglia united by commissures extends along the ventral surface of the body. The increased size of the cerebrum is the most striking characteristic, and no doubt bears a relation to the higher degree of development of the sense-organs, more especially those of sight. In some *Crustacea* the optic nerves arise from distinct lobes. As pointed out by Gegenbauer, when the optic organs are reduced or lost the cerebrum becomes so small as to be represented by nothing but a commissure. In the individuals having a large portion of the body composed of similar metameres the ganglia are regular in size, appearing in pairs. On the other hand, in the *Thoracostraca* (crabs, etc.) the anterior ganglionic masses are fused into larger masses so as to correspond to the concrescence of the anterior metameres into a cephalothorax. In the abdominal portion of the body, where the metameres are small, distinct, and more or less regular, the ganglia are also distinct and in pairs. In the *Protracheata* (*Peripatus*) the nervous system is simpler, and consists of the œsophageal collar with a double ventral cord having no ganglia or swellings on it, although nerve-cells are distributed through it. In the *Myriapoda* there is a well-marked ventral cord, with ganglia corresponding to the metameres. In the *Arachnida* the ventral ganglia are often reduced in number and fused. They are characterized by the close connection between the cerebral ganglia and the ventral cord, owing to the extreme shortness of the commissures (Gegenbauer). In the *Scorpions* the nervous system is richly segmented, and remarkable for the large size of the ganglion giving off the pedal nerves. The *Spiders* have a single large ganglion in the cephalo-thorax, no doubt consisting of several ganglia. In the *Acarina* (mites) the cerebral ganglion is extremely small, and the other ganglia are fused so as to form one single mass, giving off nerves all round. These minute animals show a remarkable degree of concentration of the nervous system. In *Insecta* (see Fig. 12) the ventral cord traverses the whole length of the body, the ganglia being at equal distances, and all united by commissures. This condition is well seen in the larval condition, and is like the permanent state of the *Myriapoda*. When the insect passes into the adult condition changes occur, consisting essentially of the fusion of ganglia and a shortening of the commissures. The cerebral ganglion is composed primitively of three pairs, and in most cases does not unite with the rest of the ventral cord. It shows hemispheres and a complicated structure. The first ganglion of the ventral cord supplies the organs of the mouth; the three succeeding send nerves to the appendages, feet, and wings; the remaining ganglia are small, except the last, which supplies the generative organs. There is great variety among the *Insecta* in the number of ganglia in the ventral cord, but coalescence always indicates a higher type of structure. The nervous system of the *Brachiopoda* is formed of masses of ganglia near the œsophagus. From these nerve-fibres pass to various parts of the body. There is an œsophageal ring, but the superior ganglion is very small, owing to the absence of higher sensory organs. In *Mollusca* (see vol. xvi. p. 657, Fig. 1) the nervous system is divided into a superior ganglionic mass, which lies above the commencement of the œsophagus—the supra-œsophageal or cerebral ganglia—and a ventral mass which is connected with the other by commissures, and forms the inferior or pedal ganglia. They are both paired. The cerebral ganglion is connected with the sense-organs. Both the cerebral and the pedal ganglionic masses really consist of ganglia fused together. This is well shown in some of the lower forms, in which the pedal ganglia are divided, and form an arrangement like the ventral cord of the *Annulata*. The remarkable feature in the nervous system of the *Mollusca* is the great development of the visceral ganglia and nerves supplying the heart, branchial apparatus, and generative organs (see vol. xvi. p. 666, Figs. 17, 18, pp. 667, 668, Figs. 20, 21, 22; p. 671, Figs. 34, 35, 36). In the *Lamellibranchia* the cerebral ganglia are very small, owing to the absence of a head and its sense-organs. In some forms they are placed so much to the side as to be united by a long commissure. There are also two pedal ganglia, of a size proportional to the degree of development of the foot. The visceral ganglionic mass is often the largest. It lies behind the posterior adductor muscle, and is united by long commissures to the cerebral ganglion (vol. xvi. p. 719, Fig. 144). The nervous system of the *Gastropoda* is remarkable for the large size of the cerebral ganglia. In the *Pteropoda* the cerebral ganglia either retain their lateral position or approach the pedal ganglia, with which the visceral ganglia are also fused. The three ganglionic masses, cerebral, pedal, and visceral, are also represented in the *Cephalopoda*, but they are more approximated by the shortening of the commissures. The ganglionic masses consequently are of great size, and they are more differentiated than any other ganglia in invertebrates. It is possible to distinguish an outer gray layer formed of ganglionic cells, surrounding a white layer, composed of fibres (vol. xvi. p. 704, Figs. 113, 114, 115). Lastly, in *Tunicata* the nervous system is dorsal, instead of ventral, as in other invertebrates. It is developed from the ectoderm, or outermost layer of the embryo, by an infolding so as to form at first a groove and afterwards a tube. In the Ascidian larvæ this nervous tube reaches throughout the length of the tail, and we have thus the remarkable condition of a dorsal-median nerve-cord, analogous to the cerebro-spinal system of vertebrates. Further, embryologists are of opinion that this rudimentary nervous system is the true central organ, although the greater portion of it disappears by the atrophy of the tail in the passage from the larval to the adult state. (Gegenbauer.)

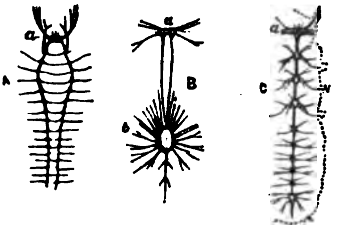

FIG. 12.—Typical forms of nervous system in invertebrates. A, in *Serpula*, a marine annelid; *a*, cephalic ganglion. B, in a crab; *a*. cephalic ganglion; *b*, ganglia fused under cephalo-thorax. C, in a white ant (*Termes*); *a*, cephalic ganglion. (Gegenbauer.)

Comparative View of Nervous System of Vertebrates.—To understand the structure of the complicated central nervous system of vertebrates, and to appreciate the physiological importance of its various parts, it is necessary to trace its development in the embryo and to note the various forms it presents from the lowest to the highest vertebrates. A consideration of the embryological and morphological aspects of the subject clears up many difficult problems which a study of the human nervous system, by far the most complicated physiological system in the body, fails to do, and in particular it gives an intelligent conception of its architecture, as seen both in simple and complex forms. The cerebro-spinal axis begins in the embryo as a tube of nervous matter produced by an infolding of the epiblast, or outermost embryonic layer. The tube widens at its anterior end, and, by constrictions in its wall, three primary cerebral vesicles are formed, which afterwards become the anterior, middle, and posterior parts of the brain. In the fully-developed condition the cavity of the tube remains as the central canal of the spinal cord and the ventricles of the brain, whilst the various parts of the brain and cord are formed by thickenings in its walls.

Nervous system of vertebrates.

Cerebral vesicles.

The three cerebral vesicles have been called the fore-brain, the mid-brain, and the hind-brain. A protrusion from the anterior cerebral vesicle, at first single, but afterwards divided by a median cleft, becomes the rudiment of the cerebral hemispheres (*prosencephala*), the cavity remaining in the adult condition as the lateral ventricle on each side. From each cerebral vesicle another hollow process protrudes which constitutes the olfactory lobe (*rhinencephalon*). What remains of the cavity of the first vesicle becomes the third ventricle (*thalamencephalon*). In the outer and under walls of the *prosencephala* a thickening is formed which becomes the *corpora striata*, two large bodies in the floor of the lateral ventricles of the adult brain, whilst the roof is modified into the substance of the cerebral hemispheres. Immediately behind the corpora striata and in the floor of the thalamencephalon, two similar thickenings occur which become the *optic thalami*, a thin layer between the two constituting the *tænia semicircularis*, and the Y-shaped canal passing from the cavity between the thalami to the cavities in the cerebral hemispheres (lateral ventricles) is the *foramen of Monro*. The floor of the third ventricle is produced into a conical process, the *infundibulum*, at the blind end of which is the pituitary body, or *hypophysis cerebri*. The roof of this ventricle is very thin, and in connection with it is developed the pineal gland, or *epiphysis cerebri*. Transverse fibres pass from the one corpus striatum to the others, constituting the *white commissure*, whilst the two optic thalami are connected by two *gray commissures*. In mammals the two cerebral hemispheres are connected by a large and important set of commissural fibres, forming the *corpus callosum*. In addition there are certain sets of longitudinal commissural fibres. Thus two sets of fibres arise from the floor of the third ventricle, arch upwards, and form the *anterior pillars of the fornix*. These are continued over the roof of the third ventricle and run backwards, constituting the *body of the fornix*. Behind this the bands diverge so as to form the *posterior pillars of the fornix*. In the higher vertebrates the upper lip of the foramen of Monro thickens, and becomes converted into a bundle of longitudinal fibres, which is continuous anteriorly with the anterior pillars of the fornix. These are continued back between the inner boundary of the cerebral hemisphere and the margin of the corpora striata and optic thalami, and project into the lateral ventricle, forming the *hippocampus major*. As in highly-formed brains the corpus callosum passes across considerably above the level of the fornix, a portion of the inner wall of the hemisphere on each side and a space between are intercepted. The two inner walls constitute the *septum lucidum*, and the space the cavity of the fifth ventricle. By a thickening of the floor of the middle cerebral vesicle (*mesencephalon*) two large bundles of longitudinal fibres, the *crura cerebri*, are formed, whilst its roof is modified into the optic lobes, *corpora bigemina* or *corpora quadrigemina*. The cavity, reduced to a mere tube, is the *iter a tertio ad quartum ventriculum*, or the *aqueduct of Sylvius*. The third cerebral vesicle, *myelencephalon*, undergoes less modification than the others. The upper wall is exceedingly thin before the cerebellum so as to form a lamina, the *valve of Vieussens*, whilst the part behind is covered only by membrane, and opens into the posterior subarachnoid space. The *cerebellum* makes its appearance as a thin medullary lamina, forming an arch behind the corpora quadrigemina across the wide primitive medullary tube. The portion forming cerebellum, *pons Varolii*, and the anterior part of the fourth ventricle is termed the *epencephalon*, whilst the remaining portion, forming the *medulla oblongata* and fourth ventricle, is the *metencephalon*. These facts are briefly summarized as follows (Quain, vol. ii. p. 828):

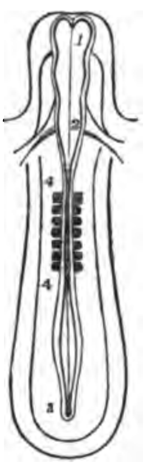

FIG. 13.

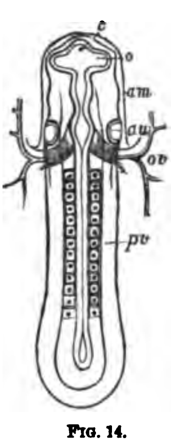

FIG. 14.

FIG. 13.—Outline from above of embryo chick in first half of the second day. 1 to 2, three primary encephalic vesicles inclosed in front and at the sides by the cephalic fold; 3, hinder extremity of medullary canal dilated into a rhomboid space in which is the primitive trace; 4, 4, seven proto-vertebral somites. (Quain's *Anatomy*.)

FIG. 14.—Embryo of dog more advanced, seen from above (after Bischoff). The medullary canal is now closed in; *c*, anterior encephalic vesicle; *o*, primitive optic vesicle; *au*, primitive auditory vesicle, opposite third encephalic vesicle; *am*, cephalic fold of amnion; *ov*, vitelline veins entering heart posteriorly; *pv*, proto-vertebral somites. (Quain's *Anatomy*.)

1. Anterior cerebral vesicle.	*a.* Prosencephalon—Fore-brain.	Cerebral hemispheres, corpora striata, corpus callosum, fornix, lateral ventricles, olfactory bulb (rhinencephalon).
	b. Thalamencephalon — Inter-brain.	Optic thalami, pineal gland, pituitary body, third ventricle, optic nerve (primarily).
2. Middle cerebral vesicle.	*c.* Mesencephalon—Mid-brain.	Corpora quadrigemina, crura cerebri, aqueduct of Sylvius, optic nerve (secondarily).
3. Posterior primary vesicle.	*d.* Epencephalon—Hind-brain.	Cerebellum, pons Varolii, anterior part of the fourth ventricle.
	e. Metencephalon—After-brain.	Medulla oblongata, fourth ventricle, auditory nerve.

The general architecture of the brain considered in this way will be understood by the diagram in Fig. 15, whilst details as to the exact anatomy of the human brain will be found under ANATOMY (vol. i. p. 763 *sq.*).

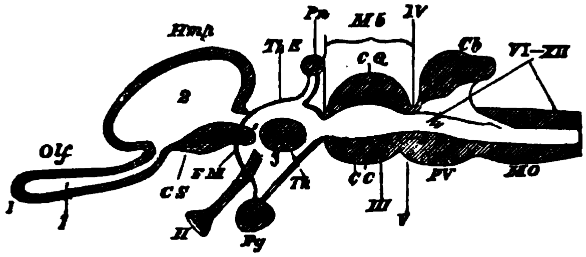

FIG. 15.—Diagrammatic longitudinal and vertical section of a vertebrate brain. The *lamina terminalis* is represented by the strong black line between *FM* and 3. *Mb*, mid-brain, what lies in front of this being the fore-brain, and what lies behind the hind-brain; *Olf*, the olfactory lobes; *Hmp*, the hemispheres; *ThE*, the thalamencephalon; *Pn*, the pineal gland; *Py*, the pituitary body; *FM*, the foramen of Monro; *CS*, the corpus striatum; *Th*, the optic thalamus; *CQ*, the corpora quadrigemina; *CC*, the crura cerebri; *Cb*, the cerebellum; *PV*, the pons Varolii; *MO*, the medulla oblongata; I, olfactorii; II, optici; III, point of exit from the brain of the motores oculorum; IV, of the pathetici; V, of the abducentes; VI–XII, origins of the other cerebral nerves; 1, olfactory ventricle; 2, lateral ventricle; 3, third ventricle; 4, fourth ventricle. (Huxley.)

The complex structure of the brain in the higher animals arises to a large extent from the great development of the cerebral hemispheres. At a very early period these grow forward and project more and more beyond the region of the first primary vesicle, which, as has been noticed, never advances farther forward than the pituitary fossa (*lamina terminalis*); in expanding upwards they take the place previously occupied by the mid-brain, and fill the most prominent part of the head; and by a downward and lateral enlargement they form the temporal lobes. Thus frontal, parietal, and temporal lobes come to be distinguishable, and somewhat later, by a farther increase posteriorly, the hindmost lobes constitute the occipital lobes, and the cerebrum at last covers completely all the lower parts of the brain. The hemispheres, therefore, which are small in the early embryo of all animals, and in adult fishes permanently, attain so large a size in man and in the higher animals as to conceal all the other parts. Whilst this general development is going on the layer of gray matter on the surface of the hemispheres increases to such an extent as to throw the surface into folds or convolutions. The upper surface of the hemispheres is at first smooth (see Fig. 16). The first appearance of division into lobes is that of a blunt notch between the frontal and temporal parts below, in what afterwards becomes the Sylvian fissure. In the fourth and fifth months there appear the vertical fissure, separating the parietal and occipital lobes, and the transverse fissure, called the fissure of Rolando, which divides the frontal and parietal lobes superiorly, and which is peculiarly characteristic of the cerebral type of man and of the apes (Allen Thomson). Then the convolutions appear from the formation of secondary grooves or *sulci*, for even at birth they are not fully perfected; and by the deepening of the grooves and the formation of subordinate ones the process goes on during the first years of infancy. For the convolutions see vol. i. p. 767; also, PHRENOLOGY, vol. xviii. p. 862.

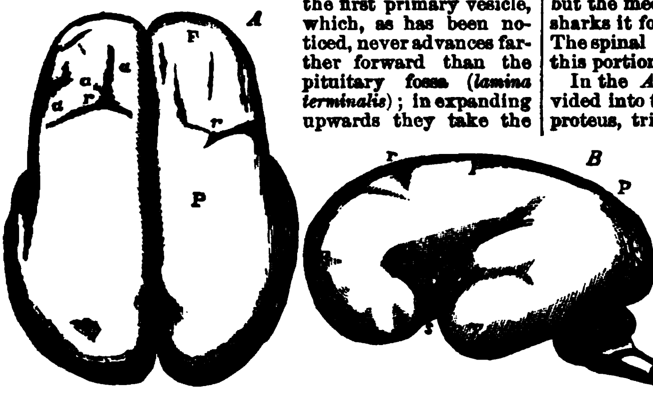

FIG. 16.—Surface of fœtal brain at six months (from R. Wagner). This figure is intended to show the commencement of formation of the principal fissures and convolutions. *A*, from above; *B*, from left side. *F*, frontal lobe; *P*, parietal; *O*, occipital; *T*, temporal; *a*, *a*, *a*, slight appearance of several frontal convolutions; *s*, Sylvian fissure; *s'*, its anterior division; within *C*, central lobe or convolutions of island of Reil; *r*, fissure of Rolando; *p*, parieto-occipital fissure. (Quain.)

Development of brain in animal series.

The evolution of the brain throughout the animal kingdom shows a graduated series of increasing complication proceeding out of the same fundamental type: so that the forms of brain found permanently in fishes, amphibians, reptiles, birds, and in the lower mammals are repetitions of those shown in the stages of the embryonic development of the brain of one of the higher animals.

In the whole class of fishes the brain retains throughout life more or less of the elementary form,—that is, it consists of a series of enlargements, single or in pairs (see Fig. 17, C). The simplest of all forms is in the lancelet (*Branchiostoma*), in which there is no distinction between brain and cord, there being no anterior enlargement to form an encephalon. In the *Cyclostomata*, as the lampreys, the form is nearer that of the embryo when the five fundamental parts of the brain can be distinguished. At this stage the cerebrum and cerebellum are extremely small, whilst the ganglia chiefly developed are those connected with the organs of sense, more especially those of vision. In the sharks and skates (*Selachii*, or cartilaginous fishes) the cerebral portion is considerably larger. In osseous fishes (*Teleostei*) the thalamencephalon is so fused with the mesencephalon as to make the homology of the parts difficult to trace, but both cerebellum and cerebrum are still small relatively to the rest of the brain. The most important part of the brain of a fish is the part behind the mesencephalon, as from it all the cerebral nerves originate. Thus not only are the optic lobes relatively important as being the centres of vision, but the medulla oblongata is usually very large. In many sharks it forms the largest part of the brain (Gegenbauer). The spinal lobes of the electric fishes are differentiations of this portion of the encephalon.

In the *Amphibia* the hemispheres are larger, and are divided into two parts (see Fig. 17, B). In the *Urodela* (siren, proteus, triton, newt) the mesencephalon remains small, and consists of one lobe, but in the *Anura* (frogs, toads, etc), there is an advance in this part, it being divided into two. In reptiles there is still an advance in the size of the thalamencephalon and mesencephalon, and the prosencephalon is so large as to pass backwards and overlap the thalamencephalon. The cerebellum (metencephalon) is still small, especially so in *Ophidii* (serpents) and *Sauri* (lizards), but in the *Chelonii* (tortoises, etc.) and in *Crocodilini* (crocodiles,

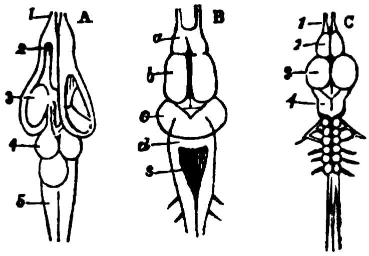

FIG. 17.—Typical forms of brains of lower vertebrates. A, Brain of tortoise (*Testudo*). 1, olfactory; 2, cerebral lobes: 3, corpora striata; 4, optic lobes; 5, medulla. Part of the surface of the cerebral lobes has been removed to show the cavities in the interior, termed "the ventricles." Immediately behind 4, the optic lobes, is the imperfectly-developed cerebellum. B, Brain of common frog (*Rana*). *a*, olfactory; *b*, cerebral lobes covering corpora striata; *c*, corpora quadrigemina, or optic lobes; *d*, cerebellum (rudimentary); *s*, back of medulla, showing fossa. C, Brain of gurnard (*Trigla*). 1, olfactory; 2, cerebral lobes; 3, optic lobes; 4, cerebellum.

alligators) it is larger. In the crocodile there is a transverse grooving of the cerebellum, giving rise to foliation or laminar division, which is carried much farther in birds and mammals, indicating a greater power of coördination or regulation of movement.

In birds (Fig. 18) the vesicles of the mid-brain are partially hidden by development of the cerebral hemispheres. These are connected by a fine anterior commissure, and they contain a large amount of ganglionic matter bulging into the primitive cavity or ventricles, which are of very small size. The middle portion of the cerebellum shows a distinctly laminated structure and a differentiation into white and gray matter. But there is no pons Varolii, nor corpus callosum, nor fornix, nor hippocampus. In the floor of the lateral ventricles may be seen a ganglionic mass corresponding to corpus striatum and optic thalamus. The optic lobes are relatively large and show considerable differentiation of structure.

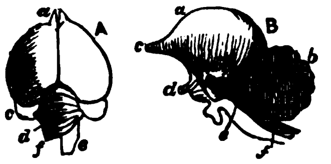

FIG. 18.—Typical brain of bird. A, view from above; B, lateral view of a bisected brain. A.—*a*, olfactory; *b*, cerebral lobes; *c*, optic or bigeminal lobes; *d*, cerebellum; *e*, medulla oblongata; and *f*, spinal cord. B.—*a*, cerebrum; *b*, cerebellum; *c*, olfactory; *d*, optic nerves; *e*, medulla; *f*, spinal cord.

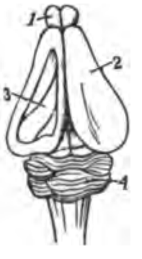

FIG. 19.

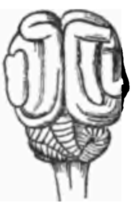

FIG. 20.

FIG. 19.—Rabbit's brain. 1, olfactory; 2, surface of cerebral hemisphere; 3, lateral ventricle, on the floor of which is seen the corpus striatum; 4, cerebellum.

FIG. 20.—Cat's brain, showing convoluted surface. Contrast the form of the cerebellum in the cat and the rabbit. In the cat the central lobe is small, whilst the lateral lobes are largely developed.

Mammals, even the lower orders, not only show a general enlargement of the cerebral hemispheres, but we find a commissure, the corpus callosum, uniting them. This commissure is of small size, and is confined to the forepart of the hemispheres in *Monotremata* (*Ornithorhynchus*, *Echidna*) and *Marsupialia* (kangaroos, etc.), and in some of the *Edentata* (ant-eaters, sloths, etc.), but it gradually extends farther and farther back as we ascend to the higher orders. The chief changes thus occur in the prosencephalon. In the lower orders of mammals the hemispheres are comparatively small and simple, and do not present any division into convolutions, and very little distinction even of lobes. The cerebral hemispheres gradually grow backwards, covering mid-brain, cerebellum, and medulla oblongata, as we find in the higher *Primates* (monkeys, apes, and man). There is also a general enlargement of the brain and of the cranial cavity. The development of a posterior lobe only takes place in the higher orders, and in these also the enlargement of the frontal lobes brings the front of the cerebrum more and more over the nasal cavities, causing a development of forehead. This also explains how the olfactory bulbs in more highly-formed brains are thrown below the frontal part of the hemispheres, instead of originating at their anterior borders. But the internal arrangements of the brain also become more complicated. The fornix, already described, establishes, by its longitudinal commissural fibres, a connection between the anterior and posterior lobes of the cerebrum. In the *Monotremata* and *Marsupialia* the mid-brain retains a bifid form, constituting the optic lobes, or corpora bigemina, but in all higher animals each is divided into two by a transverse groove, forming the corpora quadrigemina, of which the anterior pair is the largest. As we ascend also, we find the surface of the brain becoming more and more convoluted (see Figs. 19 and 20). This is the general fact; but whilst the convolutions are most numerous and deepest in the highest orders there is no regular gradation, as in each group there are very great variations in the degree of convolution (Allen Thomson). Thus in the *Monotremata* the *Echidna* has a more convoluted cerebrum than the *Ornithorhynchus*, whilst in the *Primates* the brains of the marmosets show a comparatively smooth non-convoluted surface, in striking contrast to the rich convolutions seen on the brains of the higher monkeys and of the apes. It is important to note that the cerebellum also becomes more and more complicated as we ascend from the lower to the higher groups. At first merely a lamina or band, as seen in fishes and amphibia, it is a centrally differentiated body in crocodiles. In birds there is an indication of a division into three portions, a central and two lateral, whilst the central is by far the larger, the two lateral being feebly developed. In *Monotremata* the central portion is larger than the lateral, but, whilst it is larger in *Marsupialia*, *Edentata*, and *Cheiroptera* (bats, etc.), it is clear that the lateral portions are increasing in size so as to make the disproportion less. But in *Carnivora* (felines, hyæna, otter, bear, etc.) and in *Ungulata* (sheep, ox, camel, rhinoceros, horse) the lateral lobes, or hemispheres, of the cerebellum develop to a much greater size; and in most of the *Primates* they are much larger than the median portion, which is now called the worm or "vermiform process." As regards the development of the spinal cord continuous with the medulla oblongata, it need only be said that it does not show any marked peculiarities of structure in different animals. The gray matter from which nerve-fibres originate and in which they end is found in the centre of the cord, and it is most abundant in the regions associated with the development of limbs. The white matter is external, and, in the cords of the higher animals, can be differentiated by fissures into columns, the special functions of which will be hereafter considered. The size of the cord is influenced by the masses of nerves given off from it, so that it attains its greatest thickness and development in the four higher divisions of the vertebrates possessing limbs. Thus, too, are formed cervical, dorsal, and lumbar enlargements, contrasting with the more uniform and ribbon-like form of the cord in fishes, although even in these there are special enlargements corresponding to the points of exit of important spinal nerves.

Size and weight of brain.

Size and Weight of Brain.—The gradual increase in the size of the brain, as compared with that of the body, which is observed as we rise in the animal scale, has some intimate proportional relation to a corresponding increase of the nervous and mental endowments. Information as to the size of the brain may be obtained by direct measurement of dimensions and weight; but as this is often difficult recourse may be had to the measurement of the capacity of the cranium, which contains, however, not only the brain but its accessories, such as membranes and bloodvessels. Details will be found in vol. i. p. 772. After considering the measurements of several thousand skulls made by different observers, the late Dr. Allen Thomson arrived at the conclusion that the cranial capacity is on the whole greater among the highly-civilized than among the savage races, and that there is even a very manifest difference to be found between persons of higher mental cultivation and acknowledged ability and those of the uneducated class and of inferior intellectual powers; and he states further that the amount of this difference may be from 5 to 7½ per cent. in persons of the same race, and about double that range in those of different races. Thus, the average adult brain of men in Britain being taken at 3 ℔, or, more precisely, at 49½ oz. avoir. (women, about 44 to 44½ oz.), at an average specific gravity of 1040, would give a bulk of 82.5 cubic inches of brain-substance; 10 per cent. being deducted for loss by membranes, fluid, etc., the cranial capacity will be about 90 cubic inches. Conversely, the weight of the brain may be calculated from the known cranial capacity. If, therefore, the brain of the uneducated class falls 2.5 oz. below the average, whilst that of the more cultivated persons rises to the same amount above it, or to 52½ oz., we may regard these brain-sizes as corresponding with brain-bulks and cranial capacities of 78 and 87 cubic inches, and of 88 and 97 cubic inches respectively. The average brain-weight of an Australian aboriginal man is about 42 oz., corresponding to a brain-bulk of about 70 cubic inches, and a cranial capacity of about 78 cubic inches. There are, however, great variations in all races. Thus the brain of Cuvier, the great naturalist, weighed 65 oz. avoir., corresponding to a brain-bulk of 108 cubic inches and a cranial capacity of 118 cubic inches; whilst, on the other hand, in Europeans the brain-weight has fallen as low as 32 oz., or a brain-bulk of 58 cubic inches and a cranial capacity of 63 cubic inches. The brains of the anthropoid apes—gorilla, chimpanzee, and orang—are all inferior to man in their dimensions. In the gorilla the brain does not attain more than a third of the weight of the average human brain, and in the chimpanzee and orang it does not reach a fourth, so that the ratio of brain-weight to body-weight in these animals may be as 1 to 100, whilst in man it ranges from 1 to 40 to 1 to 50. It is remarkable that in general among the largest animals of any group the brain does not reach a size proportionate to the greater magnitude of the other organs or of the whole body, so that in the smaller members of the same order a considerably greater proportional size of the brain is observed. Thus in the small marmosets the proportion of the brain-weight to the body-weight may be 1 to 20, or more than double the proportion in man. Similar facts are brought out in comparing the brains of cetaceans, pachyderms, dogs, etc., as shown in the table on page 39. Although the proportion of brain-weight to body-weight in a male child at birth is 1 to 10, yet so rapidly does the brain continue to grow during the early period of childhood that by the age of three years it has attained more than three-fourths of its full size, by the age of seven years it has reached the proportion of nine-tenths, and after this, only by slow and small gradations, it attains the full size between the ages of twenty and twenty-five years.[1] See PHRENOLOGY.

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[1] Many of the facts of this paragraph as to size and weight of brain are derived from an unpublished lecture by the late Dr. Allen Thomson.

Table of comparative sizes of Brain and Body.

Examples.	Brain-weight in oz. avoir.	Internal cranial bulk in cub. in.	Whole weight of the body in lb.	Proportion of brain to body-weight.
Average European man	48 (3 lb.)	85 to 88	140	1 to 46
Child at birth	12	22	7½	1 to 10
Chimpanzee	10	19	50	1 to 80
Marmoset	⅓	½	6 oz.	1 to 18
Middle-sized dog	3½	6	36	1 to 164
Small dog	2½	4½	7	1 to 45
Elephant	144 (9 lb).	300	6,720 (3 tons)	1 to 747
Pig	6	11	94	1 to 250
Whale[1]	96 (6 lb.)	650	134,400 (60 tons)	1 to 22,400
Porpoise	16	30	60	1 to 60

From this survey of the comparative development of the brain the following general conclusions can be drawn.

Comparative development of brain.

1. The first and essential portion of the cerebro-spinal axis is the portion forming the spinal cord and medulla oblongata, inasmuch as it is found throughout the whole range of vertebrate existence, and is connected with the reflex or automatic movements on which locomotion, respiration, and the circulation more or less depend, and with the simple sense of contact, or touch, or pressure. This portion is necessary to mere existence.

2. When higher senses are added, such as those of taste, smell, hearing, vision, portions of the anterior part of the cerebro-spinal axis are differentiated so as to form centres. The earliest and most important of these senses (next to touch) is vision, hence the high degree of development of the optic lobes even in the lowest forms; to these are added the optic thalami, which may be regarded as the centres of tactile sensations involving appreciation of differences of touch as to softness, smoothness, hardness, etc., requiring in the periphery special terminal organs. Special centres for hearing, taste, and smell are not differentiated. It is remarkable that the organs relating to the sense of smell are most anterior and most closely related with the prosencephalon, indicating, apparently, that this sense is one of the earliest in appearance, and probably, along with vision and touch, one of the most necessary to existence. It is equally striking that the origin of the auditory nerves should be placed so far back as in the medulla oblongata and cerebellum, indicating the primitive nature of simple auditory impressions and their relation to coördination of movement. The sense of taste originates in nerves springing from the medulla, and in close connection with those regulating the movements of the tongue and swallowing.

3. When sensations of a simple character are elaborated into ideas and give rise to the physical changes in some way correlated to mental states, involving memory, emotions, volitions, and intellectual acts, a part of the cerebro-spinal axis is differentiated for these functions in proportion to the extent to which such mental phenomena are manifested by the animal. Judging from the facts obtained by comparing animal intelligences, so far as they can be appreciated by us, we have the right to infer that in proportion to the degree of development in size and complexity of structure so is the mental condition of the animal. Taking it broadly, there can be no question that the intelligence of a bird is higher than that of a reptile, amphibian, or fish, and that the intelligence of the higher mammals, such as one of the *Primates*, is superior to that of the lower, as one of the *Insectivora* (hedgehog), or of the *Marsupialia* (kangaroo), and along with the higher intelligence is the more complex brain. There are qualifications to this statement to be afterwards alluded to, but they arise from deficient knowledge and do not vitiate the main conclusion. In proportion, therefore, to the degree of development of the prosencephalon do we find the intelligence of the animal, and we may regard this portion as superadded to the cerebro-spinal axis as the organic mechanism for such mental operations.

4. There is also a correspondence between the degree of development of the cerebellum and the faculty of coördination of movement. Movements of the members of the body may be of a very simple character, or they may be very complex. They may be due to the action only of flexor and extensor muscles, causing the limb to move almost in the same plane, or they may be associated with the action of adductor and abductor muscles, by which there may be many kinds of circular or rotatory movements. There is a great difference between the movements of a fish's fin, of a bird's wing, of a horse's fore-leg, and of the arm of a monkey or a man. In the first three they are almost to-and-fro movements, unlike the delicate movements of flexion, extension, pronation, supination, and prehension seen in the latter. Delicacy of movement of the anterior limb reaches its highest condition in man. It may be put generally that simplicity of movement is associated with an imperfectly developed cerebellum, whilst in animals having the power of complicated movements, involving especially the knowledge of how the limbs are acting at any moment, and of adjustment of movement in special circumstances, the cerebellum is highly developed. From this point of view, the degree of development of the cerebellum is as characteristic of man as the degree of development of the cerebrum. That this is no accidental correspondence will be shown in treating of the functions of the cerebellum.

Having reviewed the physiological anatomy of the cerebro-spinal system, an account will now be given of the more special physiology of the centres composing it,—namely, spinal cord, medulla oblongata, pons Varolii, basal ganglia (including corpora striata, optic thalami, and corpora quadrigemina), cerebellum, and hemispheres of the cerebrum.

Spinal cord.

Spinal Cord.—The spinal cord is described at vol. i. p. 760 *sq.*, but it is necessary here to allude to a few points of physiological importance. The cord consists externally of white and internally of gray matter. The white matter, composed of nerve-fibres, forms a series of strands or columns in each half of the cord. The gray matter in the central part of the cord is arranged in two crescentic masses, and shows under the microscope numerous multipolar cells connected with nerve-fibres and imbedded in neuroglia, or the special connective tissue of the nerve-centres. The neuroglia is composed of a kind of semi-fluid matrix, fibrils, and peculiar cells having numerous branches called "Deiter's cells." (See Fig. 21.) These nerve-cells are arranged in definite groups and occupy the same relative position in successive sections, forming the ganglionic or vesicular columns of the gray matter, as follows: (1) Cells found along the whole of the anterior part of the anterior cornua, many of the processes of the nerve-cells being continuous with the nerve-fibres of the anterior root of the spinal nerves. This column of nerve-cells has been called the "motor ganglionic column," or the "vesicular column of the anterior cornua." (2) A group or column of nerve-cells at the inner or mesial angle of the base of the posterior cornu, in the middle region of the cord from the third lumbar to the seventh cervical nerve. This is termed the "posterior vesicular column," or "Clarke's column," after the late Mr. Lockhart Clarke, who did much to unravel the intricate anatomy of the nerve-centres. The nerve-cell processes are continuous chiefly with nerve-fibres coming from the lateral column. This vesicular column is best developed where the column of the anterior cornu is least so. (3) The third column of nerve-cells is in the outermost portion of the gray matter, midway between the anterior and posterior cornua. Development has shown that at an early period the anterior horns are distinctly differentiated from the posterior, and that the gray matter between them is the last to be formed. The nuclei in the latter may be regarded, therefore, as accessory nuclei. It has also been observed by Flechsig and others that the white substance of the cord also makes its appearance first in the neighborhood of the anterior and posterior roots. The cord at a very early period consists almost entirely of gray mat-

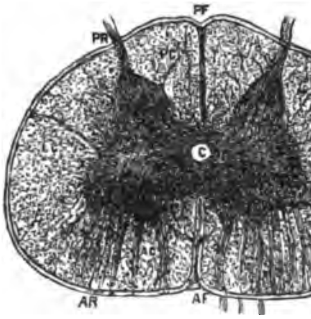

FIG. 21.—Transverse section through spinal cord. *AF*, antero-median, and *PF*, postero-median fissures; *PC*, posterior, *LC*, lateral, and *AC*, anterior columns; *AR*, anterior, and *PR*, posterior nerve-roots; *C*, central canal or cord, with its columnar epithelial lining. The crescentic arrangement of the gray matter is shown by the darker-shaded portion.

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[1] The large cranial bulk in this instance is connected with the enormous size of the roots of the cranial nerves.

ter, and the columns are superadded in the anterior first, the posterior last. The posterior can also be traced to the cortex of the cerebellum (Flechsig).

The anterior and posterior roots of the spinal nerves are attached along the sides of the cord, opposite to the corresponding cornua of gray matter. Some of the fibres of the anterior roots end in nerve-cells in the anterior cornu. Others pass through the gray matter and cross to the other side of the cord through the anterior commissure, a layer of white matter at the bottom of the anterior median fissure. A third set passes to the anterior part of the lateral column and to the posterior cornu. The course of these fibres is shown in Fig. 22. A portion of the fibres of the posterior roots ends in the gray matter on the same side, but many cross to the gray matter on the opposite side. There is thus a decussation of fibres connected with both the anterior and the posterior roots. The arrangement of the white or fibrous columns of the cord is seen in the table under medulla oblongata below.

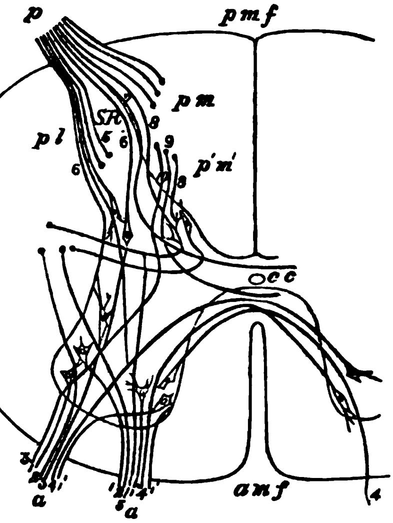

FIG. 22.—Diagram to illustrate the course taken by the fibres of the nerve-roots on entering the spinal cord (Schäfer: Quain's *Anatomy*). *a*, *a*, two funiculi of anterior root of a nerve; 1. 1, some of their fibres passing into lateral cells of anterior cornu; 1′, 1′, others passing into mesial cells of same cornu; 2, 2, fibres passing to lateral column of same side without joining nerve-cells; 3, 3, fibres passing towards posterior cornu: 4, 4, fibres passing across anterior commissure, to enter nerve-cells in anterior cornu of other side; *p*, funiculus of posterior root; *pl*, fibres of its external or lateral division coming through and around gelatinous substance of Rolando; some of these (5) are represented as becoming longitudinal in the latter, others (6, 6) as passing towards anterior cornu, either directly or after joining cells in posterior cornu, and others (7) as curving inwards towards gray commissure; *pm*, fibres of mesial or inner division, entering into posterior column and then becoming longitudinal; *p′m′*, fibres from a posterior root which had joined the cord lower down and entered posterior column, now passing into the gray matter at root of posterior cornu. Of these, 8 is represented as entering Clarke's column, 9 as curving round this and coursing to anterior commissure, and 10 as passing towards anterior cornu.—the axis-cylinder processes of the cells of Clarke's column are shown arching round and taking the direction of the lateral column; *amf*, anterior median fissure; *pmf*, posterior median fissure; *cc*, central canal; *SR*, substantia gelatinosa of Rolando.

The spinal cord acts (1) as a transmitter of motor and sensory—or centrifugal and centripetal—impressions between the encephalon and the periphery, and (2) as a reflex centre.

Motor and sensory impressions.

1. *Transmission of Motor and Sensory Impressions.*—Each spinal nerve, as already mentioned, is connected with the spinal cord by two roots, an anterior and a posterior. Section of a number of anterior roots causes paralysis of motion of muscles on the same side of the body, whilst irritation of the distal or peripheral end of the divided roots causes twitchings or tetanus of the muscles. Neither section nor irritation has any effect on sensation. Hence the anterior roots contain motor fibres, carrying impressions from the cord outwards. Again, section of a number of posterior roots is followed by loss of sensation of a part of the body on the same side, and, if the proximal ends of the divided roots—those next the cord—be irritated, painful sensations are excited. The posterior roots, therefore, contain sensory fibres, carrying impressions into the cord from the periphery. As we have seen, these roots are connected with the gray and white matter of the cord, and it is practically impossible to trace all their ramifications. Recourse must therefore be had to the evidence supplied by experiment (cutting, or by the Wallerian method, p. 30) and by pathological observation. In tracing the path of fibres, what may be called the "developmental method" has been pursued. It has been shown by Flechsig that, "if the development of the cord be carefully observed, the medullary substance of the nerve-fibres is formed later along certain tracts of the white columns than in the rest of the white matter, so that in transverse sections of the cord these tracts are easily distinguishable by their more transparent gray appearance" (Quain, vol. ii. p. 277). If the anterior columns be cut by an incision extending into the gray matter, leaving the posterior columns intact, voluntary movements disappear in the parts below the section. Again, section of the posterior columns and gray matter, leaving the anterior uninjured, enfeebles but does not destroy the power of voluntary movement below the section. Finally, section of an antero-lateral column on one side paralyzes voluntary motion on the same side. From these facts it is inferred (*a*) that the motor tracts passing from the brain to the periphery are in the antero-lateral columns, and (*b*) that the fibres forming these tracts are chiefly distributed to the same side of the body. These inferences are supported by pathological observation. In diseases where the anterior horns of gray matter are affected paralysis ensues, with complete flaccidity of the limbs; and if, from hæmorrhage, softening, or the pressure of tumors, the anterior portion of the cord be irritated there are spasmodic twitchings of muscles. Complete transverse section of the posterior columns does not abolish sensibility in the parts below; but there is a loss of the power of making coördinated movements. Section of the posterior columns and of the antero-lateral columns, leaving only the gray matter in the centre of the cord intact, does not abolish sensibility. Again, section of the antero-lateral columns and of the whole of the gray matter, leaving only the posterior columns uninjured, is followed by complete loss of sensibility in the parts beneath. The inference therefore is that sensory impressions pass through the gray matter. As already seen, many of the sensory fibres connected with the posterior roots decussate in the gray matter. This explains some of the results obtained by Brown-Séquard, that hemisection of the cord, involving the gray matter, enfeebled sensibility *on the opposite side* more and more as the section cut deeply into the gray matter; that a vertical section in the bottom of the posterior median fissure caused loss of sensibility on both sides; and that a lateral section, whilst it caused loss of sensibility (anæsthesia) on the opposite side, was followed by increase of sensibility (hyperæsthesia) on the same side,—a curious fact, explained by Brown-Séquard as being due to irritation caused by paralysis of the vessels of the cord on the side of the section. It would appear also that tactile impressions travel, for a certain distance at all events, in the posterior columns. This has been inferred chiefly from the fact that in certain cases of paralysis involving the posterior columns, where the sensation of touch was absent, the patient could still feel a painful sensation, as when a needle was thrust into the skin; whilst in other cases, in which these columns were not affected, the converse held good. In the disease known as locomotor ataxia (see ATAXY and PATHOLOGY, vol. xviii. p. 401) the patient first passes through a period in which there are disorders of general sensibility, especially lancinating pains in the limbs and back. By and by there is unsteadiness of gait when the eyes are closed or in the dark, and to a large extent the patient loses the power of coördinating movement. Especially he is unable to judge of the position of the limbs without seeing them; in other words, the so-called muscular sense is enfeebled. At last there is a stage before death in which there is almost complete paralysis. A study of this disease has thrown much light on the physiology of the cord. It is known to be caused by a slow disorganization or sclerosis of the posterior root-zones, the posterior columns,—slowly passing on to affect the columns of Goll, the lateral columns, and the anterior gray horns, and ultimately involving the cord. The disordered sensations at an early stage, the staggering gait at a later, show that the posterior part of the cord has to do with the transmission of sensory impressions. The man staggers, not because he is paralyzed as regards the power of movement, but because, in consequence of the sensory tracts being involved, he does not receive those peripheral impressions which excite or indirectly regulate all well-ordered movements of locomotion.

Spinal cord a reflex centre.

2. *As a Reflex Centre.*—The gray matter of the lower cervical, dorsal, and lumbar regions of the cord may be regarded as composed of reflex centres associated with the general movements of the body, whilst in the upper cervical region there

are more differentiated centres corresponding to special actions. The initial excitation may commence in any sensory nerve; the effect passes to the cord, and sets up changes in the nerve-cells of the gray matter, involving time, and resulting in the transmission outwards along motor fibres of impulses which excite particular groups of muscles. There is an exact coördination, with a given strength of stimulus, between certain areas of skin and certain groups of muscles, and thus movements may be so purpose-like as to simulate those of a conscious or voluntary character. Thus irritation near the anus of a decapitated frog will invariably cause movements of the limb towards the irritated point. The activity of reflex centres may be inhibited, as already shown, by higher centres, or possibly by certain kinds of sensory impressions reaching them directly from the periphery. Hence removal of these higher centres is followed by apparently increased reflex excitability. Strychnia and the alkaloids of opium increase it, whilst aconite, hydrocyanic acid, ether, chloral, and chloroform have an opposite effect. In certain pathological conditions also, as in tetanus or in some slow progressive diseases of the cord, reflex excitability may be much increased. In tetanus the slightest touch, a movement of the bedclothes, the closing of a door, the vibration caused by a footstep, may throw the patient into severe and prolonged convulsions. The earlier-formed ganglionic cells are those specially concerned in reflex acts.

Special reflex centres.

Special reflex centres have been clearly made out in the cord. (1) A *cilio-spinal* centre, between the sixth cervical and third dorsal nerves, associated with the movements of the iris. The fibres controlling the radiating fibres of the iris, and found in the sympathetic, originate here (see EYE). Hence irritation of this region causes dilatation of the pupil, an effect not produced if the sympathetic fibres have been divided. (2) *Accelerating* centres, supplying fibres to the sympathetic which ultimately reach the heart, and irritation of these centres quickens the movements of that organ. (3) *Respiratory* centres. The movements of respiration, of a reflex character, involve the action of many thoracic and abdominal muscles. Section of the cord above the eighth dorsal paralyzes the abdominal muscles; above the first dorsal, the intercostals; above the fifth cervical, the serratus magnus and the pectorals; and above the fourth cervical, by paralyzing the phrenics, it arrests the action of the diaphragm. (4) *Genito-spinal* centre. This is in the lumbar region. Irritation causes erection, etc.; destruction or disease is followed by loss of virile power. (5) *Ano-spinal* and *vesiculo-spinal* centres. These, connected with the movements of the sphincter ani and of the bladder, exist in the lower portion of the dorsal and upper portion of the lumbar regions. Disease or injury involving these centres causes involuntary evacuation of the bowel and complete paralysis of the bladder, with non-retention of urine. The bladder may be full whilst the urine constantly escapes in small quantity.

Cord as trophic centre.

3. *As a Trophic Centre.*—The ganglion-cells in the anterior cornua undoubtedly have a trophic or nutritive influence upon muscles. This has been determined chiefly on pathological evidence. If these cells undergo atrophy or degenerative changes, the muscles, even though they may be kept periodically in a state of activity by galvanism, become soft and fatty changes take place. There is thus a correlation between the nutritive condition of muscle and nerve-centre, and influences affecting the one affect the other also.

It has been supposed that the cells in Clark's vesicular column may form the centres in visceral innervation. They are bipolar, like those in the sympathetic, and not multipolar as in the rest of the cord, and the columns are absent in the lumbar and cervical enlargements. The cells are found where nerves come off that influence the viscera, and similar cells are found at the roots of the vagus in the medulla,—a nerve also much concerned in the innervation of viscera.

Inhibition of reflex actions.

Inhibition of Reflex Actions.—The reflex actions of the spinal cord may be *inhibited* or restrained to a greater or less extent by the action of centres in the encephalon, so that pure reflex actions only occur after removal of the cerebrum, or during profound sleep, when the cerebrum is inactive. Thus a strong effort of the will may restrain from scratching an irritated part of the skin, whilst the same amount of irritation would certainly cause reflex movements if the will were in abeyance. Such power of voluntary control, however, is limited with respect to most reflex actions, whilst some reflex acts cannot be so influenced. Any movements that may be originated by the will may be inhibited or restrained to a certain extent when the movement is of a reflex character; but, if the movement be invariably involuntary, it can never be inhibited. Thus the ejaculation of semen cannot be voluntarily induced, whilst the reflex act once provoked cannot be arrested (Hermann). That these inhibitions of reflex actions of the cord depend on mechanisms in the brain is proved by the fact that the removal of the brain is followed by an increase in the reflex excitability of the cord, and that even section of the cord permits of increased reflex excitability below the plane of section (Setschenoff). Further, after section of the spinal cord in the cervical region, irritation of the lower end arrests reflex movements dependent on reflex centres in the lower cervical, dorsal, and lumbar regions (M'Kendrick).

Medulla oblongata.

Medulla Oblongata.—This is the prolongation into the cranium of the spinal cord so as to unite it with the brain. Strictly speaking, the medulla spinalis and the medulla oblongata form one organ. The columns of white matter of the cord undergo changes in form, structure, and relative position when they pass into the medulla (see vol. i. p. 763). Without again detailing the minute anatomy, it is necessary to show, as in the following table, the connections of the cord and of the medulla with the rest of the brain.

Columns of the Spinal Cord.	Divided into	Continued in Medulla Oblongata as	Pass on to
Antero-lateral column. A.—Pyramidal tract.	*a.* Lateral, or crossed, fibres from the posterior part of the lateral column as low as the third or fourth sacral nerves.	Decussate in anterior pyramids.	Cerebrum.
	b. Anterior, or uncrossed, fibres from the dorsal region of the cord-columns of Türck, or columns of Lockhart Clarke.	Pass under pyramid on same side, and form longitudinal fibres of the reticularis alba in dorsal part of mesial area. 1. Posterior longitudinal bundle in pons. 2. Tract of the fillet.	Cerebrum. Corpora quadrigemina.
B.—Cerebellar tract.	*c.* Cerebellar tract, between lateral pyramidal tract and the outer surface of the cord as low as the second or third lumbar.	Restiform body.	Cerebellum.
All the antero-lateral columns except A and B.	*d.* Principal tract of anterior column, that is, the antero-lateral column less the fibres in *b.* Not continued up—probably commissural from one side of cord to the other.	....	......
	e. From anterior column.	Pass below olivary body to form part of restiform body. Sometimes called the "band of Solly"—not always present.	Cerebellum.
Posterior column.	*a.* Posterior white column, or Goll's tract, from middle of dorsal region.	....	......
	b. Posterior lateral column, between posterior median column and postero-lateral groove.	Posterior median column, becoming the funiculus gracilis, which, with the expansion called the clava, becomes the posterior pyramids.	Cerebrum.
	c. Funiculus of Rolando, between the posterior lateral column *b* and postero-lateral groove higher up.	Funiculus cuneatus, forming, with cerebellar tract from antero-lateral column, the restiform body.	Cerebellum.

It is important to note the fact that each column of the cord, through the medulla, is thus connected both with the cerebrum and with the cerebellum. Development has shown that the fibres of the bundles which are first formed develop a medullary sheath at a time when the fibres of the later-formed bundles are non-medullated. "When the cord of a human embryo is examined at the end of the fifth month it will be found that the pyramidal fibres of the lateral columns, the fibres of the columns of Türck, and of the columns of Goll are non-medullated; while the fibres of the anterior and posterior root-zones and the cerebellar fibres of the lateral columns are medullated" (Ross). It would appear, therefore, that the latter are the more primitive structures, and that the former are superadded in the cords of the higher animals. The gray matter of the medulla is broken up by changes in the distribution of the white matter in nuclei or masses of nerve-cells, instead of having the crescentic form seen in the spinal cord. These nuclei are connected with the roots of important cranial nerves, and may be regarded as corresponding with the anterior horns of gray matter, with the posterior horns, and with the gray matter between these.

The following nuclei can be found: (1) the *hypoglossal* nucleus, for the hypoglossal nerve, the motor nerve of the tongue; (2) a *common* nucleus, for a portion of the spinal accessory, vagus, and glosso-pharyngeal nerves; (3) the *principal* or *lower auditory* nucleus, for the auditory nerve; (4) nuclei for the *sixth* or *abducent* nerve, supplying the external rectus muscle of the eye; (5) nucleus for the *fourth* nerve, supplying the superior oblique muscle of the eye; (6) the *facial* nerve, the motor nerve of the face; (7) the *corpus dentatum of the olivary body*, not directly connected with the roots of nerves, but containing nerve-cells. Some fibres, both of the sensory and motor roots of the *fifth* nerve, originate also as far back as the medulla. The third, fourth, sixth, and hypoglossal nerves belong to the system of anterior motor nerves, related to the anterior cornua, whilst the spinal accessory, vagus, glosso-pharyngeal, and fifth belong to the "mixed lateral system,"—that is, they are related to the posterior cornua and intermediate gray matter.

Like the spinal cord, the medulla may be regarded as containing tracts for sensory and motor transmission, and as constituting a series of reflex centres for special movements.

Motor and sensory transmission of medulla.

1. *As a Conductor of Motor and Sensory Impressions.*—Inasmuch, also, as such movements as those of the circulation, respiration, and vaso-motor action are necessary to life, destruction of the medulla causes almost instant death. Motor fibres coming from the brain above decussate in the anterior pyramids and then run down the lateral columns of the cord, issuing to the muscles by the anterior roots of the spinal nerves. Hence, whilst section of an antero-lateral column of the cord will cause paralysis of motion on the same side, section of an anterior pyramid above the decussation causes paralysis of motion on the *opposite* side. But fibres carrying sensory impressions also decussate in the gray matter at the bottom of the posterior median fissure of the cord. It follows, therefore, that disease, such as rupture of a vessel causing a clot in the brain, say in the left corpus striatum and left optic thalamus, causes paralysis both of motion and of sensation on the opposite side,—that is, in the case supposed, there would be right hemiplegia. The path of sensory impressions is probably in the gray matter, but the precise course of sensory fibres has not been traced.

Medulla as reflex centre.

2. *As a Reflex Centre.*—Numerous special centres have been referred to the medulla oblongata.

(1) *Respiratory* centres, two in number, expiratory and inspiratory, connected with the roots of the pneumogastric nerves. Destruction at once causes cessation of respiratory movements. (2) *Vaso-motor* centre, regulating the calibre of the smaller blood-vessels throughout the body (see p. 84). (3) *Cardiac* centres, probably two in number—one accelerating, associated with the sympathetic; the other inhibitory, connected with the pneumogastric (see p. 84). (4) Centres for *deglutition*, associated with the sensory and motor nerves involved in this process (see NUTRITION, vol. xvii. p. 689). (5) Centre for *voice*, regulating to some extent, through the sterno-cleido-mastoid muscle, the emission of air through the glottis in expiration and phonation. (6) Centre influencing *glycogenesis*, probably by the action of the vaso-motor centre on the bloodvessels of the liver (see NUTRITION, vol. xvii. p. 701). (7) Centre directly influencing *salivary secretion*, from which originate those fibres of the facial, forming the chorda tympani and lesser superficial petrosal, distributed to the salivary glands (see NUTRITION, vol. xvii. p. 691). (8) Centre for the *motor fibres supplying the face and muscles of mastication*. These exist in the facial for the muscles of the face and in the motor portion of the fifth for the muscles of mastication. Further, the medulla receives nervous influences from the higher centres, by which all the centres above enumerated may be more or less influenced.

Pons Varolii.

Pons Varolii.—The pons Varolii is above and in front of the medulla oblongata, and between the hemispheres of the cerebellum. It consists of fibres passing in two directions, viz., longitudinally, connecting the brain above with the medulla and cord below; and transversely, connecting the lateral hemispheres of the cerebellum, thus forming the middle peduncles of that organ. Its general position and appearance are seen in Fig. 23. Mixed up with these fibres are various nuclei of gray matter connected with the roots of cranial nerves. The most important of these nuclei are—(1) the nucleus of the facial nerve; (2) the motor nucleus of the fifth nerve; (3) the upper sensory nucleus of the fifth nerve; (4) the inner or chief nucleus of the auditory nerve; (5) the outer or superior nucleus of the auditory nerve; (6) the accessory nucleus of the auditory nerve; (7) the nucleus of the sixth nerve. It will be observed that several of these nerves are also connected with nuclei in the medulla oblongata. Like the cord and medulla, the pons is to be regarded as a conductor of impressions and probably also as a reflex centre. Motor transmission occurs chiefly in the anterior part. As the fibres of the facial nerve decussate in the pons, and then carry influences outwards, unilateral injury or disease of the pons may cause paralysis of the face on the same side as the disease, and paralysis of the limbs on the opposite side if the disease has affected the facial *before* its decussation in the pons. Usually in cases of paralysis of one side (hemiplegia) from a clot or disorganization in one corpus striatum the paralysis of the face is on the same side as that of the limbs. In diseases of the pons loss of sensibility is a much more rare result than loss of motion, and is always on the opposite side. According to Brown-Séquard, tactile, thermal, and painful impressions pass through the central part of the pons. The numerous centres in the pons are associated in complex reflex movements. Nothnagel has described it as a convulsive centre, because irritation caused severe cramps, but this was no doubt due to irritation of the motor strands passing through it.

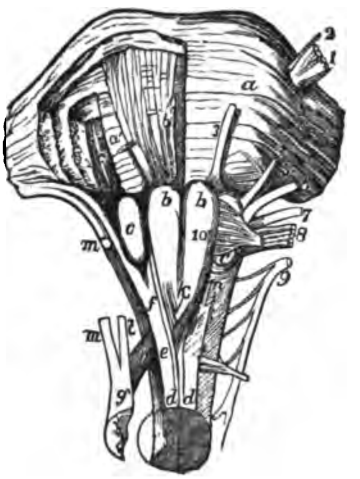

FIG. 23.—Section of medulla oblongata and pons to show the course of fibres. *a*, superficial, and *a′*, deep transverse fibres of pons; *b*, *b*, anterior pyramids ascending at *b′* through pons; *c*, *c*, olivary bodies; *c′*, olivary fasciculus in pons; *d*, *d*, anterior columns of cord; *e*, inner part of right column joining anterior pyramid; *f*, outer part going to olivary fasciculus; *g*, lateral column of cord; *h*, the part which decussates at *k*, the decussation of the pyramids; *l*, the part which joins the restiform body; *m*, that which forms the fasciculus teres; *n*, arciform fibres. 1 and 2, sensory and motor roots of the fifth nerve; 3, sixth nerve; 4, portio dura; 5, portio intermedia; 6, portio mollis of the seventh nerve; 7, glosso-pharyngeal; 8, pneumogastric; 9, spinal accessory; 10, hypoglossal nerve.

Cerebral peduncles.

Cerebral Peduncles.—These contain both sensory and motor fibres, and they establish a connection between the cerebellum and the cerebrum, and also between the ganglia at the base,—corpora striata, optic thalami, and corpora quadrigemina on the one hand, and the pons and medulla on the other. Little is known of their functions except that they are conductors. Destruction of one peduncle causes the animal to move to the side opposite the lesion, describing a circle somewhat in the manner of a horse in a circus. Irritation may cause pain or movements of various groups of muscles.

Basal ganglia.

Basal Ganglia.—As already shown in tracing the development of the cerebro-spinal system, the brain consists of a series of ganglia, in pairs, more or less overlapped by the cerebral hemispheres. These ganglia, termed the "basal-ganglia," are usually held to include, from behind forwards, the corpora quadrigemina, the optic thalami, and the corpora striata; but in addition there are bodies meriting an equal amount of attention, inasmuch as they cannot be regarded as belonging to the cerebral hemispheres. These are the locus niger, the red nucleus of the tegmentum, and the corpora geniculata; but we have no knowledge of their functions. No doubt all these ganglia act along with the cerebral hemispheres, so that practically the whole mass forms one organ.

Corpora quadrigemina.

Corpora Quadrigemina.—These are two pairs of rounded bodies found above the Sylvian aqueduct, which passes between the third and fourth ventricles. They are situated behind the optic thalami, and are intimately related to the crura and through these to the pons, medulla, and cord. Homologous with the optic lobes seen in the brain of the fish, frog, and bird (see Figs. 17 and 18), and in marsupials and monotremes, their relative size to the mass of the encephalon is much less in the brain of man and of the higher animals. These bodies contain gray matter, covered by a thin stratum of white matter. The two posterior bodies are probably connected with the cerebellum by the superior peduncles of that organ; at all events, these peduncles disappear under the base of the corpora quadrigemina. The two posterior bodies are also related to the crura cerebri by the prominences on the sides of the crura known as the inner geniculate bodies. Both anterior and posterior bodies, more especially the anterior, are connected with the optic tracts, and finally, the two anterior bodies unite with the optic thalami. (See Fig. 24 below; also, Plate XVIII., vol. i. Fig. 1, *g*, *g*.) As shown by their anatomical connections, the corpora quadrigemina are part of the mechanism of vision. Destruction causes immediate blindness. If, in a pigeon, the encephalon be removed with the exception of these bodies, the iris will still continue to contract on the influence of light. On then destroying one of these bodies, the iris is immobile, and the power of accommodation is lost. As the third cranial nerve (which is known to contain fibres controlling the circular fibres of the iris by which the pupil contracts, and the fibres governing the ciliary muscle by which the eye is accommodated or focussed to varying distances) originates in the gray matter of the floor of the Sylvian aqueduct, close to the corpora quadrigemina, it is held that these bodies are the centres of the reflex movements of the iris and of the ciliary muscle. The corpora quadrigemina are also the first recipients of visual impressions. When light falls on the retina changes are there induced which stimulate the optic nerve-fibres, and these fibres carry impressions through the optic tracts to the corpora quadrigemina. What then occurs is matter of conjecture. Whether sensation is there excited, or whether to produce sensation it is necessary that the impulses be sent onwards to the cerebrum, or whether the impressions directly received from the retina may excite, through the corpora quadrigemina and adjacent ganglia, reflex movements (like those of the somnambulist, who may see so that his steps are taken rightly, but who may at the same time not see consciously), are all speculative questions. We know that these bodies are concerned in the movements of the iris and of the ciliary muscle, but their great proportionate size in lowly-formed brains indicates that this is probably a secondary function, and that they are largely concerned in the phenomena of consciousness of light and color.

Optic thalami.

Optic Thalami.—These are two ganglionic masses placed behind the corpora striata and in front of the corpora quadrigemina. The internal surfaces are seen chiefly in the third ventricle, the upper surfaces in the same ventricle and the lateral ventricles (see vol. i. p. 769, Figs. 74 and 75), whilst the external and under surface of each thalamus is united with other parts of the brain. The under surface receives fibres from the crus cerebri, whilst the upper surface is covered by fibres which diverge and pass between the thalamus and a mass of gray matter in the extra-ventricular portion of the corpus striatum (called lenticular nucleus), to form a white layer called the "internal capsule." From the internal capsule, which thus contains fibres from the optic thalamus, fibres radiate outwards to the surface of the cerebral hemispheres. The under surface of the thalamus is connected with the tegmentum,—that is, with the layer of fibres forming the upper surface of the crus cerebri. They also receive fibres from the corpora quadrigemina, and according to some authorities, from the superior peduncles of the cerebellum. The substance of the thalamus contains nerve-cells scattered and also aggregated into two nuclear masses, but the relations of these to nerve-tracts have not been ascertained. It is important physiologically to notice that the thalami receive fibres from the back of the crura, and therefore are probably related to the posterior or sensory portion of the spinal cord.

There is still much uncertainty as to the functions of the optic thalami. The most commonly received opinion is that they are centres for the reception of peripheral impulses, which they may elaborate and transmit forwards to the corpora striata, or directly to the cerebral hemispheres. If the sensory impulses received by the optic thalami are sent to the corpora striata, and by these transmitted downwards and outwards through the crura cerebri, then reflex actions may occur in which the basal ganglia are the centres; but, if the impulses are sent up, in the first place, to the cerebral hemispheres, and by these transmitted down to the corpora striata, then the action must include the higher mechanism of the gray matter of the hemispheres. In the first case it is supposed by those who hold that consciousness is specially connected with the gray matter of the hemispheres that the action would be purely reflex and unconscious. Experiment has not thrown much light on this problem, owing to the deep-seated situation of these bodies rendering the results of operative interference untrustworthy. The little that has been done shows that injury to them does not cause paralysis of motion. Nor can it be said that such injuries cause loss of sensation, the only phenomenon observed being that the animal places its limbs in anomalous positions, and does not seem to be aware of having done so. Meynert is of opinion that the optic thalami fulfil the same functions as to tactile impressions—that is, impressions on the periphery of the body—that the corpora quadrigemina do for visual impressions—that is, impressions on the retina. In cases of apoplexy in which these bodies are involved there are always sensory disturbances on the side opposite the lesion. This would lead to the inference that the optic thalami are the sensory ganglia of the opposite sides of the body. They are not, however, the first ganglionic apparatus through which sensory impressions pass, but they probably coördinate in some way centripetal impulses before these are sent to the cerebral hemispheres, where they are correlated with feeling. Further, as the old name "optic thalami" indicates, these ganglia are concerned in some way in vision, because, if seriously injured, blindness, or at all events disturbance of vision, is one of the constant results. This favors the view that they are the "middlemen" between special sensory centres and the higher centres of the cerebrum.

Corpora striata.

Corpora Striata.—These ganglia, sometimes termed the "ganglia of the cerebral hemispheres," situated in front and on the outer side of the optic thalami, are seen in the lateral ventricles. (See vol. i. p. 769, Figs. 74 and 75.) The greater part of each is imbedded in the white substance of the hemisphere (extra-ventricular portion), whilst the part seen in the floor of the lateral ventricular is called the intra-ventricular portion. Each of these contains a nucleus of gray matter, the *nucleus caudatus* in the intra-ventricular, and the *nucleus lenticularis* in the extra-ventricular. The latter is separated internally from the intra-ventricular portion by a layer of white matter called the "internal capsule," whilst on the outer side there is another layer of white matter called the "external capsule," beyond which, again, is a lamina or web of gray matter, called the "claustrum," which separates the external capsule from the island of Reil. The internal capsule is of great importance, inasmuch as it is continuous with the *crusta*, a portion of the crus cerebri, which, in turn is a continuation of the pyramidal fibres of the medulla oblongata and the pons. Multipolar nerve-cells are found in the nucleus caudatus; in the claustrum the cells are small and spindle-shaped. Posteriorly, therefore, the corpus striatum is related by fibres with the optic thalamus; inferiorly, through the internal capsule, with the pyramidal portion of the medulla and cord; and externally and superiorly with the gray matter of the cerebrum. The corpus striatum is a centre for the coördination of centrifugal or motor impulses. It may be roused into activity by impressions reaching it directly from the optic thalamus, but probably it usually acts in

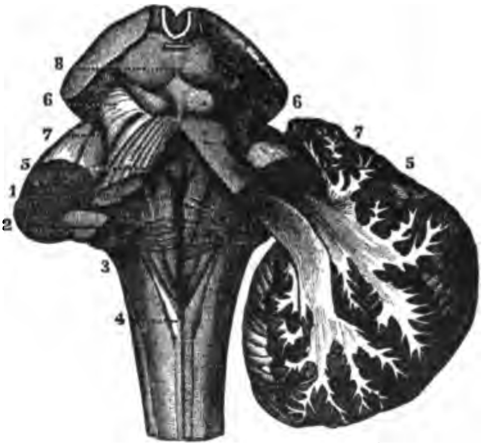

FIG. 24.—Three pairs of cerebellar peduncles (from Sappey, after Hirschfeld and Leveillé. Quain). On the left the three cerebellar peduncles have been cut short; on the right side the hemisphere has been cut obliquely to show its connection with the superior and inferior peduncles. 1, median groove of fourth ventricle; 2, the same groove at the place where the auditory striæ emerge from it to cross the floor of the ventricle; 8, inferior peduncle or restiform body; 4, funiculus gracilis; 5, 5, superior peduncles,—on the right the dissection shows the superior and inferior peduncles crossing each other as they pass into the white substance of cerebellum; 6, 6, fillets at the side of crura cerebri; 7, lateral grooves of crura cerebri; 8, corpora quadrigemina.

obedience to impulses coming from the cerebral hemispheres. When a clot of blood is formed in, say, the right corpus striatum there is motor paralysis of the opposite side of the body, and, according to the size of the clot, the paralysis may affect more or less completely the different groups of muscles. Destruction of the two bodies destroys voluntary movement, but the animal may move forwards as in running. Destruction of the nucleus caudatus renders movements of progression impossible, and the animal performs movements of rotation. Nothnagel, by injecting a minute drop of a solution of chromic acid destroyed the nucleus lenticularis of a rabbit, with the result of throwing the animal into complete unconsciousness. He also states that in the corpus striatum of the same animal there is a point, the *nodus cursorius*, the excitation of which caused the rabbit to rush forwards. This observation agrees with the statement of Magendie, that, when he injured the corpora striata, the animal seemed to have an irresistible propulsion forwards. Ferrier states that when the corpora striata were stimulated by an interrupted current convulsive movements of the opposite side of the body took place; and when the current was powerful the side of the body opposite to the side of the brain stimulated was forcibly drawn into an arch.

Peduncles of cerebellum.

Cerebellum.—In connection with the physiology of this organ it is important to note its connections with the rest of the cerebro-spinal axis. It has three peduncles: (1) the superior peduncles (see Fig. 24)—crura ad cerebrum, or processes ad testes—together with the valve of Vieussens, connect the cerebellum to the cerebrum; (2) the inferior peduncles, or crura ad medullam, are the superior extremities of the restiform bodies; (3) the middle peduncles, or crura ad pontem, much the largest, are the lateral extremities of the transverse fibres of the pons Varolii. They act as commissural fibres for the hemispheres of the cerebellum. All these peduncles pass into the interior of the cerebellum at its forepart. In the interior of the organ, where the peduncles enter, we find a nucleus of gray matter, the *corpus dentatum*. The cortical substance consists of two layers,—an outer *molecular* layer, consisting of a delicate matrix containing a few round cells and fibres, and an inner or *granule* layer, containing granules or nucleated corpuscles closely packed together. The corpuscles are from $\frac{1}{4000}$th to $\frac{1}{3000}$th of an inch in diameter, and are mixed with a network of delicate nerve-fibres. At the junction of the granular layer with the molecular layer there are peculiar large cells called "Purkinje's cells." They are flask-shaped and about $\frac{1}{500}$th to $\frac{1}{1000}$th of an inch in diameter, and the long process is directed towards the surface of the cerebellum (see Fig. 25). The white centre of each lamina consists of delicate nerve-fibres, the terminations of which have not been satisfactorily made out. Probably they end in the plexus of nerve-fibres in the granule layer, or in the processes of Purkinje's cells. On comparing the section of cerebrum (Fig. 28) with that of cerebellum (Fig. 25) the contrast is striking. The structure of cerebellum is more like that of the retina (vol. i. p. 780, Fig. 78) than of any other nerve-centre.

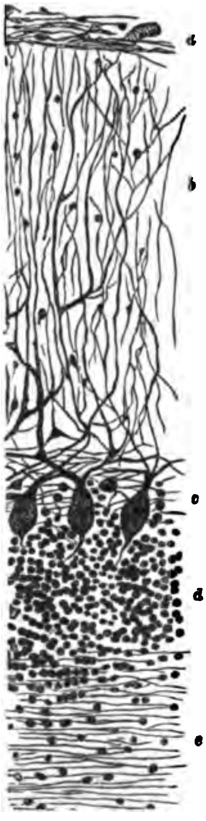

FIG. 25.—Vertical section through cortex of cerebellum (Sankey). *a*, pia mater; *b*, external layer; *c*, layer of cells of Purkinje; *d*, inner or granule layer; *e*, medullary centre.

Experiments on cerebellum.

Results of Experiments.—The cerebellum is insensible to mechanical excitations. Puncture causes no indications of pain, but there may be twisting of the head to the side. Ferrier states that Faradaic irritation causes movements of the eyeballs and other movements indicative of vertigo. Section of the middle peduncle on one side causes the animal to roll rapidly round its longitudinal axis, the rotation being towards the side operated on.

If the cerebellum be removed gradually by successive slices—an operation easily done in a pigeon—there is a progressive effect on locomotive actions. On taking away only the upper layer there is some weakness and a hesitation in gait. When the sections have reached the middle of the organ the animal staggers much, and assists itself by its wings in walking. The sections being continued further, it is no longer able to preserve its equilibrium without the assistance of its wings and tail; its attempts to fly or walk resemble the fruitless efforts of a nestling, and the slightest touch knocks it over. At last when the whole cerebellum is removed, it cannot support itself even with the aid of its wings and tail; it makes violent efforts to rise, but only rolls up and down; then, fatigued with struggling, it remains for a few seconds at rest on its back or abdomen, and then again commences its vain struggles to rise and walk. Yet all the while sight and hearing are perfect. See Fig. 26. It attempts to escape and appears to have all its sensations perfect. The results contrast very strongly with those of removing the cerebral lobes. "Take two pigeons," says Longet; "from one remove completely the cerebral lobes, and from the other only half of the cerebellum; the next day the first will be firm on its feet, the second will exhibit the unsteady and uncertain gait of drunkenness."

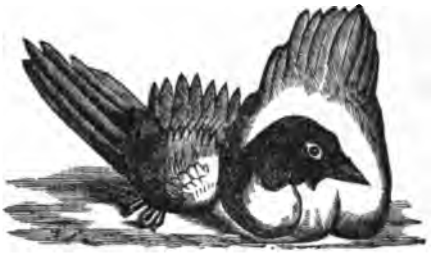

FIG. 26.—Pigeon from which the cerebellum has been removed.

There is thus a loss of the power of coördination, or of regulation of movement, without the loss of sensibility, and hence it has been assumed that in some way or other the cerebellum acts as the coördinator of movements.

Coördination of movement.

Coördination of Movement.—The nervous mechanisms by which movements are coördinated—that is, adapted to specific ends—are not thoroughly understood, but a short description of what is known may be here given. Muscular movements may be either simple or complex. In winking, the movement of the eyelid is affected by two muscles, one bringing the lid down, the other raising it. But picking up a pen from the table, taking a dip of ink, and writing a few words involve a complicated set of movements of the muscles of the trunk, shoulder, arm, forearm, fingers and thumb. To perform the movements with precision each muscle or group of muscles must act at the right time and to the proper amount. It is also clear that all this is accomplished automatically. We are not conscious of the requisite combinations; but it must be noted that many of these complicated movements are first acquired by conscious efforts, and that they become automatic only by repetition. Again, in walking, equilibrium is maintained by a delicate series of muscular adjustments. When we swing forward one leg and balance the body on the other many muscular movements occur, and with every change in the position of the centre of gravity in the body there are corresponding adjustments. It would appear that in all mechanisms of coördination the first part of the process is the transmission of sensory impressions from the periphery. These sensory impressions may be derived from the skin or muscles, and may be caused by variations of pressure arising in them. Thus, if we lift a heavy weight, as a large stone, by the right hand and raise it to the bend of the elbow we throw the body to the other side by the action of the muscles of that side, thus maintaining the equilibrium. We judge of the amount of force necessary to overcome an obstruction by the feeling of resistance we encounter. All the movements of the body, therefore give rise to feelings of varying pressures, and these feelings regulate the amount or degree of muscular action necessary to maintain equilibrium, or to perform a requisite movement. This is at first a conscious experience, and a child has to pass through an education, often involving pain, before the nervous mechanisms become automatic and the movement is done without effort. But the ordinary sensory nerves, coming from skin and muscle, are not the only channels by which such guiding mechanisms are set in action. As one would expect, sensory impressions, such as those associated with sight and hearing, may be brought into play.

Impressions from semicircular canals.

1. *Peripheral Impressions from Semicircular Canals.*—If the membranous portion of the horizontal semicircular canal in the internal ear of a pigeon be cut, the bird moves its head from side to side, and if one of the vertical canals be divided it moves the head up and down. The effects may pass off in a few days if only one canal has been cut.

If the canals on both sides be divided the movements are exaggerated and the condition becomes permanent. It will then be observed that the animal has lost the power of coördinating its movements. It can rest with only a twitching, perhaps of the head, but if it attempt to fly or walk its movements are indefinite and irregular, like those of a dizzy person, or like those described as following injury to the cerebellum. The irregular movements do not arise from deafness, or noises in the ears, or partial paralysis, or from an uncontrollable impulse. Any strong sensory impression, such as holding the bird, supporting its beak, or holding a brilliant light before its eyes, will steady it, and it has been noticed that "it can, even without assistance, clean its feathers and scratch its head, its beak and foot being in these operations guided by contact with its own body." It has been supposed that the semicircular canals are concerned in the mechanism of equibration,—a view urged chiefly by Mach and Crum-Brown. If a blindfolded man is seated on a horizontal rotating table, such as that used in a lighthouse for rotating or eclipsing the light, and the table is turned round, at first there is a sensation of movement in the same direction as that of the table; then this sensation fades away, until he has no sensation of movement, although the table may be rapidly rotating; finally, if the table be stopped without a jerk there is first a very short period in which there is no definite sensation, which is succeeded by a sense of rapid movement in the opposite direction, often accompanied by a feeling of nausea. Now it is evident that neither sight nor touch nor muscular sensations can give a sense of rotation in these circumstances, and yet it is possible to form a fairly accurate judgment of the angle through which the body has moved. It has been suggested that this is effected by the action of the semicircular canals. The membranous portions are surrounded by a fluid called the "endolymph," and are free to move through a short distance. Hence it has been supposed that rotations more or less rapid must cause variations of tension of the membranous portion. Thus, if the membranous part, especially the ampulla or dilated ends of the canals, lag behind when rotation in one direction takes place, the nerves ending in them will be subjected to a strain; by and by both membranous portions and surrounding parts will be moving with the same velocity, when there will be no strain and no sense of movement; and at last, when the rotatory movement is arrested, there will be a tendency on the part of the membranous portions, as they are floating in a fluid, to move on a little farther than the rest, and thus again produce a strain, causing a sensation of movement in the opposite direction. By similar reasoning it can be shown that if we take the peculiar position of the three canals into consideration any movement in space might be thus appreciated, and these appreciations enter into the judgment we form of the movements. According to this theory, the sense of equilibrium may be largely due to impressions derived from the position of the head, and, as muscular movements required for placing the body in definite positions are determined, as we have seen, by peripheral impressions, the irregular movements of the pigeon, after injury to these canals, may be accounted for. It is not improbable that in the bird, which from the structure of its extremities—feet and wings—can have no peripheral impressions so delicate as those derived from the papillæ of the skin on the extremities of other animals, the sense of equilibrium is maintained chiefly by impressions from these canals, and this may account for the comparatively large size of these organs in birds and fishes. This is in correspondence also with the requirements of birds in the balancings of flight and of fishes in swimming. It is well known that disease or injury of these canals in the human being produces symptoms of vertigo and a diminution of the power of coördinated action, as in Menière's disease, showing that the canals, even in man, have similar functions to those in the bird.

Impressions from eye.

2. *Peripheral Impressions from the Eye.*—Many movements are guided and controlled by the sense of vision. Simply blindfolding a bird usually makes it passive, and it will not attempt either to walk or to fly; the same effects to a less degree may be seen in a mammal; and a blindfolded man will stagger in his gait. The wonderfully accurate movements of the blind in walking are acquired by long and laborious effort, and are guided by the sensations of hearing, of touch, and of resistance. If the optic lobes of a frog be destroyed, its power of balancing itself is lost. There are thus at least three channels by which peripheral impressions pass to the centres and seem to guide or coördinate movement: (1) from the periphery, by nerves of ordinary sensibility arising in the skin, muscles, and viscera; (2) from the semicircular canals of the ear, by special nerve-fibres in the auditory nerve; (3) from the eye, by fibres of the optic nerve. How and where these skeins of sensitive impressions are gathered up and so arranged as to call forth the requisite movements can only be conjectured; but the cerebellum is the organ most likely to be concerned in such a mechanism. It is in organic connection with many of the nerve-fibres conveying sensory impressions. By the restiform bodies it receives many of the sensory fibres of the spinal cord; the auditory nerve has roots intimately related to the cerebellum; and it is fair to assume that there are communications between the corpora quadrigemina and the cerebellum. Stimulation of the cerebellum causes movements of the eyeballs, and disease of the cerebellum is sometimes attended by blindness. How the cerebellum coördinates movement is quite unknown, and the difficulty in explaining its functions is not lessened by the clinical fact that extensive disease of this organ may exist without any appreciable sensory or motor disturbance. There is no evidence to support the view of the founders of phrenology that the cerebellum has to do with the sexual functions.

Cerebral Hemispheres.—As these have been fully described in vol. i. p. 766, it is only necessary here to point out the anatomical facts that assist in explaining the functions of the organ. It is important to observe, first, the general arrangements of the fibres, and, secondly, the arrangement and structure of the gray matter. The white matter of the cerebrum consists of ascending or peduncular fibres, longitudinal or collateral fibres, and of transverse or commissural fibres.

(1.) *Peduncular Fibres.*—The crusta of the cerebral peduncles consists of bundles of longitudinal fibres derived mainly from the anterior pyramid of the medulla. The crust is quadrilateral in form, but in ascending to the hemispheres it becomes flattened from above downwards, so that the fibres spread out like a fan. The fan formed by these fibres is bent into the form of an incomplete hollow cone, the convex surface of which is directed upwards and inwards.

Peduncular fibres of cerebrum.

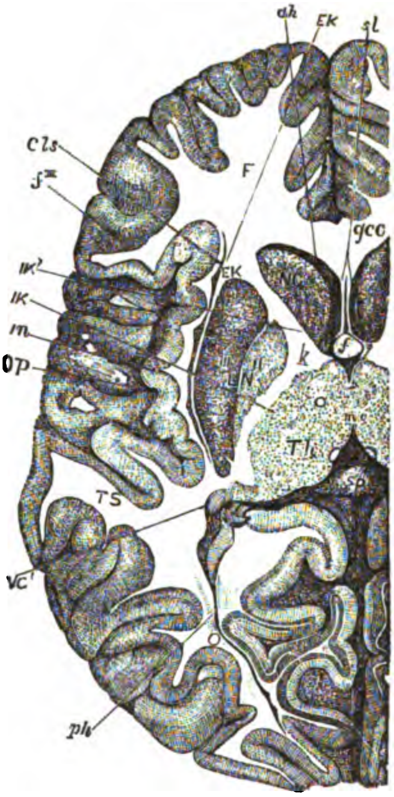

FIG. 27.—(After Flechsig.) Horizontal section of brain of child nine months old, only a portion of the right side being shown. *F*, frontal, *TS*, temporo-sphenoidal, and *O*, occipital lobes; *op*, operculum; *In*, island of Reil; *Cls*, claustrum; *f'''*, third frontal convolution; *Th*, optic thalamus; *NC*, caudate nucleus; *NC'*, tail of caudate nucleus; *LN*, lenticular nucleus; *II*, *III*, second and third divisions of lenticular nucleus; *EK*, external capsule; *IK*, posterior division, *IK'*, anterior division, and *K*, knee of internal capsule; *ah*, *ph*, anterior and posterior horns respectively of lateral ventricles; *gcc*, knee of corpus callosum; *sp*, splenium; *mc*, middle commissure; *f*, fornix; *sl*, septum lucidum.

Thus the fibres pass between the optic thalamus and the lenticular nucleus, forming the internal capsule. Higher up the fibres pursue their course beneath and to the outside of the thalamus and the caudate nucleus, and over the lenticular nucleus. "Still higher up the internal capsule has spread out from before backwards, while the anterior half forms an obtuse angle with the posterior. The angle where the halves meet is called the knee (Fig. 27, K), while the divisions themselves are called the anterior (Fig. 27, IK') and posterior segments of the internal capsule" (Ross). On emerging from the basal ganglia the fibres of the internal capsule radiate in all directions to reach the cortex of the brain, giving rise to the appearance called the "corona radiata." The following sets of fibres have been traced into connection with the cerebrum.

(*a*) Sensory peduncular fibres, derived from the posterior root-zones and the columns of Goll. These are in connection with the cerebellum; but, as shown by Meynert, Flechsig, and others, many pass up through the pons to reach the crus cerebri, occupying the posterior and external portion of the pyramidal tract. They do not appear to be connected with the optic thalamus and the lenticular nucleus, but pass between them to the cortex. (*b*) Fibres from the roots of the optic nerves, reaching the brain by what have been called the "optic radiations of Gratiolet." This bundle of fibres issues from the posterior and external border of the optic thalamus and is closely applied to the peduncular sensory tract in its passage through the internal capsule, and the fibres seem to be connected with the convolutions of the occipital lobe. It is important to note that at least one of the roots of the optic nerve (the internal) passes into the external geniculate body and thence into the anterior bodies of the corpora quadrigemina. Thus there is a path for the passage of impressions from the retina to the cortex of the brain. (*c*) Fibres from the olfactory lobes have been traced to a junction with the optic radiations of Gratiolet, and pass with them to the convolutions of the cortex of the occipital or temporo-sphenoidal lobe. (*d*) The pyramidal tract has already been traced through the spinal cord, medulla, and pons. It then goes on, as already seen, to form the internal capsule and the corona radiata, the fibres ending in the parietal lobule, the paracentral lobule, the superior extremities of the ascending frontal and parietal convolutions, probably the posterior extremity of the first frontal convolution, the posterior extremity of the third frontal, and the inferior extremities of the ascending frontal and parietal convolutions,—in short, in the convolutions forming the middle and parietal region of the surface of the cortex. (*e*) Fibres issuing from the external surface of the optic thalamus to join the internal capsule. These are distributed to the convolutions of the frontal and parietal lobes. (*f*) Fibres issuing from the external surface of the caudate nucleus, passing also into the corona radiata. (*g*) Fibres issuing from the superior and internal surface of the lenticular nucleus to join the ascending fibres of the internal capsule. (*h*) Fibres ascending from the superior peduncle of the cerebellum. Flechsig says that some of the fibres of the superior peduncle of the cerebellum of the opposite side pass uninterruptedly through the red nucleus and along the internal surface of the fibres of the pyramidal tract to be distributed to the central convolutions of the cerebrum. (*i*) Fibres issuing from the corpus callosum and descending into the internal capsule. (*k*) Fibres of the external capsule which ascend from the crusta and ultimately reach the cortex through the corona radiata.

In addition to the peduncular fibres above enumerated, all of which belong to what may be termed the system of the internal capsule and corona radiata, fibres from the fornix, tænia semicircularis, outer layer of septum lucidum, and the fillet of the crus also pass from below upwards to the cortex of the hemispheres (Ross).

Longitudinal fibres of cerebrum.

(2.) *Longitudinal or Collateral Fibres.*—(*a*) Fibres running immediately below the surface of the cortex, and connecting the gray matter of adjacent convolutions. (*b*) Fibres in the gyrus fornicatus, a convolution immediately above the corpus callosum. It is said that bands of these fibres arise in the anterior perforated space and pass completely round the corpus callosum to end in the same perforated space, and that offsets of these fibres pass upwards and backwards to reach the summits of the secondary convolutions derived from the gyrus fornicatus near the longitudinal fissure. (*c*) Longitudinal fibres of the corpus callosum (nerves of Lancisi), connecting the anterior and posterior ends of the callosal convolution. (*d*) Longitudinal septal fibres, lying on the inner surface of the septum lucidum, and entering into the gyrus fornicatus. (*e*) The fasciculus uncinatus, passing across the bottom of the Sylvian fissure and connecting the convolutions of the frontal and temporo-sphenoidal lobes. (*f*) The longitudinal inferior fasciculus, connecting the convolutions of the occipital with those of the temporal lobe.

Commissural fibres of cerebrum.

(3.) *Transverse or Commissural Fibres.*—(*a*) Many, if not all, of the fibres of the corpus callosum pass transversely from one side to the other and connect corresponding convolutions in the hemispheres. This is the generally accepted view; but Professor Hamilton of Aberdeen has recently stated that his preparations show that there is no such commissural system between convolutions, and that the fibres decussating in the corpus callosum are not continued to convolutions on the other side, but pass downwards. (*b*) The fibres of the anterior commissure wind backwards through the lenticular nuclei to reach the convolutions round the Sylvian fissure. (*c*) The fibres of the posterior commissure run through the optic thalami.[1]

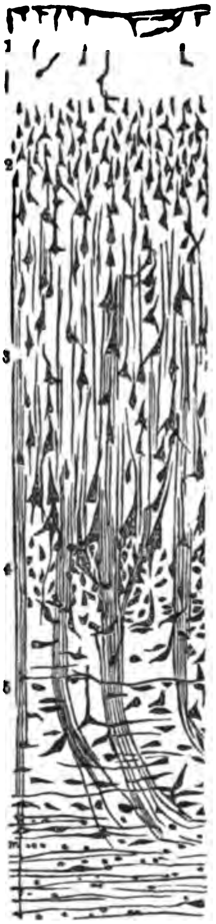

FIG. 28.—(After Meynert.) Vertical section of a furrow of third cerebral convolution of man. 1, layer of scattered small cortical corpuscles; 2, layer of close-set small pyramidal corpuscles; 3, layer of large pyramidal cortical corpuscles; 4, layer of small close-set irregular-shaped corpuscles; 5, layer of fusiform corpuscles (like those in the claustrum); *m*, medullary lamina.

Arrangement and structure of gray matter.

Arrangement and Structure of Gray Matter.—The gray matter in the medulla and basal ganglia has been already considered. A web or sheet of it is also thrown over the surface of the cerebrum, and forms the outer portion of all the convolutions. The cortical substance consists of cells and fibres imbedded in a matrix similar to the neuroglia of the spinal cord. It may be divided into five layers, which merge into each other by almost insensible gradations. The most external layer consists of delicate nerve-fibres, neuroglia, and a few small round cells destitute of processes (see Fig. 28). Going deeper we find cells of a characteristic pyramidal form, the largest being in the deepest layer. Their bases are turned inwards, and their apices towards the surface of the convolution. Cleland states that fibres passing from the apices are continuous with the delicate fibres found on the very surface of the cortex. In the ascending frontal convolutions Betz and Mierzejewski have found pyramidal cells two or three times larger than those of other regions of the cortex, and these have been termed "giant-cells." All the pyramidal cells, no doubt, anastomose by their processes, and give origin to the nerve-fibres of the white substance, but it is rarely possible to trace the fibres from cell to cell. A consideration of these anatomical facts, along with those mentioned in connection with the comparative anatomy of the brain, shows that the cerebral hemispheres are in intimate connection by fibres with all the other portions of the cerebro-spinal system. Further, they are not only intricate in structure themselves, but the commissural sets of fibres indicate that there is harmony of function between one part and another. In determining the function of so complicated an apparatus recourse must be had to the evidence (1) of development, (2) of comparative anatomy, (3) of human anatomy, (4) of the observed effects of disease before and after death, and (5) of experiment. Facts have already been collected from the first three of these fields of inquiry, all tending to show that the gray matter of the hemisphere is associated with the manifestation of intelligence in its various forms. The phenomena of disease support the same conclusion. Diseases producing slow changes in the layer of gray matter on the cortex are invariably associated with mental disturbance, such as melancholia, mania, or dementia. If the gray matter be suddenly injured or submitted to compression, as by a blow causing fracture and depression of a portion of the skull, or the effusion of fluid consequent on inflammation, unconsciousness is a certain result. So long as the pressure continues there is no consciousness; if it be removed, consciousness may soon return. On the other hand, if the disease affect the white matter of the central portions or the ganglia at the base, there may be paralysis or convulsions without consciousness being affected. All the facts, therefore, of pathology relating to the brain indicate that the gray matter on the surface of the hemispheres is the organ of consciousness and of all mental operations. This statement is now an axiom of medical science, and the basis of the rational treatment of the insane and of all maladies of the central nervous organs.

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[1] In preparing the foregoing sketch of the fibres of the cerebrum the writer is much indebted to Ross, *Diseases of the Nervous System.*

Two methods of experiment upon the cerebrum have usually been followed, and both have yielded important results.

Removal of gray matter.

(a.) *Removal.*—Flourens and the older observers were aware of the fact that as successive slices of gray matter are removed from the surface of the cerebrum an animal becomes more dull and stupid, until at last all indications of perception and volition disappear. A pigeon in this condition (see Fig. 29), if carefully fed, may live for many months; to quote from Dalton:

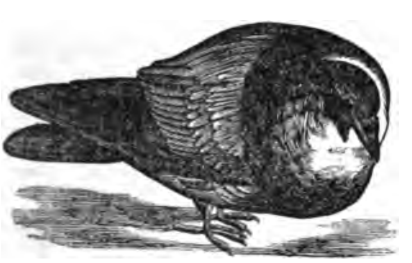

FIG. 29.—Pigeon, in which the cerebrum has been injured or removed.

> "The effect of this mutilation is simply to plunge the animal into a state of profound stupor, in which it is almost entirely inattentive to surrounding objects. The bird remains sitting motionless upon his perch or standing upon the ground, with the eyes closed and the head sunk between the shoulders. The plumage is smooth and glossy, but is uniformly expanded by a kind of erection of the feathers, so that the body appears somewhat puffed out, and larger than natural. Occasionally the bird opens its eyes with a vacant stare, stretches its neck, perhaps shakes its bill once or twice, or smooths down the feathers upon its shoulders, and then relapses into its former apathetic condition."

Similar observations have also been made on reptiles and mammals, but the latter survive the operation for a comparatively short time. In watching such an animal it is difficult to divest one's mind of the belief that it still feels and sees and hears. It may be observed that it rarely makes movements unless stimulated from without. Thus it may remain motionless for many hours; but if pushed, or gently touched, it moves. As remarked by Professor M. Foster—

> "No image, either pleasant or terrible, whether of food or of an enemy, produces any effect on it, other than that of an object reflecting more or less light. And though the plaintive character of the cry which it gives forth when pinched suggests to the observer the existence of passion, it is probable that is a wrong interpretation of a vocal action; the cry appears plaintive, simply because, in consequence of the completeness of the reflex nervous machinery and the absence of the usual restraints, it is prolonged. The animal is able to execute all its ordinary bodily movements, but in its performance nothing is ever seen to indicate the retention of an educated intelligence."

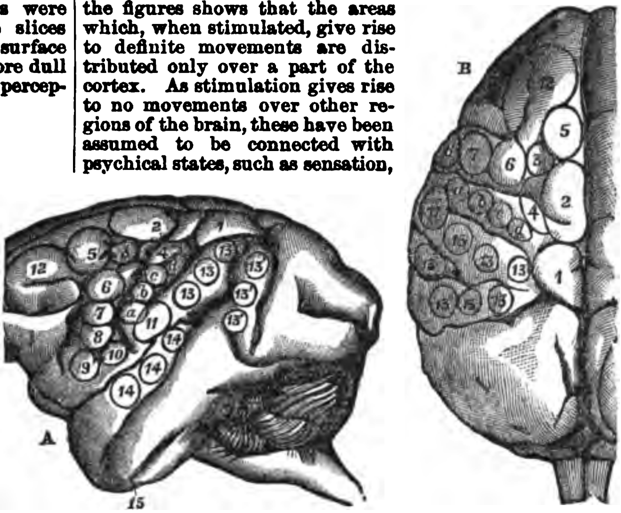

FIG. 30.—A. Left hemisphere of monkey. B. Upper surface of hemisphere of monkey. The numbers in A and B correspond. 1, advance of opposite leg as in walking; 2, complex movements of thigh, leg and foot, with adapted movements of trunk; 3, movements of tail; 4, retraction and adduction of opposite fore-limb; 5, extension forward of opposite arm and hand, as if to reach or touch something in front; *a*, *b*, *c*, *d*, individual and combined movements of fingers and wrists, ending in clenching of fist; 6, supination and flexion of forearm, by which the hand is raised towards the mouth; 7, action of zygomatics, by which the angle of the mouth is retracted and elevated; 8, elevation of ala of nose and upper lip, with depression of lower lip, so as to expose the canine teeth on the opposite side; 9, opening of mouth, with protrusion of tongue; 10, opening of mouth with retraction of tongue; 11, retraction of angle of mouth; 12, eyes opening widely, pupils dilating, head and eyes turning towards opposite side; 13, 13′, eyeballs moving to opposite side,—pupils generally contracting; 14, sudden retraction of opposite ear; 15, subiculum cornu ammonis,—torsion of lip and nostril on same side. (Ferrier.)

Electric stimulation of brain surface.

(*b.*) *Electrical Stimulation of Surface of Brain.*—It is remarkable that, although many of the early workers in cerebral physiology stimulated the surface of the brain by electric currents, they observed no effect, and therefore Magendie, Matteucci, Longet, Weber, Budge, Schiff, and others taught that irritation of the surface of the hemispheres called forth no muscular movements; and it was generally accepted that the gray matter on the cortex of the brain was entirely concerned in the phenomena of sensation, volition, and intellectual action. During the Franco-German war in 1870 Hitzig had occasion to apply galvanism to a portion of the exposed brain of a wounded soldier, and he observed contractions of the muscles of the eyeball. When peace was restored, experiments were made on the lower animals by Hitzig and Fritsch, in which a portion of exposed brain was irritated by a continuous current, and it was observed that the phenomena took place on opening and closing the current. By these experiments the German observers discovered that, when certain areas of gray matter were stimulated, contractions of certain muscles occurred, and they were thus able to map out areas for groups of muscles. Immediately afterwards the research was taken up by Professor David Ferrier of King's College, London, who, using a Faradaic instead of a continuous current, greatly extended the field of inquiry, and obtained many important results, which are not only of value in cerebral physiology but have been successfully applied to the diagnosis of various diseases of the nervous system. The motor areas as determined by Ferrier in the monkey are shown in Fig. 30. Dr. Ferrier has also indicated the corresponding motor areas in man by carefully comparing the convolutions with those of the monkey.[1] An inspection of the figures shows that the areas which, when stimulated, give rise to definite movements are distributed only over a part of the cortex. As stimulation gives rise to no movements over other regions of the brain, these have been assumed to be connected with psychical states, such as sensation, volition, etc. Much controversy has arisen as to the real nature of these so-called "motor areas." It has been clearly ascertained that the effects are not due to diffusion of the electric currents influencing other parts of the brain. That there is to some extent such diffusion between the electrodes there can be no doubt, but the exact correspondence between the area stimulated and the movements produced, and the fact that shifting the electrodes a very short distance to one side or another is followed by different results, show that the effect is somehow owing to changes excited by the electric current in that particular area of gray matter. Hitzig, Ferrier and others have also found that removal of the layer of gray matter of a "motor centre" is followed by enfeeblement of the movements assigned to the area, but in the course of a few days the paralytic symptoms disappear. The latter effect cannot be due to the corresponding centre on the opposite side taking up the work "as subsequent destruction of the latter produced the usual paralysis on the side opposite to the lesion, but did not cause a repetition of the paralysis on the side opposed to the first lesion" (Carville and Duret). It would appear, therefore, that after destruction of a centre on one side some other part of the same hemisphere may take up the functions of the destroyed part. Goltz of Strasburg has removed large portions of the gray cortex (even to the extent of almost the whole of one hemisphere) by a jet of water so as to avoid hæmorrhage, and still recovery of motor power took place after a time, although there remained "clumsiness in the execution of certain movements." His opinion is that the paralytic phenomena are caused by the injury exciting an inhibitory action on lower centres. This view, substantially that advocated for many years by Brown-Séquard, does not explain why it is that gentle irritation of the centre by a weak Faradaic current calls forth movements of a definite character. The evidence, therefore, is strongly in favor of the view that there are definite motor areas of gray matter on the cortex,—that is, in ordinary circumstances these areas are intimately related to specific

Ferrier's motor areas.

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[1] For figures of human brain showing motor areas, see Foster's *Physiology*, 4th ed., Figs. 86 and 87, pp. 627, 628.

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muscles or groups of muscles. It is quite possible, however, that each group of muscles does not depend on one area alone, but on several, whilst it is more intimately related to one than to the others. This would account also for the fact that movements of a group of muscles may be excited by stimulation of other areas than those mapped out by Ferrier and Hitzig. Recently areas associated with definite movements of the thorax, abdomen, and pelvis have been discovered by Horsley and Schäfer, and thus almost all the muscular mechanisms have been connected with some of the cerebral convolutions.

Sensory centres.

Ferrier has also attempted to differentiate sensory centres. On stimulating the angular gyrus he obtained movements of the eye and associated movements of the head, and he regarded the phenomena as being "merely reflex movements on the excitation of subjective visual sensation." He then found that, "when the angular gyrus of the left hemisphere was destroyed, the animal was blind on the right eye soon after the operation, but recovered sight completely on the following day." On destroying the angular gyri of both hemispheres, an animal became permanently blind in both eyes. In neither case was there motor paralysis. By similar processes of thought and experiment he placed the auditory centre in the superior temporo-sphenoidal convolution, the centres of taste and smell at the extremity of the temporo-sphenoidal lobe, and that of touch in the gyrus uncinatus and hippocampus major. On the other hand, Goltz asserts that even after removal of a considerable part of the cortex the animal is not actually blind, but suffers from an imperfection of sight; and he states that he "can no more obtain distinct evidence of localization in reference to vision or other sensations than in reference to movements." Ferrier's view is supported by the observations of Munk, who finds that destruction of a considerable portion of the occipital lobes causes blindness. Munk has put forth the important distinction that there may be blindness in the sense of total deprivation of vision, and "psychical blindness," or the "inability to form an intelligent comprehension of the visual impressions received;" and he supposes that the gray matter of the cortex over the occipital lobes has to do with the elaboration of simple visual impressions into perceptions. In like manner he concludes that other parts of the cortex may have to do with the elaboration of tactile, olfactory, gustatory, and auditory sensations. This is a likely hypothesis, and not very dissimilar to what has been held for many years, the only novelty being that there is localization in these actions. At present the question cannot be regarded as settled; but it may be stated generally that the posterior portion of the brain has to do chiefly with the reception of sensory impressions, and the middle and lateral regions with the transmission outwards of motor impulses. But there still remains the anterior portion. Electrical irritation of the præ-frontal region of the cortex in the monkey causes no motor reaction. Complete destruction causes no paralysis of motion and no sensory disturbance. Dr. Ferrier states:

> "Removal or destruction by the cautery of the antero-frontal lobes is not followed by any definite physiological results. The animals retain their appetites and instincts, and are capable of exhibiting emotional feeling. The sensory faculties—sight, hearing, touch, taste, and smell—remain unimpaired. The powers of voluntary motion are retained in their integrity, and there is little to indicate the presence of such an extensive lesion or a removal of so large a part of the brain. And yet, notwithstanding this apparent absence of physiological symptoms, I could perceive a very decided alteration in the animal's character and behavior, though it is difficult to state in precise terms the nature of the change. The animals operated on were selected on account of their intelligent character. After the operation, though they might seem to one who had not compared their present with the past fairly up to the average of monkey intelligence, they had undergone a considerable psychological alteration. Instead of, as before, being actively interested in their surroundings, and curiously prying into all that came within the field of their observation, they remained apathetic or dull, or dozed off to sleep, responding only to sensations or impressions of the moment, or varying their listlessness with restless and purposeless wanderings to and fro. While not actually deprived of intelligence, they had lost to all appearance the faculty of attentive and intelligent observation" (*Functions of the Brain*, 1st ed., p. 231).

Thus the frontal lobes appear to have to do with cognition and intellectual action. If so, the gray matter on the surface of the brain may be mapped out into three great areas—an area concerned in cognitions and volitions in front, a motor or ideo-motor area in the middle, and a sensory area behind. These distinctions are no doubt arbitrary to a considerable extent; but, if they are retained as the expressions of a working hypothesis, they are of service. Long ago, and prior to the researches above alluded to, Dr. Hughlings Jackson pointed out that disease of certain areas of gray matter on the cortex of the hemispheres may occasion epileptiform convulsions, localized to particular groups of muscles. The theory of the localization of motor functions has been of great service in the diagnosis and prognosis of such diseases. As to the localization of the faculty of language in the third left frontal convolution, founded on pathological evidence, see APHASIA, vol. ii. p. 150.

Consciousness.

The functions of the nervous system have now been described; but they are so complicated and so closely related to each other as to make it no easy matter to form a conception of the system working as a whole. The progress of discovery naturally tends to differentiation, and probably to attach too much importance to one organ as compared with the others, so that we are in danger of losing sight of the solidarity of the whole nervous system. Probably every nervous action, however minute and evanescent, affects more or less the entire system, and thus there may be an under-current of nervous action streaming into and out of the nerve-centres, along with a perpetual series of interactions in the centres themselves, contributing to and accounting for the apparent continuity of conscious experience. Certain relations of one nerve-centre to the others are indicated in Fig. 31. No one now doubts that consciousness has an anatomical substratum, but the great problem of the relation between the two is as far from solution as in the days when little or nothing was known of the physiology of the nervous system. Consciousness has been driven step by step upwards until now it takes refuge in a few thousand nerve-cells in a portion of the gray matter of the cortex of the brain. The ancients believed that the body participated in the feelings of the mind, and that, in a real sense, the heart might be torn by contending emotions. As science advanced, consciousness took refuge in the brain, first in the medulla and lastly in the cortex. But even supposing we are ultimately able to understand all the phenomena—chemical, physical, physiological—of this intricate ganglionic mechanism we shall be no nearer a solution of the problem of the connection between the objective and subjective aspects of the phenomena. It is no solution to resolve a statement of the phenomena into mental terms or expressions and to be content with pure idealism; nor is it any better to resolve all the phenomena of mind into terms describing physical conditions, as in pure materialism. A philosophy that recognizes both sets of phenomena, mutually adjusted and ever interacting, may be no explanation; but at all events it is unpretentious, recognizes facts, and does not delude the mind by offering a solution which is no solution at all. But apart from the ultimate question there is the important one of whether physiologists are on the whole right in relegating sensation or consciousness entirely to the gray matter of the brain. The facts of comparative physiology are against such an exclusive notion, because we cannot deny consciousness to many animals having rudimentary nervous systems. As already said, research in anatomy and physiology and the observation of disease have driven physiologists to adopt the view that the brain is the organ of sensation. This is no doubt true in the sense that it ultimately receives all those nervous impressions that result in consciousness; but the parts transmitting the nervous impressions are in another sense as much concerned in the production of conscious states as the brain. This view of the matter, put forward by Professor John Cleland in 1870, has not received

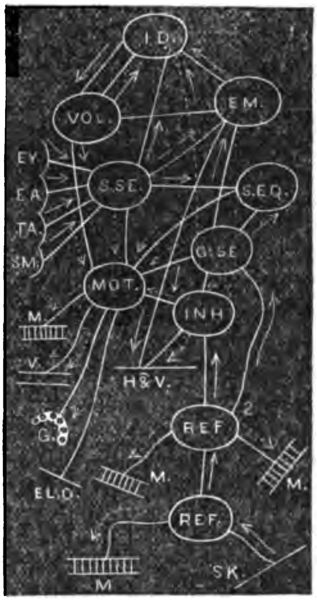

FIG. 31.—*M.*, muscle; *SK.*, skin; *REF.*, reflex centre; *INH.*, inhibitory centre; *MOT.*, motor centre; *G.SE.*, centre of general sensation; *S.SE.*, centre of special sensation; *S.EQ.*, sense of equilibrium; *VOL.*, volitional centre; *EM.*, emotional centre; *ID.*, ideational centre; *EY.*, eye; *EA.*, ear; *TA.*, taste; *SM.*, smell; *V.*, vessel; *G.*, gland: *H&V.*, heart and vessels; *EL.O.*, electric organs in some fishes. The arrows indicate direction of currents, by following which the influence of one centre over another may be studied.

from psychologists the attention it deserves. His thesis is—

> "that the consciousness extends from its special seat so far as there is continuity of the impressed condition: that when an irritation is applied to a nerve-extremity in a finger or elsewhere the impression (or rather impressed condition) travels, as is generally understood, but exists for at least a moment along the whole length of the nerve, and that as soon as there is continuity of the impressed condition from finger to brain the consciousness is in connection with the nerve and is directly aware of the irritation at the nerve-extremity" (*Evolution, Expression, and Sensation*, Glasgow, 1881, p. 106).

This view is quite consistent with all the facts of nervous physiology and presents fewer difficulties than the one generally held, which drives consciousness into the recesses of the nerve-cells in the cortex of the cerebral hemispheres. It appears to keep clear of the prevailing error in the philosophy of modern physiology,—that of regarding the body and even the nervous system as a vast series of almost independent organs, losing sight of the community of function and interdependence of parts, characteristic of the body of one of the higher animals.

CIRCULATION IN THE BRAIN.

Circulation in brain.

A due supply of healthy arterial blood and the removal of venous blood are essential to cerebral activity. The brain is contained in an osseous case of which the total capacity is variable. The cerebral substance undergoes almost insignificant changes of volume even under a pressure of 180 mm. of mercury. The quantity of blood in the cranium may vary. In the rabbit not more than 1 per cent. of the total quantity of blood of the body (equal to about 5 per cent. of the total weight of the organ) is present at any one time in the brain, whereas in the kidney, by weight, the blood may amount to nearly 12 per cent., and in the liver to as much as nearly 30 per cent. (Foster.) If a small round window be made in the cranium and a suitable piece of glass fitted into it, the veins of the pia-mater may be observed to dilate or contract if intermediate pressure be made on the veins of the neck. There is evidently, then, within the cranium some arrangement by which such variations become possible. This is probably accomplished by the anatomical arrangements of the sub-arachnoid spaces. These spaces, containing fluid, communicate freely with each other and with the space surrounding the spinal cord, so that when the quantity of blood increases in the cranium a corresponding quantity of fluid escapes into the spinal space, the walls of which are not inextensible like those of the cranium. In young children, before the fontanelles are closed, the variations of circulation and blood-pressure cause pulsations, of which there are two kinds—those coinciding with the ventricular systole, produced by the pulsation of the arteries at the base of the brain, and those coinciding with expiration. Pressure on the brain-substance beyond a limit leads to paralysis, unconsciousness and death. The large sinuses probably assist in equalizing internal pressure, and, as inspiration favors the flow of blood from the sinuses, too great distension of these is also avoided. Vaso-motor nerves regulate the calibre of the arterioles of the brain, but we know nothing of the conditions affecting the nerves. Nor do we know how the waste-products of the brain are got rid of. There are no lymphatic vessels, but there are spaces around many of the vessels. These probably communicate with the cavities in the membrane containing the cerebro-spinal fluid, the value of which, as suggested by Foster, "depends in all probability more on its physiological properties as lymph than on its mechanical properties as a mere fluid." The gray matter is much more richly supplied with capillaries than the white matter, as seen in Fig. 32.

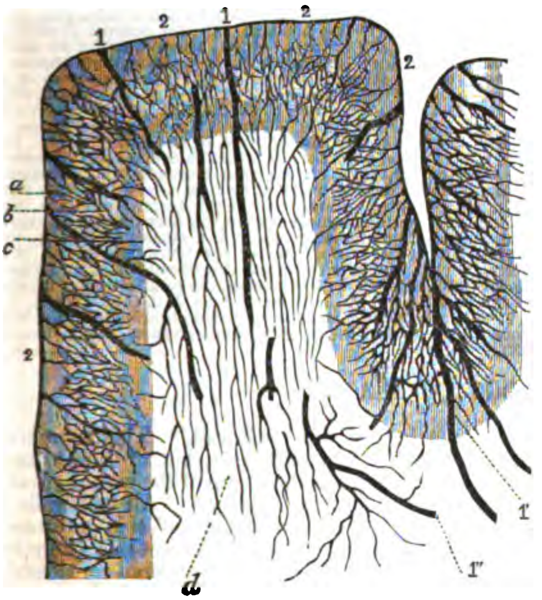

FIG. 32.—Injected convolution of cerebrum (Duret). 1, 1, medullary arteries; 1', group of medullary arteries in fissure between two neighboring convolutions; 1'', arteries of system of arcuate fibres; 2, 2, 2, arteries of gray substance of cortex; *a*, large-meshed capillary network situated under pia mater; *b*, smaller-meshed capillary network situated in middle layers of cortex; *c*, somewhat larger network in internal layers adjoining white substance; *d*, capillary network of white substance.

CRANIAL NERVES.

Cranial nerves.

The general anatomy of these nerves is described under ANATOMY, vol. i. p. 773, *sq.*, and it remains only to enumerate their functions. Their deep roots have also been alluded to in treating of the medulla oblongata and the pons Varolii above.

1. The *olfactory nerve*. The nerve of smell (see SMELL).
2. The *optic nerve*. The nerve of sight (see EYE).
3. The *oculo-motor* or *third nerve*,—motor, supplying all the muscles of the eyeball except the superior oblique and external rectus; it also supplies the circular fibres of the iris and the ciliary muscle (see EYE).
4. The *pathetic* or *fourth nerve*,—motor, supplying the superior oblique muscle.
5. The *trigeminal* or *fifth nerve*. It has three branches: (A) The *ophthalmic* division of the fifth, or nerve of Willis, is sensory and supplies (*a*) the skin of the forehead, the eyebrow, the upper eyelid, the root and lobule of the nose; (*b*) the palpebral and ocular conjunctiva, the mucous membrane of the lachrymal passages, the frontal sinuses, the upper part of the nasal mucous membrane; (*c*) the cornea, the iris, the choroid, and the sclerotic; (*d*) the periosteum and bones of the frontal, orbital, and nasal regions; and (*e*) muscular sensibility to the intra-orbital muscles. It also influences the secretion of the lachrymal gland. It contains the fibres from the sympathetic governing the radiating fibres of the iris (see EYE), and also the vaso-motor fibres for the iris, choroid, and retina. It is associated with the otic ganglion. (B) The *superior maxillary* division of the fifth furnishes sensory branches to (*a*) the skin of the lower eyelid, alæ of the nose, upper lip, and skin covering the malar bone; (*b*) the mucous membrane of the nasal, pharyngeal, and palatine regions, the maxillary sinuses, the gums, the upper lip, and the Eustachian tube; (*c*) the periosteum of the bones corresponding to its distribution; and (*d*) the teeth of the upper jaw. It furnishes filaments to the nasal and palatine glands, and probably to the glands of the velum palati. It contains vaso-motor fibres from the sympathetic for the vessels, and is associated with the spheno-palatine ganglion. (C) The *inferior maxillary* division of the fifth contains sensory branches to (*a*) the skin of the cheeks, temples, lower lip, chin, front part of the ear, and external auditory canal; (*b*) the mucous membrane of the cheeks, lips, gums, front part of the tongue, the mucous membrane of the tympanum, and the mastoid cells; (*c*) the periosteum of the lower jaw and temporal bones; (*d*) the teeth of the lower jaw; (*e*) the temporo-maxillary articulation; and (*f*) the muscles in the neighborhood (muscular sensibility). It thus exercises an influence on taste, hearing, and secretion (see NUTRITION). It contains vaso-motor fibres for the bloodvessels. Its motor branch is distributed to the muscles of mastication; and it is related to two ganglia, the otic and the sub-maxillary.
6. The *sixth nerve* is motor, and supplies the external rectus muscle of the eyeball only.
7. The *facial* or *seventh nerve* is purely motor, and supplies all the muscles of expression. It also contains secretory fibres influencing the action of the salivary glands (see NUTRITION). Some assert that the chorda tympani contains gustatory fibres, but the question has not been settled. Claude Bernard found that the facial contains vaso-motor fibres.
8. The *auditory* or *eighth nerve* is the nerve of hearing (see EAR). In addition to purely auditory filaments it contains fibres from the semicircular canals having to do with impressions of movement in space (see pp. 44, 45).
9. The *glosso-pharyngeal nerve* is sensory to (*a*) the mucous membrane of the posterior part of the tongue (nerve of taste), the pillars of the fauces, the anterior face of the epiglottis, and the tonsils; and (*b*) the mucous membrane of the tympanum, the fenestra ovalis and fenestra rotunda (see EAR), the mastoid cells, and the Eustachian tube along with the fifth. It probably supplies motor fibres to the muscles of the pharynx, but this is doubtful. Vulpian states that it contains vaso-dilator fibres for the vessels of the posterior third of the tongue.
10. The *pneumogastric* or *vagus nerve* has many complicated actions. (A) It is sensitive to (*a*) the mucous membrane of all the respiratory passages, including specially the larynx; (*b*) the heart; (*c*) a portion of the digestive tube, namely, the base of the tongue, the velum palati, the pharynx, œsophagus, stomach, and probably the duodenum; (*d*) it confers muscular sensibility on the muscles to which it is distributed; (*e*) the mucous membrane of the biliary passages; (*f*) a part of the dura mater corresponding to the transverse and occipital sinuses; (*g*) the posterior part of the auditory canal. By the laryngeal branches it specially stimulates expiratory movements. (B) It is motor to (*a*) many

of the muscles of the palate; (*b*) the constrictors of the pharynx; (*c*) the œsophagus; (*d*) the larynx by (α) the superior laryngeal to the crico-thyroid muscle and a portion of the arytenoid, and by (β) the inferior or recurrent laryngeal to the rest of the muscles of the larynx; and (*e*) to the muscular fibres of the bronchial tubes. (C) It contains vaso-inhibitory fibres for the heart. In connection with this organ the vagus also contains sensory fibres and fibres belonging to the depressor system. (D) It influences secretion in the stomach (see NUTRITION); but it is doubtful whether it has any action on the renal secretion. (E) It influences the production of glycogen in the liver (see NUTRITION).

11. The *spinal accessory* is a motor nerve supplying the sterno-cleido-mastoid muscle and the trapezius. It gives an important branch to the vagus (*internal* branch), which supplies all the motor fibres in that nerve distributed to the larynx, except those in the superior laryngeal supplying the crico-thyroid muscle, and also the motor fibres of the vagus sent to the pharynx. According to Heidenhain, it also supplies the vagus with the inhibitory cardiac fibres.

12. The *hypoglossal* is exclusively a motor nerve supplying the muscles of the tongue and also the sub-hyoid muscles (see ANATOMY). It also contains vaso-motor filaments.

SPINAL NERVES.

Spinal nerves.

The spinal cord gives origin in its course to thirty-one pairs of spinal nerves, each nerve having two roots, anterior and posterior, the latter being distinguished by its greater thickness and by the presence of an enlargement called a ganglion, in which are found numerous bi-polar cells. The anterior root is motor, the posterior sensory. The mixed nerve after junction of the roots contains (*a*) sensory fibres passing to the posterior roots; (*b*) motor fibres coming from the anterior roots; (*c*) sympathetic fibres, either vaso-motor or vaso-dilator.

SYMPATHETIC SYSTEM.

Sympathetic system.

The fibres of the sympathetic system consist of two kinds —(1) of gray or gelatinous fibres, destitute of the white substance of Schwann; and (2) of medullated fibres similar to those met with in the cerebro-spinal centres. The gray fibres originate in the ganglia so prevalent in the sympathetic system, whilst the medullated fibres are believed to come from the cerebro-spinal system. The trunk of the great sympathetic nerve consists of a chain of swellings or ganglia, connected by intermediate cords of gray nerve-fibres, and extending nearly symmetrically on each side of the vertebral column, from the base of the cranium to the coccyx. On this part of the nerve twenty-four ganglia are placed on each side. This great trunk, as it passes along the spine, is connected with the spinal nerves, the connecting fibres being of the two kinds already described. The gray fibres dominate in the sympathetic nerves, and the medullated in the cerebro-spinal; and these two elements are mixed in various proportions in both of the great divisions of the nervous system. At their lower extremities the main trunks of opposite sides generally unite in the middle line; and at the upper ends each trunk, after being connected with the eighth and ninth cranial nerves, extends to the cranium, passes into that cavity along with the internal carotid artery, and there as well as in other situations, comes into connection with all the remaining cranial nerves, except the olfactory, auditory, and optic. This conjunction may be effected directly, as with the fourth, sixth, and ninth nerves; or through a ganglion, as the ophthalmic, with the third and fifth; the spheno-palatine, otic, and sub-maxillary, with the fifth and seventh, or facial; the geniculate, with the seventh or facial; the jugular, with the glosso-pharyngeal; and with the vagus, through one of its own ganglia. On the fibres of the sympathetic distributed to the viscera numerous ganglia, or plexuses in which ganglia exist, are met with, and frequently there is a plexus following the course of each vessel.

As to the functions of the sympathetic, experiment has led to the following conclusions:

Functions of sympathetic.

(*a*.) The *vaso-motor fibres of the head* are supplied by the cervical portion of the sympathetic, and originate in the cervical region of the cord, proceeding from it by the anterior roots of the lower cervical and upper dorsal nerves. The fibres supplying the radiating fibres of the iris also come from that region (see EYE).

(*b*.) The *vaso-motors of the upper limbs* and of the thorax come (α) from the inferior cervical and superior thoracic ganglia, and (β) from the cord, by communicating branches between the third and seventh dorsal vertebræ.

(*c*.) The *vaso-motor fibres of the lower limbs* come from the cord through the sciatic and crural nerves, whilst those of the pelvic organs are derived from the abdominal ganglia of the sympathetic.

(*d*.) The *vaso-motors of the abdominal viscera* exist chiefly in the splanchnic nerves; some fibres supplying the stomach appear to be derived from the pneumogastric.

(*e*.) The *splanchnic nerves* all arise in man from the thoracic ganglia of the sympathetic—the greater splanchnic from the fifth to the tenth ganglia, the lesser splanchnic from the tenth and eleventh, and the smallest splanchnic from the twelfth ganglion. The splanchnics supply the stomach, liver, spleen, pancreas, intestines, and kidneys. Division causes dilatation of vessels; irritation causes contraction of vessels, and appears also to arrest or inhibit peristaltic motions of the stomach and intestines. Probably they also contain secretory filaments. The functions of vaso-motor nerves have been already described.

A very complete bibliography of works relating to the nervous system will be found in the *Dictionnaire Encyclopédique des Sciences Médicales*, 2d ser., xii. p. 619. For the comparative anatomy of invertebrates consult Gegenbauer, *Elements of Comparative Anatomy* (trans. and rev. by F. Jeffrey Bell and E. Ray Lankester, London, 1878); for the comparative anatomy of vertebrates, Owen, *Anatomy of Vertebrates* (3 vols., London, 1866); for details in human anatomy, Quain, *Elements of Anatomy* (9th ed., ed. by Allen Thompson, E. A. Schäfer, and G. D. Thane, London, 1882); for general physiology, Foster, *Text-Book of Physiology* (4th ed., London, 1883); for special details in physiology, H. Beaunis, *Nouveaux Éléments de Physiologie Humaine* (2d ed., Paris, 1881); (specially for the functions of the cranial nerves) Flint, *Physiology of Man* (vol. v., New York, 1872); Ferrier, *On the Functions of the Brain* (London, 1876, also new ed.); Meynert, "On the Brain of Mammals," in Stricker's *Manual of Human and Comparative Histology* (vol. ii., the new Syd. Soc., London, 1872); Flechsig, *Die Leitungsbahnen im Gehirn und Rückenmark des Menschen* (Leipsic, 1876), also "Zur Anatomie und Entwickelungsgeschichte der Leitungsbahnen im Grosshirn des Menschen," in Du Bois-Reymond's *Archiv für Anatomie* (Leipsic, 1881); Gudden, "Experimentaluntersuchungen über das peripherische und centrale Nervensystem," in *Arch. f. Psychiatrie* (vol. ii., 1869, p. 713); Hitzig, *Untersuchungen über das Gehirn* (new series, 1874); Goltz, "Ueber die Verrichtungen des Grosshirns," in Pflüger's *Archiv* (1876), also "The discussion on the localization of function in the cortex cerebri," in *Trans. of Inter. Med. Cong.* (vol. i., 1881, p. 218); Munk *Ueber die Functionen der Grosshirnrinde* (Berlin, 1881); Ross, *Treatise on the Diseases of the Nervous System* (2d ed., London, 1883). (J. G. M.)

PART III.—PHYSIOLOGY OF PLANTS.

THE body of a plant, like that of an animal, consists of one or more structural units which are termed "cells," and in plants, as in animals, the cell consists essentially of an individualized mass of protoplasm.

The probable structure and chemical composition of protoplasm have been already considered. It need only be stated here that the protoplasmic cell-contents do not consist of pure protoplasm, but that the protoplasm contains imbedded in it particles of various substances which may be of the nature of food, or which may have been formed from food, or which are products of the metabolism of protoplasm; it is to the presence of these particles that the granular appearance of protoplasm is largely due. Moreover, there is present in the protoplasm of the cell, in the vast majority of cases at least, a well-defined, highly-refractive, usually somewhat spherical body, also protoplasmic in nature, the nucleus.

Cell-walls.

The cell or cells constituting the body of a plant present, in most cases, the important peculiarity that the protoplasm is enclosed in a membrane termed the "cell-wall." This membrane does not consist of protoplasm, but of a substance, cellulose, belonging to the group of the carbohydrates, and having the formula $xC_6H_{10}O_5$. All cell-walls do not, however, consist exclusively of this substance, though this is probably always the case at their first formation; but the cell-wall may undergo considerable modification during the life of the cell. It may, for example, undergo lignification; it then comes to consist largely of a substance termed "lignin," which is much richer in carbon than is cellulose; this takes place typically in those cells which form woody or sclerenchymatous tissue. Or it may undergo cuticularization, when it comes to consist largely of a substance termed "suberin" or "cutin," which, like lignin, is richer in carbon than cellulose. Or, again, it may become gummy or mucilaginous. These chemical differences are accompanied by differences in the physical properties of the cell-wall. A cellulose cell-wall is extensible, capable of swelling from taking up water into itself by imbibition, and is readily traversed by water. A lignified or cuticularized cell-wall is more rigid and less capable of swelling by imbibition; moreover, a cuticularized cell-wall is almost impermeable to water. A gummy or mucilaginous cell-wall is more extensible and more capable of swelling by imbibition.

Structure of cell.

The structure of the plant-cell is not the same at all periods of its life. When a cell is young the protoplasm occupies the whole of the cavity enclosed by the cell-wall. But in the course of growth the increase in bulk of the protoplasm is not nearly so great as the increase in surface of the cell-wall, so that in the mature cell the protoplasmic contents form merely a rather thin layer known as the *primordial utricle*, which lies in close contact with the internal surface of the cell-wall at all points. There thus comes to be a relatively large cavity in the cell, the *vacuole*, which is filled with a liquid, the *cell-sap*, consisting of water holding various substances, organic and inorganic, in solution. The structure of a mature living cell is then this: it consists of a cell-wall, lined with a layer of protoplasm, which encloses the vacuole, filled with cell-sap.

Functions of cells.

The protoplasm of plants is endowed with all those fundamental properties which are possessed by that of animals. When a plant is unicellular these properties are all exhibited, so far as they are necessary to the maintenance of the organism, by its protoplasm; in other words, all the necessary vital functions are performed by the protoplasm of the single cell of which the plant consists. The performance of all the necessary vital functions by the protoplasm of one cell obtains also in the case of not a few multicellular plants,—in those, namely, in which all the cells are similar to each other in structure and contents. In the great majority of multicellular plants, however, the functions are distributed to a greater or less extent; there is more or less complete physiological division of labor. In these plants the cells are not all similar in appearance, and their diversity is to be ascribed to their adaptation in different ways to the performance of particular functions. Further, the cells which have undergone modification in some particular direction for the performance of some particular function are grouped together in certain parts of the plant, and these parts are spoken of as "organs." Thus the roots of one of the higher plants are the organs for the absorption from the soil of water and substances in solution; the leaves are the organs for the absorption of gases from the air, and, in virtue of the green coloring-matter chlorophyll, which their cells contain, they are also the organs in which certain important constructive processes are carried on. But the extent to which physiological division of labor is carried out in plants is not nearly so considerable as it is in animals, and accordingly the protoplasm of the different cells of plants exhibits only in a very slight degree that specialization of structure which is so conspicuous in animals.

Absorption.

Absorption by root-hairs.

Osmosis.

1. *Absorption of Water and Substances in Solution.*—The bodies of plants, unlike those of the great majority of animals, do not contain any internal cavity into which the food may be taken as a preliminary to its being absorbed by the tissues. The materials of the food of plants are therefore taken up directly from without into the cells of the absorbent organs. The cells which are especially concerned in absorption are, in the higher and subaerial plants, the *root-hairs*,—thin-walled, unicellular, unbranched filaments which are developed from the epidermal cells some way behind the growing-point of the root; in the lower plants, and even in those of the higher plants which lie submerged, all the cells of the plants may take part in absorption. Since the food is directly absorbed by the cells, and since the cells all possess a cell-wall, the materials of the food must be taken up in solution. Salts and other substances are, as a matter of fact, taken up by the absorbent cells in the form of watery solutions. Substances which are soluble in water are dissolved in the water which is present in a greater or smaller proportion in all soils, and of those which are not soluble in water many are brought into solution by the acid sap which saturates the walls of the root-hairs. The actual process of absorption is an instance of diffusion through a membrane,—that is, of osmosis. Only such substances can be absorbed by a root-hair, for instance, as are capable of diffusing not only through the cell-wall but also through the protoplasmic primordial utricle. Further, only such substances can be absorbed by the root-hair as are present in larger proportion in the water to be absorbed than they are in the cell-sap of the root hair; this inequality between the proportion of any substance in solution in the liquid on the one side and in that of a membrane on the other is a necessary condition of osmosis. Hence, in order that the absorption of any particular substance by the root-hairs may be continuous, it is necessary that the substance in question should not accumulate in the cell-sap; this accumulation is prevented either by the actual consumption (*i.e.*, chemical decomposition) of the substance in the cell or by the withdrawal of it to supply the needs of adjacent cells. In fact, so far as the process of absorption is concerned, the cell-sap of the internal cells of the root stands in the same relation to the cell-sap of the root-hairs as the cell-sap of the root-hairs does to the external liquid; and, as this relation exists between the successive internal layers of cells, there is set up a current of absorbed substances which travels from the surface towards the centre.

Conditions of amount absorbed.

It appears from the foregoing considerations that the amount of any particular salt absorbed in a given time depends upon (1) its diffusibility and (2) its consumption in the plant. Of these two conditions the second is the one which is of real physiological importance, and, if only the given time is sufficiently long, the first condition may be neglected. For instance, let us suppose that a plant is absorbing by its roots two salts— the one (*A*) being very diffusible, the other (*B*) much less diffusible—and that, whilst the former undergoes no change in the plant after absorption, the latter is at once decomposed. Now, if the time of observation is short, it may happen that the amount absorbed of the salt *A* will be found to be greater than that of the salt *B*; but, if the time be extended, the amount absorbed of the salt *B* will certainly be found to be greater than that of the salt *A*. The explanation is that the salt *A* would at first be absorbed very rapidly, on account of its high diffusibility; but the absorption of it would gradually diminish, in consequence of the accumulation of it in the cell-sap of the plant, until it ceased altogether. The absorption of the salt *B*, on the other hand, if less active at first than that of *A*, would be continuous, and thus, over a relatively long period of time, the amount of it absorbed would come to be much greater than that of *A*.

Specific absorbent capacity.

As a matter of fact, it has been ascertained that when different salts or other substances are presented to the root of a plant they are absorbed in different quantities. And further, it has been ascertained that the different salts are absorbed in different proportions by the roots of different plants; it is, in fact, upon this that the necessity for the "rotation of crops" depends. A striking illustration of this is afforded by a comparison of the amount of silica present in the ash of equal dry weights of gramineous and leguminous plants. According to Wolff—

100 parts meadow-hay contain 27.01 per cent. of silica.
" wheat-straw " 67.50 " "
" red clover " 2.57 " "
" pea-straw " 6.83 " "

The absorption of salts in certain proportions by a plant is the expression of what may be conveniently termed its "specific absorbent capacity." It must not be supposed that this term suggests that the roots possess any selective power by which they absorb this salt and reject that one, or by which this one is absorbed in larger proportion than that one. The question as to whether or not a particular substance will be absorbed is a purely physical one, dependent upon the relation between molecules of the substance and the cell-wall and primordial utricle which they have to traverse, and in no degree dependent upon the usefulness or hurtfulness of the substance to the plant. The amount absorbed of any particular substance depends ultimately upon the activity with which the plant chemically alters the substance after absorption. To return to the illustration just given. The great difference between the amounts of silica present in the ash of gramineous and of leguminous plants respectively, is the expression of the fact that the former are capable of withdrawing relatively large quantities of absorbed silica from the sphere of osmotic activity, and depositing it in the insoluble form in the tissues, whereas the latter can only do so to a comparatively small extent. The specific absorbent capacity of a plant is simply a manifestation of its specific metabolic properties.

Law of absorption.

The amount of the various salts absorbed is not, however, exclusively dependent upon the specific absorbent capacity of the plant, for it is materially affected by the composition of the soil. The larger the quantity of any substance presented to the roots, the greater, other things being equal, will be the amount of it absorbed. This does not mean that substances can be absorbed by the roots in solutions of any degree of concentration. It appears that the root-hairs can only absorb very dilute solutions; but for the watery solution of any salt capable of being absorbed there is a certain degree of concentration at which the proportion of the amount of the salt absorbed to that of the water absorbed is the same as that of the solution. If the solution be more concentrated the proportion of water absorbed will be greater; if the solution be more dilute the proportion of salt absorbed will be greater. This is the general "law of absorption" determined by the experiments of De Saussure and of Wolff. It must, however, be borne in mind that, though the *proportion* of salt absorbed is larger in the case of a dilute than of a more concentrated solution, yet the *absolute quantity* of it absorbed from a more concentrated solution in a given time is greater than that absorbed from a dilute solution.

Absorption of gases.

2. *Absorption of Gases.*—An interchange of gases is constantly taking place between the plant and the medium in which it lives—in the case of terrestrial plants, between the plant and the air; in the case of aquatic plants, between the plant and the water. When the plant is a simple one each of its cells is in direct relation with the external medium; when it is of complex structure there is usually some means provided by which the more internal cells are brought into relation with it, namely, a continuous system of intercellular spaces which communicate with the exterior in terrestrial plants by certain apertures termed "stomata," in the epidermis of the leaves and young stems, and by others termed "lenticels," in the cortical tissue of older stems and of roots.

Oxygen and carbon dioxide.

The gases principally absorbed by plants are oxygen and carbon dioxide. The former is absorbed by every living cell, and at all times; the latter is absorbed exclusively by cells which contain chlorophyll, and by them only when exposed to light. In the more highly organized plants the cells which contain chlorophyll are confined almost entirely to the leaves, so that the leaves may be regarded as the organs by which these plants absorb carbon dioxide. It has been held that the stomata are of great importance in promoting the absorption of this gas by the leaves, but the experiments of Boussingault prove that this view is not well founded. He discovered, namely, that the upper surface of the leaves of various plants with which he experimented absorbed carbon dioxide more actively than the lower surface, although the upper surface had scarcely any stomata, whereas they were very numerous on the lower. The absorption of carbon dioxide by the leaves is directly effected by the superficial cells.

Absorption of gases in solution.

Gases, like solid substances, are only absorbed in solution by the cells of plants. They may be brought to the surface of the cell-wall already dissolved in water, as in the case of submerged plants, or they may be dissolved from the atmosphere by the sap which saturates the cell-wall, as in the case of land-plants; in either case they reach the interior of the cell in solution. When a gas has been taken up at the surface it diffuses throughout the cell-sap; and in the case of a gas like nitrogen, for instance, which is not chemically altered in the cell, the absorption of it will cease when the cell-sap has become saturated with it. If, however, the metabolism of the cell changes the chemical condition of a gas its absorption will be continuous. This accords with what has been said with regard to substances absorbed by the roots.

Another analogy exists between the absorption of gases and the absorption of substances in solution, namely, that, just as the root can only absorb a solution below a certain degree of concentration, so the leaf can only absorb a gas below a certain degree of pressure. Let us take in illustration the case of carbon dioxide. The pressure of the carbon dioxide in the air is very slight (0.04 per cent. by volume). It was first observed by Percival that an increase in the quantity of carbon dioxide in the air is favorable to the nutrition of green plants; De Saussure found that a considerable increase is prejudicial; and subsequently Godlewski showed that the optimum proportion is from 8 to 10 per cent.,—that is, that carbon dioxide is most readily absorbed by the plant when its pressure is about 200 times greater than in ordinary air. Boussingault found that when leaves are exposed to sunlight in an atmosphere of pure carbon dioxide at the ordinary pressure they cannot decompose it, but if the gas is at a low pressure (in his experiment 0.17 mm. of mercury) they can do so.

Other gases absorbed.

Besides oxygen and carbon dioxide other gases are also absorbed by plants, but to a small extent only. Nitrogen is absorbed in small quantities merely in virtue of its solubility and diffusibility; as mentioned above, it is not in any way acted upon by the cells after its absorption. It appears that ammonia may be absorbed from the air in the form of gas by the leaves, and that, when thus absorbed, it contributes to the nutrition of the plant. Other gases, such as sulphur dioxide, sulphuretted hydrogen, and hydrochloric acid, which are occasionally present in the air as impurities, are absorbed by the leaves, as is shown by the pernicious effects which they produce.

Circulation.

Osmotic circulation.

It is obviously necessary, in multicellular plants in which certain cells only are in a position to absorb food-materials from without, that these food-materials should be conveyed from the absorbent cells to the remainder of the plant. In no plant is there any organ comparable to the heart of animals by means of which a distribution throughout the tissues of absorbed food-materials is effected. The distribution is accomplished by purely physical means, principally by osmosis. When the cell-sap of a cell becomes charged, by absorption from without or from neighboring cells, with any substance, diffusion-currents are at once set up between this cell and any adjacent cells the cell-sap of which may contain the substance in question in smaller proportion, and these currents will persist until osmotic equilibrium, as far as this substance is concerned, is established. The diffusion-currents do not flow in any definite direction, but their course is determined simply by inequalities in the chemical composition of the cell-sap of the cells in different parts of the plant. Since in subaerial plants the roots are as a rule the only organs which absorb substances from the soil, and since the cell-sap of their cells is therefore relatively rich in absorbed food-materials, the general direction of the diffusion-currents is from the roots upwards into the stem and leaves.

Root pressure.

In cellular plants—that is, in plants which possess no vascular tissue—the distribution of absorbed food-materials is effected solely by osmosis. Many of these plants are small, so that the distribution is effected from cell to cell with sufficient rapidity by this means. Those of them that are large have a very considerable absorbent surface, many of them being aquatic in habit, so that the absorbed substances have no great distance to travel. In vascular plants, more particularly in those which are subaerial in habit, the distribution of the water, holding substances in solution which is absorbed by the roots, is effected to a considerable extent by means of the vascular system. The forces by which the flow of liquid through the vascular tissue is maintained are the following. The first is the *root pressure*. It is a matter of common observation that, when the stems of vascular plants are cut across, particularly in the spring, an escape of water takes place from the surface of that portion of the stem which still remains connected with the root, an escape which may persist for some considerable time. It has been ascertained that this outflow of water takes place under considerable pressure; for instance, Hales observed, in the case of a Vine, that the pressure was sufficiently great to support a column of mercury 32½ inches in height. But the root-pressure not only manifests itself by causing a flow of water from the cut surfaces of stems, it also causes in many plants the exudation of drops of water at the free surface. Drops may commonly be seen on the surface of certain Fungi (*Pilobolus crystallinus*, *Penicillium glaucum*, *Merulius lacrimans*), which are exuded in consequence of the hydrostatic pressure set up in the plant by the active absorption effected by the organs (rhizoids) which here perform the functions of roots. Again, drops are frequently to be found on the margins and at the apices of the leaves, especially the younger ones, of many plants, such as Grasses, Aroids, Alchemillas, Saxifrages, etc. That the formation of these drops depends upon the forcing of water upwards through the vessels by the root-pressure is proved by the fact that, if the stem be cut off from the root and then placed with its cut end in water, no more drops will appear on the leaves. The water thus forced into the vascular system is not pure water, but a watery solution of various substances, principally salts absorbed by the roots. It is therefore obvious that the root-pressure assists in the distribution of these substances throughout the plant.

Structure of root.

In order to understand how the root-pressure is set up it will be necessary to give a brief description of the general structure of the root. It consists of a central fibro-vascular cylinder which is surrounded by several layers of parenchymatous cells, the most external of these layers being in contact with the epidermal layer, certain cells of which are developed into root-hairs. Water is absorbed by the root-hairs and passes from them by osmosis into the subjacent parenchymatous cells. It is obvious, however, that osmosis cannot take place between the cells of the innermost layer and the vessels, for the conditions of osmosis are not fulfilled, inasmuch as the vessels at first contain no liquid. The passage of water from the cells into the vessels can only take place by filtration. For this a certain pressure is necessary, and this pressure is set up by the absorbent activity of the root-hairs and of the parenchymatous cells. The system of cells absorbs large quantities of water, more indeed than the cells can contain, so that at length the resistance of the cell-walls is overcome at what is presumedly the weakest point, and water filters into the cavities of the vessels of the wood. There it collects, and it may, under certain circumstances, fill the whole vascular system; then, since absorption is still going on at the surface of the roots, sufficient pressure is set up to cause that exudation of drops on the leaves to which allusion has been made, and, if the stem be cut across, to cause "bleeding" at the cut surface. From the foregoing account it is apparent that the root-pressure is the expression of the absorbent activity of the root-hairs.

Transpiration.

Light and transpiration.

But the vessels of the wood do not always contain water. Hales observed that, whereas a Vine will bleed freely if its stem be cut across in the month of April, no bleeding is observed if it be cut in July. And yet it cannot be doubted that the plant is absorbing water by its roots more actively in July than in April. The explanation of these facts is that, although in July the plant is absorbing water actively by its roots, yet it is losing so much in the form of a vapor from its leaves that water does not accumulate in the cavities of the vessels. This loss of water in the form of vapor from the general surface of the plant exposed to the air is termed "transpiration." The parts of the plant which are more especially concerned in transpiration are the leaves. By their structure they are peculiarly adapted for this purpose. The tissue of a leaf is penetrated in all directions by intercellular spaces, which communicate directly with the external air by means of the stomata in the epidermis. In this way a very large surface of moist and thin cell-wall is brought into contact with the air, a condition most favorable to evaporation. Some idea of the activity of transpiration in a plant is afforded by the following determinations made by Hales. In the case of a Sunflower with a leaf-surface of 5616 square inches the amount of water transpired during twelve hours of daylight was 30 fluid oz. (a pint and a half); in the case of a Cabbage with 2736 square inches of leaf-surface the amount of water transpired in the same time was 25 fluid oz. The activity of transpiration is very much affected by external conditions,—the moister the air, the smaller will be the transpiration; and conversely, the drier the air and the higher the temperature, the greater will be the amount of water transpired. Light, too, has a remarkable influence: it has been ascertained by a great number of observers that transpiration is more active in light than in darkness. It seems probable that this is to be attributed largely to the influence of light upon the stomata. Each stoma is usually bounded by two cells, termed "guard-cells," which are capable of so altering their form as to close or to open the aperture between them. The form of the guard-cells is dependent upon the amount of water which they contain. When they hold comparatively little water, and are flaccid, their adjacent free surfaces are straight and in contact with each other; the stoma is then closed. When, however, they contain so much water that their cell-walls are under considerable pressure from within—in a word, when the guard-cells are turgid—they curve so that their adjacent free surfaces are no longer in contact, but a space is left between them; the stoma is then open. It appears that the guard-cells become turgid under the influence of light; and it it is probably to this open condition of the stomata that the greater transpiration of leaves when exposed to light is to be ascribed.

Transpiration-current.

It is obvious that the effect of transpiration upon the distribution of water through the plant is very great. It sets up a rapid current, known as the "transpiration-current," which travels from the roots upwards towards the leaves. Sachs has made some observations as to its rate by means of the lithium-method, which consists in supplying the root of a plant with a solution of a salt of lithium, and determining by means of the spectroscope the length of the stem in which lithium could be detected after the lapse of a given time. He estimates the rate per hour to be in *Nicotiana Tabacum* 118 centimètres (46.458 inches), in *Helianthus annuus* 63 (24.793 inches), and in *Vitis vinifera* 98 (38.583 inches). But the water of the transpiration-current holds salts and other substances in solution. It is clear, therefore, that transpiration promotes the distribution not only of water but also of the substances which the water holds in solution. Sachs's experiments go to prove that salts travel in solution in the current; hence it affords a ready means of transport of substances from the roots, where they are absorbed, to the leaves where (as will be shown below) the food undergoes certain changes which fit it for the nutrition of the plant. There is yet another important point to be noted with regard to the physiological significance of transpiration. It has been mentioned that the roots absorb from the soil only very dilute solutions of salts and other substances, so that for any given quantity of a salt absorbed an excessive quantity of water has to be absorbed likewise. It is obvious that the absorption of salts from the soil by the roots can only go on provided that the plant is able to get rid of the excess of absorbed water, and this is effected chiefly by transpiration, though, as mentioned above, an actual excretion of water in the form of drops not unfrequently takes place.

Channel of transpiration.

It has been conclusively proved that the channel along which the transpiration-current travels is the fibro-vascular tissue, and that it is the xylem or woody portion of a fibro-vascular bundle which is the conducting tissue. In the case of plants like Conifers and Dicotyledons, in which there is a formation of secondary xylem or wood from a cambium-layer, it is the younger wood, the alburnum, along which the transpiration-current passes. The older wood, the duramen, it is true, usually contains water, but it does not serve as a conducting channel, only as a reservoir. The question now arises as to the mode in which the transpiration-current travels through the wood. Since the vessels contain no water in their cavities at the time when transpiration is most active, it is clear that it is not in the cavities of the vessels that the water of the current travels. Sachs is of opinion that it moves in the substance of the lignified cell-walls. Others, amongst whom Hartig may be especially named, consider that it travels from the cavity of one wood-cell to that of the next by filtration under pressure. The mechanism of conduction would, in the latter case, be this: the conducting cells contain air and water; when water is withdrawn from one of them the contained air becomes rarified, and the water in that cell is then subject to a lower pressure than that in neighboring cells; as a consequence water is forced into the former cell through the thin membranes of the pits in its walls until equilibrium is re-established. Inasmuch, then, as the air in the conducting wood-cells in the leaves is constantly undergoing rarefaction in consequence of transpiration, a current is set up towards the leaves from the stem and the root.

Negative pressure.

There can be no doubt, however, that, as Hales first pointed out, transpiration has the effect of diminishing the pressure of gases contained in the cells and vessels. Von Höhnel has found that, if the stem of a transpiring plant be cut through under mercury, the mercury will at once rise to a height of several centimètres in the vessels, the greatest height being reached in the younger vessels. This rise can only be accounted for by ascribing it to the difference between the atmospheric pressure and the pressure of the gases in the vessels, the lower pressure of the latter being due to the removal of water by transpiration, which necessarily involves an expansion, and therefore also a diminished pressure of the gases. The effect of this so-called "negative pressure" is to set up diffusion-currents of gases from the surrounding tissues into the cells and vessels of the fibro-vascular bundles. It must not be assumed, however, that the vessels are the principal channels in which gases circulate throughout the plant. They circulate principally in the intercellular spaces which communicate with the external air by means of the stomata.

Recapitulation.

Stating the foregoing facts in the most general terms, it appears that in a plant the food-materials travel by osmosis from the absorbent organs to the organs in which the processes of constructive metabolism are carried on—in one of the higher plants, for instance, from the roots to the leaves—and that the distribution of the food-materials is assisted and accelerated by root-pressure and by transpiration, the fullest expression of this being the transpiration-current in terrestrial vascular plants. And just as there is a current of food-materials tending towards the organs in which the processes of constructive metabolism are carried on, so also there is a current of the organic nutrient substances formed in these organs travelling from them to the other parts of the plant. The final cause of the current is the same in both cases. A given salt, for instance, which has been absorbed by the root travels towards the leaves because it is in some way undergoing chemical alteration in those organs; similarly, a given organic substance formed in the leaves travels from them towards any part of the plant in which that substance is being chemically altered, or, to use a somewhat different expression, is being consumed. The cause of the diffusion in either case is the disturbance of osmotic equilibrium by the chemical alteration of the substance, and the result is a current of the substance from those parts which are relatively rich in it to those which are relatively poor.

Distribution of organic nutrient substances.

Distribution of Organic Nutrient Substances.—In vascular plants the distribution of the organic nutrient substances is, like the conduction of substances absorbed by the roots, assisted by the vascular tissue; but, whereas it is the wood which is the conducting tissue in the latter case, in the former it is the bast or phloem, and more especially the bast-vessels or sieve-tubes. These vessels consist of elongated cells placed end to end, the septa between the adjacent cells being perforated so as to admit of a direct continuity between their protoplasmic contents.

The importance of the wood and of the bast respectively as conducting tissues is well illustrated by the "ringing" experiments which have been repeatedly made on plants, such as Dicotyledons and Conifers, which have the fibro-vascular bundles arranged in a ring in the stem. When a ring of tissue, extending inwards as far as the cambium-layer, is removed from the stem of a dicotyledonous plant the following facts are to be observed: (1) that the leaves which are borne on branches arising from the stem above the level at which the ring of tissue has been removed will not exhibit any signs of withering; (2) that the part of the stem below the incision will not increase in thickness to nearly the same extent as the part above the incision. From these facts it is clear (1) that the operation in question has not materially affected the conduction of water and food-materials in solution upwards to the leaves, and, since the wood is the only unimpaired tissue, it is obviously in the wood that the upward current travels; and (2) that the operation has materially affected the conduction of organic nutrient substances to the parts below the incision, the diminished growth of these parts being the result of inadequate nutrition; this effect of the operation is to be ascribed, principally at least, to the destruction of the continuity of the bast-tissue.

Laticiferous tissue and vessels.

In various families of vascular plants, and in some cellular plants also (certain Fungi), there are to be found cells, forming what is known as "laticiferous tissue," which probably assist in distributing both food-materials and organic nutrient substances throughout the plant. In some plants (*Euphorbiaceæ*, *Asclepiadaceæ*, *Moreæ*, etc.) the cells are quite distinct from each other, and extend from one end of the plant to the other, growing with its growth, so that they attain a very considerable size, and are much branched; these are spoken of as "laticiferous cells." In other plants (*Cichoriaceæ*, *Papaveraceæ*, etc.) the cells are comparatively small, and fuse together to form an intricate network; these are spoken of as "laticiferous vessels." The cells of the laticiferous tissue contain a milky liquid, termed "latex," which consists of water holding inorganic salts, sugar, gum, extractives and proteids, in solution, and holding in suspension resinous and fatty bodies. The cells contain protoplasm in addition, and not uncommonly starch-granules.

Food of Plants.

Food of plants.

A rough idea of the nature of its food can be obtained by analyzing a plant. It is found that, in the process of incineration, a considerable weight of its dry solid is burned up and given off in the form of gas; this represents the combustible or organic portion of the plant. The incombustible residue, the ash, is found to be of a mineral or inorganic nature. The gases given off are carbon dioxide, watery vapor, and nitrogen, showing that the combustible portion of the plant contained the elements carbon, hydrogen, and nitrogen. In the ash occurs a number of elements, of which the principal are sulphur, phosphorus, potassium, calcium, magnesium, iron, sodium, chlorine, and silicon. But it does not necessarily follow that, because any given chemical element can be detected in a plant, that element is to be regarded as part of the food of the plant, for, as has been already pointed out, plants may absorb substances which in no way contribute to their nutrition, or are even injurious. When an element enters into the chemical composition of the substances of which the organized structure of the plant consists (as C, H, O in starch and cellulose, C, H, O, N, S, P in proteids), then it is clear that this element must form part of the food; but, when, as in the case of the rest of the elements mentioned above, an element does not thus contribute to the building up of the organized substance of the plant, its admission to the rank of a food-material must be the subject of direct experiment. It has been ascertained that many of the elements enumerated above, though, so far as is known, they are not essential constituents of the organized structure of the plant, are nevertheless essential to the maintenance of its life; they may not, indeed, go to build up the plant-substance, but in some way or other they promote the metabolic processes.

Water-culture.

The method which has afforded the most valuable results bearing upon the relative physiological importance of various food-materials is that which is known as "water-culture." It consists in growing plants with their roots immersed in water holding certain salts in known quantities in solution. The mixture of salts can, of course, be varied at pleasure, and the effect upon the plant of the absence of certain elements, as of their presence in smaller or larger quantities, can be observed. Further, by an analysis of that portion of the solution which remains unabsorbed at the close of the experiment, the proportion in which the various salts have been absorbed can be ascertained.

The elements of the food of plants may be conveniently classified into two groups, the first consisting of those which enter into the composition of organized plant-substance, the second consisting of those which, without actually entering into the structure of the plant, are essential to the proper performance of the metabolic processes. To the first group belong the elements C, H, O, N, S, P; to the second, K, Ca, Mg, Fe, Cl (?).

We will now briefly discuss the form in which the various chemical elements are absorbed, and their use in the economy of the plant, beginning with those which enter into the composition of organized plant-substance. A few words will also be said about those elements, such as sodium and silicon, which, though always present in the ash of plants, appear to have no real physiological significance as far as nutrition is concerned.

Food elements.

Carbon.—This element constitutes a large percentage of the total dry weight of plants. It enters into the composition of all the organic substances, such as starch, cellulose, and other carbo-hydrates, fats and other hydrocarbons, proteids, organic acids, alkaloids, etc., which may be present in plants. The form in which carbon is absorbed depends upon the nature of the plant. It may be broadly stated that all those which contain chlorophyll absorb their carbon in the form of carbon dioxide, whereas those which do not contain chlorophyll absorb their carbon in the form of more complex carbon compounds which contain C, H, and O, and in which the C is directly combined with H. Moreover, in green plants it is only those cells which contain chlorophyll that can absorb carbon dioxide, and this only under the influence of light. It must not be assumed, however, that plants containing chlorophyll are incapable of absorbing complex carbon compounds. It is known from the researches of Darwin and others that the "insectivorous" plants absorb such compounds by their modified leaves, and it is known also that a number of green plants, such as the Mistletoe, the Rattle, and others, live parasitically on other plants. It has indeed been proved by direct experiment that green plants can absorb substances such as urea, glycocoll, asparagin, leucin, tyrosin, which are all highly complex carbon compounds. The physiological distinction to be drawn between plants which do and those which do not contain chlorophyll is really that the former are capable of assimilating carbon in a simple compound, such as CO_2, whilst the latter are incapable of doing this, and require, therefore, compounds of more complex constitution. Plants which do not contain chlorophyll are either parasites (that is, they live upon other living organisms) or saprophytes (that is, they live upon the products of the waste and decay of other living organisms). The plants which do not contain chlorophyll are the Fungi and a few Phanerogams,—*Epipogium Gmelini*, *Cuscuta*, *Monotropa*, *Lathræa*, *Corallorhiza*. Of these the Fungi include both parasites and saprophytes; *Epipogium Gmelini* is a saprophyte, *Cuscuta* a parasite, and *Monotropa* may apparently be either the one or the other. The *Orobancheæ*, which are parasitic, and *Neottia*, which is saprophytic, have not a green color, but small quantities of chlorophyll have nevertheless been detected in them.

Hydrogen.—This element is absorbed by all plants in the form of water and of ammonia and its compounds; it may also be absorbed in the form of organic compounds.

Oxygen.—Oxygen is taken up either in the free state, or in combination in the form of water or of salts; it may also be absorbed in the form of organic compounds. The free oxygen absorbed is especially concerned in the processes of destructive metabolism, the combined oxygen in those of constructive metabolism.

Nitrogen.—Nitrogen is absorbed in the form of ammonia and its compounds and of nitrates; it may also be absorbed in the form of organic nitrogenous compounds. The researches of Lawes, Gilbert, and Pugh, as also those of Boussingault, have proved that plants are incapable of assimilating free nitrogen. It appears that, on the whole, nitrogen absorbed in the form of ammonia compounds is more readily assimilated by plants than nitrogen absorbed in the form of nitrates. Pasteur has shown, for instance, that the Yeast plant cannot assimilate nitrates.

Sulphur.—Sulphur is absorbed from the soil as sulphates, those of ammonium, potassium, magnesium, and calcium being the most advantageous. It may also be absorbed to some extent in the form of organic compounds.

Phosphorus.—Phosphorus is absorbed from the soil in the form of phosphates. Besides being a constituent of certain substances allied to the proteids, such as nuclein and plastin, phosphorus seems to bear an important relation to certain of the metabolic processes. Phosphates are to be found especially in those parts of plants which are rich in protoplasmic cell-contents. It appears that a supply of phosphates promotes considerably the assimilation of nitrogen by the plant.

Elements promoting metabolism.

Potassium.—Potassium is absorbed in the form of a variety of salts, of which the chloride is the most advantageous form, according to Nobbe. Like phosphorus, it is to be found in largest quantity in those parts of plants which are rich in protoplasmic cell-contents. It appears to have an important influence on the constructive metabolic processes of plants which contain chlorophyll. Nobbe found, in the case of a Buckwheat plant, that in the absence of a supply of potassium its growth was diminutive, and that the amount of starch in the plant was very small. On the addition of potassium chloride to the water-culture the starch-grains became more numerous in the chlorophyll-corpuscles, and made their appearance also in the tissues of the stem. The precise significance of potassium in relation to these processes is not known. Liebig was of opinion that it played an important part in the distribution of carbohydrates throughout the plant, but this view has not been confirmed. It appears rather that the facts upon which this view was based point to an effect due not to the potassium itself, but the particular salt of it which was absorbed (see "Chlorine" below). There can be no doubt, however, that potassium bears some important relation to the formation and storing up of carbohydrates, for it is always present in large quantity in organs, such as leaves, tubers, seeds, etc., in which these processes especially take place.

Calcium.—The compounds in which calcium is usually absorbed are the sulphate, phosphate, nitrate, and carbonate, the last-named salt undergoing decomposition in the process. It appears that the chloride is injurious to plants. The precise use of calcium is unknown. It very commonly occurs in the cells of plants in the form of crystals of the carbonate or the oxalate, and possibly one of its important functions is to form insoluble salts with acids which are of no further use in the plant, and are even injurious to it.

Magnesium.—Like calcium, this may be advantageously absorbed in the form of all its salts, except the chloride. Nothing definite is known as to its use.

Iron.—It appears that iron may be absorbed in the form of any of its salts. It is known to be essential only to those plants which contain chlorophyll. If a seedling be cultivated by the method of water-culture, with its roots in a solution which contains no iron, the leaves formed will be successively paler in color until at length they are nearly white; in this state the plant is said to be "chlorotic." If a small quantity of a salt of iron be then added to the solution in which the roots are, or if the pale leaves be painted over with a dilute solution of iron, they will soon become green. Iron, therefore, plays an important part in connection with the formation of the green coloring matter chlorophyll. It is still a debated question whether or not iron enters into the the composition of the chlorophyll-molecule.

Chlorine.—Chlorine is absorbed from the soil in the form of chlorides. The evidence as to its significance in the nutrition of plants is conflicting. Nobbe, Leydbecker, Beyer, and more recently Farsky, have observed that water-cultures of Buckwheat, Barley, and Oats do not flourish when grown in solutions containing no chlorides, and since the chlorophyll-corpuscles of the plants become crowded with starch-grains it was thought that chlorine had some importance in connection with the translocation of carbohydrates. Knop and Dworzak have observed, on the other hand, that Maize plants will grow well in solutions containing no chlorine, and further, that the accumulation of starch in the chlorophyll-corpuscles may be induced by various abnormal external conditions.

Elements in ash.

Sodium.—This element is never absent from the ash of plants, and in some cases, especially in maritime plants, it is present in considerable quantity. It might be inferred from its constant occurrence in the ash that sodium is of some importance as a food material; it was thought, in fact, that it might serve as a substitute for potassium, but this has not been found to be the case. Its constant presence in the ash is due merely to its universal distribution in the soil.

Silicon.—Silicon is absorbed in the form of soluble silicates, and possibly as soluble silicic acid. The silicates are brought into solution to some extent by the carbon dioxide present in the soil, and also by the acid sap of the root-hairs. It is always present in the ash of plants, sometimes in large quantity; in wheat-straw, for instance, it constitutes 67.50 per cent. of the ash (Wolff). It was thought that silicon must be essential to nutrition. Sachs found, however, that a Maize plant will grow well in a water-culture from which it can obtain no silicon. On the other hand, Wolff has ascertained that in the case of Oats the number of perfect seeds formed is greater when the plant is abundantly supplied with silicon.

Constructive Metabolism (Anabolism).

Metabolism.

When a plant is adequately supplied with appropriate food-materials, the external conditions to which it is exposed being favorable, it increases in weight, owing to an accumulation of the substances which constitute its organized structure. But this gain in weight is only relative; for side by side with the constructive processes by which the food is converted into the substance of the plant—processes, that is, which have as their result the formation of relatively complex from relatively simple chemical compounds—there are going on destructive processes—processes, that is which have as their result the formation of relatively simple from relatively complex chemical compounds—which are attended by a loss of weight. The gain in weight by the plant represents the difference between the activity of the constructive and of the destructive metabolic processes respectively. The end of constructive metabolism is the formation of protoplasm. Protoplasm is certainly a very complex substance, though its precise constitution is unknown, and the food-materials of plants are much simpler substances; there must, therefore, be a considerable number of processes to be gone through before protoplasm can be produced from the food-materials. We will now study these processes, and, in the first instance, confine our attention to those which have been ascertained to take place in plants which possess chlorophyll.

Building up of protoplasm.

It has been already mentioned that a green plant absorbs carbon dioxide when it is exposed to light. Under these circumstances it also increases in weight; it does not increase in weight when kept in the dark, nor when it is kept in an atmosphere from which all carbon dioxide has been removed. The absorption of carbon dioxide is then an indication that the plant is performing certain constructive processes,—that it is assimilating carbon. The absorption of carbon dioxide is accompanied by an evolution of oxygen gas, the volume of the latter exhaled being approximately equivalent to that of the carbon dioxide absorbed. This is an indication that the absorbed carbon dioxide is undergoing chemical change. It seems probable that the change is of the nature expressed by the following equation—

$$xCO_2 + xH_2O = x(CH_2O) + xO_2.$$

—that is, that from carbon dioxide and water a substance allied to formic aldehyde, or a polymer of it, is formed, free oxygen being evolved. It may be stated generally, with some considerable probability, that the first step in the constructive metabolism of a plant containing chlorophyll is the formation of a non-nitrogenous organic compound. It is just this formation of non-nitrogenous organic substance from carbon dioxide and water that the plant which is destitute of chlorophyll is unable to perform; and it is on account of this inability that the carbon of its food must be supplied to it in the form of organic compounds, as pointed out above. The further processes of constructive metabolism appear to be much the same in all plants, whether they contain chlorophyll or not. The next step is probably the formation of some relatively simple nitrogenous organic substances from the nitrogen of the food and the non-nitrogenous organic substance which has been either formed in the plant or absorbed as food from without. The nitrogenous substances thus formed are probably crystallizable bodies, such as asparagin and leucin, which all contain nitrogen in the form of the group NH_2. The derivation of these substances from the nitrogenous food when it contains nitrogen in the form of ammonia (NH_3) is sufficiently obvious. When, however, it consists of nitrates it appears probable that the nitrogen of the nitric acid has to be transformed into the nitrogen of ammonia,—that is, to be combined directly with hydrogen; it is probably owing to their inability to effect this transformation that some plants, as mentioned above, cannot be supplied with nitrogen in the form of nitrates. The first step in this transformation is probably, as Emmerling has pointed out, the decomposition of the absorbed nitrates by the organic acids, especially the oxalic, of the plant; the liberated nitric acid then undergoes chemical change, resulting in the formation of ammonia. It is impossible to say with precision how this is effected, but there can be little doubt that it does take place; some direct evidence is afforded by Hosaeus's observation that ammonia salts were to be found on analysis in a number of plants which had been supplied with manure containing no ammonia. The next process is an increase in the size and complexity of the molecule, attended in certain cases by the introduction of new elements (S and P), the product being one of those substances which are known as "proteids." The last stage is the formation of living protoplasm from the proteid and other organic substances.

Formation of nitrogenous organic substance.

The formation of nitrogenous organic substance may take place in any living cell, and, unlike the formation of non-nitrogenous organic substance, it goes on quite independently of the presence of chlorophyll and of the action of light. But there is evidence to show that in green plants it is especially in the cells which contain the chlorophyll that the process goes on. The experiments by which this evidence has been obtained were made on plants with distinctly differentiated leaves. Emmerling observed in the Bean that, whereas in the root a relatively large quantity of nitric acid could be detected, there was much less in the stem, and in the leaves none at all, and he inferred that as the nitrates are supplied to the leaves they are used up in the formation of organic nitrogenous substance. Further, from the researches of Kellner, Emmerling, Borodin, and others it appears that the leaves contain the above-mentioned crystallizable organic substances, asparagin, leucin, etc., in considerable quantity; and it is quite possible that these substances may be formed synthetically in the leaves, though it is true that they may be formed in other ways as well. Finally, Pott has found that the proportion of proteid in the plant increases from the roots upwards towards the leaves, the proportion in the latter being about twice as great as that in the former of many of the plants which he analyzed.

The formation of living protoplasm from the organic substances elaborated from the food necessarily goes on in every living cell. It has been already mentioned that destructive metabolism—that is, processes of decomposition—is active in living cells, and it is especially the protoplasm which is the seat of these processes. The maintenance of the life of the cell is, therefore, an indication of the fact that the activity of the destructive metabolism is at least equalled by the activity of the constructive metabolism. In a young cell the latter exceeds the former, so that the protoplasm is increased in quantity; then for a time the two are approximately equivalent, until at length the destructive gradually gains the upper hand, and eventually the death of the cell is the result.

Destructive Metabolism (*Katabolism.*)

Just as all the processes by which increasingly complex organic substances are formed in the plant, and which intervene between the food-materials on the one hand and the protoplasm on the other, are designated collectively "constructive metabolism," so all the processes of decomposition by which relatively simple substances are produced from relative complex ones, and which intervene between the protoplasm on the one hand and the excreta and other waste-products on the other, are designated collectively "destructive metabolism." Of all the various processes of destructive metabolism the most fundamental is the decomposition of the protoplasm. It appears that this decomposition is spontaneous—that is, as Pflüger terms it, a "self-decomposition;" and it is, in fact, only so long as this self-decomposition is proceeding that protoplasm can be said to be living. The destructive metabolism of an organism is not, however, confined to the self-decomposition of its protoplasm; the various complex organic substances which the cells contain may undergo chemical change quite independently of their entering into the metabolism of the protoplasm. The most active agents in producing chemical changes of this kind are certain bodies which are termed "ferments," and are distinguished as "unorganized" ferments from the so-called "organized" ferments, such as Yeast and Bacteria. But little is known as to their chemical composition, and nothing as to the peculiarity of chemical constitution upon which their characteristic properties depend.

Self-decomposition of protoplasm.

Unorganised ferments.

The unorganized ferments which have hitherto been detected in plants may be classified, according to the nature of the chemical changes which they induce, in the following four groups.

1. Ferments which convert starch into sugar (diastatic ferments). These have been found to be very widely distributed in plants, and in fact it seems probable that a ferment of this kind is present in all living plant-cells. Their mode of action is generally indicated by the following equation—

$$\overset{\text{Starch.}}{2(C_6H_{10}O_5)} + H_2O = \overset{\text{Maltose.}}{C_{12}H_{22}O_{11}}.$$

2. Ferments which convert cane-sugar into glucose (inverting ferments). A ferment of this kind, termed "invertin," has been obtained from Yeast; it is probable that a similar ferment is present in succulent fruits, for they commonly contain a mixture of cane-sugar and glucose. The following equation will indicate the nature of the process—

$$\overset{\text{Cane-sugar.}}{C_{12}H_{22}O_{11}} + H_2O = \overset{\text{Dextrose.}}{C_6H_{12}O_6} + \overset{\text{Lævulose.}}{C_6H_{12}O_6}.$$

3. Ferments which decompose glucosides. The most familiar members of this group are emulsin or synaptase, found in the Bitter Almond; myrosin, in the seed of the Black Mustard; erythrozym, in the root of the Madder. The following equation represents the decomposition of the glucoside amygdalin by emulsin—

$$\overset{\text{Amygdalin.}}{C_{20}H_{27}NO_{11}} + 2H_2O = \overset{\substack{\text{Oil of Bitter}\\ \text{Almonds.}}}{C_7H_6O} + \overset{\substack{\text{Prussic}\\ \text{Acid.}}}{HCN} + \overset{\text{Glucose.}}{2(C_6H_{12}O_6)}.$$

4. Ferments which convert proteids that are indiffusible and may be insoluble in water into others (peptones) which are both soluble and diffusible. These, which are only active in the presence of free acid, are termed "peptic" ferments. They have been found in quantity in the latex of certain plants (*Carica Papaya* and *Ficus Carica*) and in the liquid excretion of carnivorous plants. It is, of course, impossible to represent by an equation the nature of the chemical change which these ferments induce.

It is probable that other ferments than these may be present in plants, but they have not yet been actually obtained. There is probably one which decomposes fats (glycerides) into glycerin and the corresponding fatty acid, thus—

$$\overset{\text{Olein.}}{C_{57}H_{104}O_6} + 3H_2O = \overset{\text{Oleic Acid.}}{3C_{18}H_{34}O_2} + \overset{\text{Glycerin.}}{C_3H_8O_3}.$$

Müntz and Von Rechenberg have pointed out that the quantity of free fatty acids in oily seeds increases very much during germination, and the only satisfactory explanation of this fact which can at present be offered is that it is the result of the decomposition of the fats, in the manner indicated above, by an unorganized ferment. Again, it was mentioned above that crystallizable nitrogenous organic substances, such as leucin, asparagin, and tyrosin, occur in plants, and it was pointed out that they may be formed synthetically. But there can be no doubt that they may be, and frequently are, formed analytically,—that is, by the decomposition of more complex substances. For instance, when the seeds of leguminous plants, such as the Pea or the Bean, germinate, the quantity of proteid substance diminishes, and the quantity of Amides, notably asparagin, increases; there can be no doubt that the latter are derived from the former. It is well known that similar changes take place in the pancreatic digestion of animals, that leucin and tyrosin are formed from proteids, and that this is effected by an unorganized ferment termed "trypsin;" it is quite possible that a ferment of this kind may be present in plants. Finally, there is probably, in certain plants at least, a ferment which converts cellulose into sugar. For instance, the Date seed contains a quantity of non-nitrogenous reserve material stored up as cellulose in its very thick cell-walls; on germination this undergoes absorption and is conveyed to the embryo; it is extremely probable that the conversion of the insoluble cellulose into some soluble substance (doubtless sugar) is effected by the action of a ferment. The penetration of the absorbent organs of parasites into the tissues of their hosts is probably effected by the action of a ferment of this kind which is excreted by the parasite.

Oxidations.

But there are still other chemical changes to be accounted for as the result of which substances relatively rich in oxygen are produced from others which are relatively poor in that element. Some of these are, so far as is known, processes of simple oxidation, which go on as readily outside the organism as within it; for instance, chlorophyll is oxidized quite as readily in alcoholic solution as when it exists in the chlorophyll-corpuscles of a plant; these processes of simple oxidation may then be regarded as going on independently of the vital activity of the organism. But there are other and more complex oxidations which may be termed "oxidative decompositions"; these involve something more than mere oxidation, and appear to depend upon the vital activity of the organism.

The following instances may be given to illustrate the nature of these changes. Ethyl-alcohol becomes oxidized, under the influence of a Fungus known as the *Mycoderma Aceti*, as follows—

$$C_2H_6O + O_2 = \overset{\text{Acetic acid.}}{C_2H_4O_2} + H_2O.$$

Another similar Fungus, the *Mycoderma Vini*, induces a more complete oxidative decomposition of alcohol,—carbon dioxide and water being the products of its action. Again, a substance termed "pyrocatechin" and various organic acids occur in plants, and there seems reason, from the researches of Hoppe-Seyler and of Carl Kraus, to believe that they are derived from carbohydrates in some such way as the following—

$$\overset{\text{Glucose.}}{3C_6H_{12}O_6} + 4O_2 = \overset{\text{Pyrocatechin.}}{C_6H_6O_2} + \overset{\text{Succinic acid.}}{3C_4H_6O_4} + 3H_2O,[1]$$

it being understood that this suggests only one of the ways in which the vegetable acids are formed.

Fermentations.

There are yet other processes of decomposition which, like the oxidative decompositions, are effected under the influence of living protoplasm, but which, unlike them, do not depend upon the presence of oxygen; on the contrary, these decompositions, which may be generally termed "fermentations," depend upon the absence of free oxygen, for their activity is the greater the more limited the supply of this element. A characteristic example of this kind is afforded by the decomposition of sugar into alcohol and carbon dioxide, which is effected by Yeast, and is known as the "alcoholic fermentation." Its nature is indicated by the following equation—

$$C_6H_{12}O_6 = 2C_2H_6O + 2CO_2.$$

Again, various forms of Bacteria effect decompositions of this kind. Of these the putrefaction of organic matter, the lactic and butyric fermentations, are examples. It must not be supposed, however, that the property of exciting fermentation is confined to the protoplasm of lowly plants such as Yeast and Bacteria. It has been found that various fermentations are set up when living plant-organs of any kind—leaves, flowers, fruits, seeds—are kept in an atmosphere which contains no free oxygen.

Respiration.

The characteristic accompaniment of the destructive metabolism of plants, as of all living organisms, is, under normal conditions, that interchange of gases between the plant and the atmosphere which is known as "respiration," and which consists in the absorption of oxygen and the evolution of carbon dioxide. It may be stated generally that the continual absorption of free oxygen is essential to the existence of at least the more highly-organized plants, and that in the absence of a supply of free oxygen they die. Death under these circumstances is to be attributed to the arrest of those metabolic processes which are accompanied by an evolution of kinetic energy in the organism—that is, of the destructively metabolic processes; and of these by far the most important is the self-decomposition of the protoplasm. It would appear that the absorption of oxygen is essential to the self-decomposition of the protoplasm-molecule. It is impossible to say anything definite as to the mode in which oxygen affects this process. Pflüger has, however, suggested that the absorbed oxygen enters into the protoplasm-molecule as "intramolecular" oxygen, that the molecule is thereby rendered unstable, and that it then readily undergoes decomposition.

Anaerobiotic plants.

In contrast to the plants which continue to live only when supplied with free oxygen (the *aerobia*, as Pasteur has termed them) stand the *anaerobia*—those, namely, which thrive best in the absence of free oxygen, and to which, in certain cases, the access of free oxygen is fatal; of the latter, certain Schizomycetes and Saccharomycetes may be taken as examples. It is remarkable that it is just the anaerobiotic plants which are most highly endowed with the property of exciting fermentation; and this, taken in conjunction with the fact that the activity of fermentation stands in an inverse relation to the supply of free oxygen, indicates the existence of some sort of correlation between the normal respiratory and the fermentative processes. It appears that in aerobiotic plants the normal processes of destructive metabolism, of which the absorption of oxygen and the evolution of carbon dioxide are the outward expression, may be replaced for a longer or shorter time by those abnormal processes of which fermentation is the outward expression; in completely anaerobiotic plants the fermentative are the normal processes. It is difficult to explain the physiological significance of fermentation, and to determine the manner in which it contributes to the maintenance of the life of the organism. Pasteur has suggested that it is the expression of an effort of the organism to obtain oxygen from substances which contain it in combination. Another possible view is that the organism obtains, by the fermentative decomposition of the substances upon which it acts, the supply of energy which, in the case of an aerobiotic plant, is afforded by the normal decomposition of its own protoplasm-molecules.

The products of destructive metabolism are extremely numerous and of very different chemical nature. They may be roughly classified into two groups: (1) the *waste-products*, substances which cannot be used in the constructive metabolism of the plant, and which may be excreted; and (2) the *plastic products*, substances which can enter into the constructive metabolism.

Waste-products.

1. *Waste-Products*. Among the waste-products the most constant are carbon dioxide and water, which are exhaled in respiration; it may, in fact, be stated generally that all living plants and parts of plants exhale carbon dioxide and watery vapor at all times. There is, however, no constant relation between the volumes of carbon dioxide exhaled and of oxygen absorbed in respiration, and the processes of destructive metabolism, of which the respiratory interchange of gases is the external expression, are so complex that the relation, whatever it may be, between the volumes of these

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[1] [One part of Pyrocatechin, three parts of Succinic acid + 12 (HO) will make the sides of this equation balance.—AM. ED.]

gases in any particular case cannot be accounted for. The degree of independence between these processes is well illustrated by the fact that the absorption of oxygen is relatively greater at low temperatures, and that the exhalation of carbon dioxide is relatively greater at high temperatures. This seems to indicate that at a low temperature the storing-up of intra-molecular oxygen is relatively more active than the decomposition of the protoplasm-molecules, whereas at a high temperature the converse is the case. At medium temperatures these processes are about equally active, for it has been ascertained in various cases that the volumes of oxygen absorbed and of carbon dioxide exhaled are under these circumstances approximately equal. It must not, however, be concluded that the exhalation of carbon dioxide is entirely independent of the absorption of oxygen, for the observations of Broughton, Wilson, and Wortmann all show that when plants are deprived of a supply of free oxygen the activity of the exhalation of carbon dioxide rapidly diminishes.

Among the other waste products the following are those which are of most common occurrence,—organic acids, aromatic substances, coloring matters, bitter principles, certain fatty bodies, alkaloids.

Organic acids.

(1.) *Organic Acids.*—The organic acids are very generally present in plants either free or in combination with organic or inorganic bases, and it is to the presence of these acids or of their acid-salts that the acid reaction of plant-tissues is due. Those most commonly occurring are the malic, tartaric, citric, oxalic, and fatty acids, the last-named being generally in combination with glycerin, forming fats (glycerides). There can be little doubt that they are to be regarded as products of destructive metabolic processes, though Liebig regarded some of the more highly-oxidized acids as the first products of constructive metabolism, and as being formed from carbon dioxide and water in the cells which contain chlorophyll. It is not so clear that they are all to be regarded as waste-products; it appears possible that some of the less highly-oxidized may undergo reduction with the formation of carbohydrates, for it has been observed, especially by Beyer, that in ripening fruits the acids diminish and the sugar increases in quantity. Again, there can be no doubt that fats enter into constructive metabolism, and hence the fatty acids must be regarded as plastic products. The more highly-oxidized acids are almost certainly waste-products. Oxalic acid, for instance, is commonly found as crystals of calcium oxalate which, in most cases at any rate, undergo no alteration. It appears that the oxalic acid is withdrawn in this way from the sphere of metabolism, and, inasmuch as these crystals are deposited especially in the deciduous parts of the plant, it is also ultimately got rid of. It is probable that the organic acids are largely produced as the result of oxidative decomposition (see *supra*). There can be no doubt that the self-decomposition of protoplasm is attended by a formation of acids, especially of nitrogenous acids, such as the aspartic and glutaminic, and of fatty acids.

In addition to their significance in the constructive metabolism of plants the organic acids are of use in other ways. Their presence in the living cells contributes to the maintenance of the turgid condition: the presence of acid-sap in the root-hairs renders possible the solution and absorption of mineral substances which are insoluble in water; oxalic acid, at least, decomposes the salts absorbed by the roots; and finally it appears that the organic acids are capable of inducing the conversion of one carbohydrate into another —cane-sugar into glucose, for instance—and they may in this way play an important, though hitherto undetermined, part in the general metabolism of plants.

Aromatic substances.

(2.) *Aromatic Substances.*—These occur generally in the form of glucosides, the most common of which is tannin. The glucosides are bodies, for the most part non-nitrogenous, which yield sugar on decomposition amongst other substances. In so far as they yield sugar they may be regarded as plastic products; but the aromatic substances to which they give rise on decomposition are waste-products, for it appears from the observations which have been made on this point that the higher plants, at least, cannot avail themselves of carbon when combined in an aromatic molecule for the purposes of their constructive metabolism. Probably the resins which are so commonly present in plants are derived from tannin. The first step is the formation of a terpene ($C_{10}H_{16}$) in the secreting cells; this is then excreted into the ducts and undergoes partial oxidation with the formation of resin. In connection with the terpenes two hydrocarbons, caoutchouc and gutta-percha $(C_5H_8)x$, may be mentioned, which occur in the latex of certain plants.

It is not possible to make any definitive statement as to the mode of origin of the aromatic substances in the plant, but the fact that tannin is constantly present in the cells of parts in which destructive metabolism is active—growing points, mobile organs of leaves, galls, for example—tends to prove that this glucoside at least may be derived from protoplasm. It must not be overlooked, too, that substances like tyrosin, which contain an aromatic radical, occur in plants, and that they are derived more or less directly from protoplasm.

Coloring matters.

(3.) *Coloring Matters.*—The principal coloring matters of plants are—(*a*) those which occur in the walls of the bark-cells of trees and shrubs (phlobaphenes); (*b*) those of woods, such as logwood; (*c*) those which occur in solution in the cell-sap, as in most flowers; (*d*) those which occur in connection with protoplasmic corpuscles, as in the *Algæ* and in the leaves and other green parts of the higher plants. With regard to the three first-named groups it appears probable that they are derived in various ways from tannin.

Of the coloring matters which occur in connection with protoplasmic corpuscles by far the most important is chlorophyll, the substance to which plants owe their green color. The corpuscle has a spongy structure, the interstices of which are occupied by the chlorophyll in solution in some fatty substance. The other coloring matters which may be present in corpuscles are—*etiolin*, yellow, which is apparently present in all chlorophyll-corpuscles, conspicuously so in those in parts of normally green plants which have been growing in darkness, and is apparently an antecedent of chlorophyll; *xanthophyll*, also yellow, and commonly present in chlorophyll-corpuscles, especially in those of fading leaves, probably a derivative of chlorophyll; *anthoxanthin*, also yellow, the coloring matter of yellow flowers, and a derivative of chlorophyll; *phycoxanthin*, brownish, present in the chlorophyll-corpuscles of the brown *Algæ* (*Phæophyceæ* or *Melanophyceæ*); *phycoerythin*, red, present, in the chlorophyll-corpuscles of the red *Algæ* (*Rhodophyceæ, Florideæ*).

Formation of chlorophyll.

Chlorophyll is a substance of such great physiological importance that the conditions of its formation and its properties must be treated of in some detail. The general conditions upon which its formation depends are (*a*) exposure to light, (*b*) a sufficiently high temperature, (*c*) a supply of iron. Plants which are normally green are not green if they have been grown in the dark, or if the temperature has been too low, or if they have not been supplied with iron; they are usually yellow, and in the last case especially they may be quite colorless. Normally green plants which have been kept in the dark or at too low a temperature are said to be "etiolated," since they form etiolin; plants which have grown in absence of a supply of iron are said to be "chlorotic." There are good grounds for regarding etiolin as an antecedent to chlorophyll. It is formed in the corpuscle in darkness and at a temperature lower than that which is necessary for the formation of chlorophyll. It appears from the researches of Gris, Mikosch, and others that when the corpuscle is about to form etiolin it contains a starch-granule, and that as it assumes a yellow color the included starch-granule diminishes in size and may disappear. It must not be inferred from this observation that the etiolin is directly formed from the starch. It is more probable that it is derived from the protoplasm, and that, as the protoplasm is consumed in the formation of the etiolin, the starch is used in the construction of fresh protoplasm. Under the influence of light and of a sufficiently high temperature the yellow etiolin is converted into the green chlorophyll, but nothing is known as to the nature of the process by which the conversion is effected.

Properties of chlorophyll.

With regard to the physical properties of chlorophyll it has long been known that it is soluble in alcohol, ether, benzol, chloroform, carbon disulphide, and various oils. Hansen has obtained, by a process of saponification, from the alcoholic extract of leaves a green crystalline substance, probably the purest form of chlorophyll yet obtained, which is readily soluble in water. All solutions of chlorophyll in the above-mentioned media are fluorescent,—that is, when they are viewed by reflected light they appear opaque and of a deep lake-red color, but when thin layers are viewed by transmitted light they appear green. If the light which has passed through a layer of a moderately strong solution be examined with the spectroscope a characteristic absorption-spectrum will be observed. Beginning at the red end of the spectrum, a well-marked dark band will be seen between Fraunhofer's lines B and C, extending rather beyond C, a second dark band in the orange between C and D, a third very faint band at the junction of the yellow and the green, and a fourth more distinct band in the green near F. When an alcoholic extract of leaves is used, as is ordinarily the case, the whole of the blue end of the spectrum beyond F is absorbed, in consequence of the coalescence of three broad bands, which can be seen separately when a very dilute solution is used, two of the bands being in the blue between F and G, and one at the end of the violet. The spectrum of the alcoholic extract presents then seven bands in all. According to Hansen, the spectrum of solutions of his crystallized chlorophyll possesses only the first four of the above-mentioned bands, and it is only when very thick layers are used that the blue end of the spectrum is absorbed; this is true also of the spectrum of the green coloring matter obtained by Tschirch.

Little is as yet known as to the chemical composition of chlorophyll. Gautier and Hoppe-Seyler have both obtained a crystalline green substance from the alcoholic extracts of leaves, termed by the latter, "chlorophyllan," which is not to be regarded as pure chlorophyll. The following are their analyses of this substance, to which is added for comparison Hansen's analysis of the green crystalline substance which he obtained:

	Gautier.	*Hoppe-Seyler.*	*Hansen.*
C	73.97	73.34	60.33
H	9.80	9.72	9.37
N	4.15	5.68	4.77
O	10.33	9.54	14.77
Ash	1.75	P. 1.38 Mg. 0.34	10.76

Hansen states that the ash found by him is due to the previous processes of preparation, and that the only normal ash-constituent is iron, which neither Gautier nor Hoppe-Seyler had discovered. Tschirch on reducing chlorophyllan by means of zinc-dust has obtained a green substance which does not crystallize, and is soluble in alcohol, ether, and oils, but not in water. This he believes to be pure chlorophyll. From the percentage composition of the crystals of chlorophyllan Gautier deduces the formula $C_{19}H_{22}N_2O_3$, and draws attention to the similarity between this and the formula of bilirubin ($C_{16}H_{11}N_2O_3$). Hoppe-Seyler concludes that chlorophyllan contains phosphorus in its molecule, and is either a lecithin or a lecithin compound. Schunck has found that the residue of an ethereal solution of chlorophyll when treated with sulphuric or hydrochloric acid yields glucose amongst other products; he therefore regards chlorophyll as a glucoside.

Bitter principles.

(4.) *Bitter Principles.*—It has been ascertained that some of these are glucosides, and some alkaloids, but the chemical nature of many of them is still undetermined. Such are santonin ($C_{15}H_{18}O_3$), aloin ($C_{15}H_{16}O_7$), quassiin ($C_{10}H_{12}O_3$). It is impossible at present to say anything as to the possible mode of their origin or as to their physiological significance in the plant.

Fatty bodies.

(5.) *Certain Fatty Bodies.*—The ordinary fats (glycerides) are to be regarded as plastic products, and they will be subsequently treated of under that head. But there are certain fatty bodies of which this statement cannot be made; these are cholesterin, lecithin, and wax. It is not known how these substances are formed, but probably they, like the ordinary fats, are derived from protoplasm. This view is especially probable with regard to lecithin, which is a nitrogenous and phosphorized fat. Wax occurs especially in the external cell-walls or on the surface of those parts of plants which have a cuticularized epidermis; the "bloom" on fruits, for example, is a layer of wax.

Alkaloids.

(6.) *Alkaloids.*—The alkaloids are regarded as waste-products, because, as the observations of Knop and Wolff show, the demand for combined nitrogen cannot be met by supplying the plant with it in the form of alkaloids, though the plant can avail itself of such organic nitrogenous substances as urea, uric acid, leucin, tyrosin, or glycocoll. The alkaloids are compound ammonias which are not volatile at ordinary temperatures. With regard to their mode of origin in the plant, there can be little doubt that they are derived more or less directly from protoplasm, or at least from proteid, as are urea and uric acid in the animal body. But, although these nitrogenous waste-products are formed in the destructive metabolism of plants, their formation is not accompanied by a loss of nitrogen, for they are not excreted, as is the case in animals, but are deposited in the cells.

Glandular excretion.

2. *Excretion.*—Of the waste-products, some, such as oxygen, water, and carbon dioxide, are excreted in the gaseous form—the oxygen and the carbon dioxide through the superficial cell-walls of the plant, the watery vapor through the stomata. Some of the carbon dioxide may combine with earthy bases to form carbonates, which are either retained in the plant or excreted in solution. The resins and ethereal oils, as well as wax, are frequently excreted. The mechanism of excretion is widely different in different cases. The resins and ethereal oils are usually excreted by means of special glandular organs. The gland may be a hair on the surface, and it is then commonly the terminal cell at the free end which is secretory; or it may be a group of epidermal cells between which large intercellular spaces are formed, which serve as receptacles for the excreted substance; or it may be formed by the absorption of the adjoining walls of a group of cells belonging partly to the epidermis and partly to the underlying ground-tissue, a cavity being thus constructed, which contains the excreted substance; or again, longitudinal strands of cells may become separated so as to enclose an elongated intercellular space into which they excrete (resin-ducts). In many cases the substance to be excreted may be detected in the glandular cells; not unfrequently, however, and always in the case of wax, no trace of it can be discovered in the cells themselves; it is first to be found in the cell-walls between the cuticular and the deeper layers. The actual excretion is usually effected, in the case of superficial glands, by the rupture of the cuticle which is continuous over the gland, and by the consequent escape of the contents; in some cases the gland remains closed, and any volatile substances (ethereal oil) which may be present escape by evaporation.

The excretion of the earthy carbonates in solution is most commonly effected by means of a well-developed gland. Such a gland consists of a group of modified parenchymatous cells in connection with the termination of a fibro-vascular bundle; and one or two openings, termed "water-pores," and somewhat resembling stomata, are present in the epidermis immediately over it. Under the action of the root-pressure the gland excretes water which holds the carbonates in solution. Glands of this kind are present in the leaves of various Saxifragaceous and Crassulaceous plants. In other cases these salts appear to be excreted by ordinary epidermal cells. In certain Ferns (various species of *Polypodium* and *Aspidium*), for instance, scales of calcium carbonate are found on depressions in the surface of the leaves which are situated immediately over the terminations of the fibro-vascular bundles.

Nectary excretion.

It not unfrequently happens that plants excrete substances other than waste-products, but this has the effect of securing indirect advantages. In the great majority of flowers there are glandular organs which excrete a watery fluid holding principally sugar in solution; these organs are termed "nectaries," and the excretion "nectar." The nectary has essentially the same structure as the water-gland described above, the only important difference being that, whereas the gland is sunk in the tissue and is covered by the epidermis, the nectary has a large free surface, so that the nectar is at once poured out on to the exterior. But there is an important functional difference between them, namely, that, whereas excretion by the gland can only take place under the influence of the root-pressure, excretion by the nectary is independent of the root-pressure, for it will continue when the flower has been removed from the plant. Another instance of an excretion of this kind is afforded by the carnivorous plants. The glands of their leaves excrete a watery liquid which holds in solution a peptic ferment and one or more organic acids. The use of the nectar is to attract insects, and thus to insure cross-fertilization. The use of the excretions of the carnivorous plants is to dissolve the organic matter (usually insects) which has been deposited on the leaves, so as to bring it into a form in which it can be absorbed.

Waste-products not excreted.

Many of the waste-products are not excreted, but remain in the plant. Thus the terpenes are indeed excreted by the cells which line the resin-ducts, but these ducts have no aperture on the surface of the plant. Similarly the caoutchouc and gutta-percha which are contained in the laticiferous tissue of certain plants have no means of egress. This is also true of the tannic acid, of the calcium carbonate (usually) and oxalate, of the alkaloids, and of silica. These substances are usually deposited in the cells. Calcium carbonate and oxalate are deposited in the form of crystals either in the cell-wall or in the cell-cavity, and silica in the cell-wall. In some cases calcium carbonate is deposited on cellulose processes which extend into the cell from its wall, the whole body being termed a "cystolith."

3. *Plastic Products.*—The principal non-nitrogenous plastic products are the carbohydrates and the fats (glycerides); to these, as suggested above, some of the organic acids are perhaps to be added.

Starch.

Of the carbohydrates the substance which most demands attention is starch. Starch makes its appearance in the form of minute granules in chlorophyll-corpuscles in which constructive metabolism is being actively carried on. It was thought that it was the immediate product of the decomposition and recombination of carbon dioxide and of water in the corpuscle under the influence of light, the process being represented by some such equation as the following:

$$6CO_2 + 5H_2O = C_6H_{10}O_5 + 6O_2.$$

Increased knowledge of the conditions under which starch makes its appearance in plants has, however, made it evident that this is not the case. Starch may be regarded as the first *visible* product of the constructive metabolism going on in a chlorophyll-corpuscle, but it is not the first non-nitrogenous substance formed. That, as has been pointed out, is probably a body allied to formic aldehyde. The starch is formed as one of the products of the decomposition of the protoplasm of the corpuscle. That this is so is made evident when the formation of starch in parts of plants which are not green and which are not exposed to light is considered. In the cells of these parts there are certain small colorless protoplasmic bodies which are termed "starch-forming corpuscles" or "leukoplasts," and it is by these that the starch-granules are formed. It appears that the starch-granule is formed in the first instance by the decomposition of a portion of the protoplasm of the corpuscle, successive layers of starch being deposited upon the primitive granule by the decomposition of successive layers of protoplasm. It is in this way that the stratified structure of these starch-granules is produced. There is no reason for assuming that the process of starch-formation in chlorophyll-corpuscles is essentially different from that in leukoplasts; on the contrary, in view of the close relationship of these bodies, the one being convertible into the other, there is every reason for believing it to be the same. There is, however, this functional difference between chlorophyll-corpuscle and leukoplast, that in the former the synthetic processes, *i. e.*, the construction of protoplasm, begin with such simple substances as carbon dioxide, water, and mineral salts, whereas in the latter they begin (see below) with tolerably complex substances, such, for example, as glucose and asparagin. Starch, then, is the immediate product, not of constructive, but of destructive metabolism.

Glucose.

Various kinds of sugar, notably glucose and cane-sugar, are also commonly to be found in plants. Glucose may be regarded as having been derived by the action of an unorganized ferment from one or other of the other carbohydrates, except in certain plants, the Onion for example, in which it appears to be formed in the chlorophyll-corpuscles in the first instance. Nothing is known at present as to the mode of origin of cane-sugar which exists in such large quantities in certain plants, as the Beet and Sugar-cane.

Cane-sugar.

Fats.

With regard to the fats, it is commonly assumed that they are formed directly from the carbohydrates, because in oily seeds, for example, as the starch which they contain when young diminishes in quantity it is replaced by fats. There is, however, sufficient evidence to prove that the fats are the products of the decomposition of protoplasm. The disappearance of the starch in ripening oily seeds is due to its being used up in the construction of protoplasm, as the protoplasm undergoes decomposition in connection with the formation of fat.

Proteids.

The nitrogenous plastic products are proteids and amides. There can be little doubt that the proteids may be derived from protoplasm. If the molecule of living protoplasm be regarded as an extremely complex one, there is no difficulty in inferring that proteid may be one of the products of the decomposition of the protoplasm-molecule. The amides may also be products of the decomposition of protoplasm, or they may be formed from proteids by the fermentative action of living protoplasm or by the action of some as yet undiscovered unorganized ferment, as pointed out above.

Amides.

It has been stated that the plastic products are so called because they are substances which can be used in the constructive metabolism of plants. But it must not be inferred that they are so used immediately. The very fact that it is possible to detect their presence in considerable quantity is a proof that this is not the case. They are largely stored up either for the use of the plant itself at some future time, or for the benefit of the progeny of the plant. In a perennial plant, for example, plastic products are stored in the persistent parts for the use of the plant when it recommences its active growth; they are also stored up in seeds and spores to be used by the young plant during the early stages of germination. Plastic products thus stored up are termed "reserve materials," and the organs in which they are deposited are termed "depositories for reserve materials." The non-nitrogenous reserve materials are stored up in the form of carbohydrates or of fats. The starch which is formed in the green parts of the plant (which is, be it observed, a temporary reserve material) is converted into a soluble substance, probably glucose, and is conveyed in solution to the depository; and from it, directly or indirectly, the non-nitrogenous reserve materials are formed. The reserve carbohydrates are stored up either in the insoluble or the soluble form. In the former case they are deposited as starch-granules, or as cellulose (as in the endosperm of the Date) in thick cell-walls; in the latter they exist as various forms of sugar in solution in the cell-sap. The starch-granules are formed in these depositories by the leukoplasts. From the soluble non-nitrogenous substance, probably glucose, together with nitrogenous substances conveyed to the cells, the leukoplasts construct protoplasm; and it is as the result of the decomposition of this protoplasm in a certain way that starch is formed. This is true also of the reserve cellulose.

Non-nitrogenous reserve materials.

From the plastic materials, both nitrogenous and non-nitrogenous, which are supplied to the cells protoplasm is constructed, and the external layers of protoplasm undergo decomposition in such a way that cellulose is formed and deposited in successive layers upon the internal surface of the cell-wall. The various kinds of sugar (cane-sugar in the Beet root, glucose in the Onion, inulin in the Dahlia root, mannite in the unripe fruits of the Olive and in some Agarics, trehalose in many Agarics) are probably formed more or less directly from the glucose conveyed from other parts to the depository in each case. The fats occur as reserve materials characteristically in seeds and sometimes in fruits; they are not stored up in any considerable quantity in any other kind of depository. They too are formed by the decomposition of protoplasm which has been constructed from plastic materials, nitrogenous and non-nitrogenous, which have been conveyed to the cells.

Nitrogenous reserve materials.

The nitrogenous reserve materials are stored either in solution or as solid granules. In the former case they are amides, such as asparagin and glutamin, leucin and tyrosin, and are held in solution in the cell-sap; they are present characteristically in roots and tubers, but they have also been found, though in small quantity, in seeds. In the latter case these materials are stored in the form of proteids, chiefly globulins and peptones, and the granules in which they are deposited are termed "aleurone grains." The aleurone grain may consist simply of an amorphous mass of proteid, or a portion of the proteid may have crystallized out so as to form a crystalloid; in most cases the grain contains a small mass of mineral matter which consists, according to Pfeffer, of double phosphate of lime and magnesia. Aleurone grains occur characteristically in seeds, and they are especially well developed in oily seeds.

Value of reserve materials for growth.

When once deposited, the reserve materials suffer no further change, or at most the proteids may slowly undergo some alteration (globulin being converted into albuminate), so long as the organ in which they are deposited remains in an inactive condition. But when the external conditions become favorable the quiescent organ resumes its active life—in a word, it germinates—and the reserve materials which it contains then undergo chemical changes of such a nature as to convert them into substances which can readily travel to the seat of growth and can be used as plastic material by the growing cells. In a germinating seed, for instance, as the embryo grows the reserve materials of the seed diminish in quantity; they are evidently conveyed to the seedling, and are used by it in the construction of new protoplasm. Beginning with the non-nitrogenous reserve materials, the starch in starchy seeds and the cellulose in such seeds as the Date are converted into sugar; this is proved by the detection of sugar as well in the seed as in the seedling, and by the detection in the seed of an unorganized ferment which possesses the property of converting starch into sugar. In oily seeds the fats are replaced by starch, formed through the intermediation of protoplasm, and the starch so formed is converted into sugar. With regard to the reserve proteids, they are converted into amides, for it has been ascertained that, as they diminish in quantity, the amides, and notably asparagin, increase.

The effect of the absorption of these plastic substances by the embryo is that the cell-sap of its cells becomes charged with them, for the supply is more rapid than the consumption in the formation of protoplasm. If the seedling is growing under favorable conditions these substances gradually diminish in quantity. Some light has been thrown upon the nature of these conditions by the researches of Pfeffer. He found that Lupin seedlings grown in the dark contained a very large quantity of asparagin so long as they continued to live, but that if they were exposed to light the asparagin gradually diminished. But he ascertained further that mere exposure to light is not the cause of this, since the asparagin did not diminish in seedlings exposed to light in an atmosphere which contained no carbon dioxide. The disappearance of the asparagin depended, therefore, upon conditions which were essential to the formation of non-nitrogenous organic substance by the seedlings. Now the Lupin seed is one which is particularly rich in nitrogenous reserve materials, the quantity of non-nitrogenous reserve materials being relatively small. The accumulation of the asparagin in the seedlings grown in the dark is then to be ascribed to the absence of an adequate supply of non-nitrogenous substance with which it could combine to form proteid. When the seedlings were exposed to light this supply was forthcoming, and then the asparagin disappeared.

Supply of Energy.

Supply of energy.

It is evident that the various chemical processes which make up the metabolism of plants involve an expenditure of energy; hence the maintenance of the life of the plant is dependent upon a supply of energy.

In the case of animals the food affords the principal supply of energy. It consists for the most part of complex organic substances which represent a considerable amount of potential energy, and when these substances are decomposed in the body the potential energy appears in the kinetic form. This holds good also with reference to plants which are destitute of chlorophyll, for their food necessarily includes, like that of animals, complex organic substances. But with plants which possess chlorophyll the case is entirely different. Their food consists of inorganic substances which do not represent any considerable amount of potential energy; from these simple substances green plants build up complex organic substances which do represent a considerable amount of potential energy; it is evident, therefore, that green plants must be largely supplied from without with kinetic energy in some form or other. It has been already mentioned that the metabolic processes of plants are materially affected by external conditions, especially by the presence or absence of light, and by variations in the temperature of the surrounding medium. A somewhat elevated temperature is essential to the active life of all plants, but light is essential only to the life of those which contain chlorophyll. This naturally suggests that the energy requisite for the maintenance of the life of plants is obtained by them in the form either of light or of heat.

Light a source of plant-energy.

Light.—In discussing the constructive metabolism of green plants it was pointed out that such can only assimilate their food—that is, can only construct protoplasm from it—when exposed to light, whereas plants which do not possess chlorophyll can assimilate their food in the absence of light. It is true that a green seedling can live for a time in continuous darkness and increase in size, but it does so, not by assimilating its food, but at the expense of the organic reserve materials which may be present in it. The fact of the dependence of green plants upon exposure to light suggests that the energy necessary for the processes of their constructive metabolism is obtained in the form of light, and that their chlorophyll enables them to avail themselves of this form of kinetic energy. The function of chlorophyll has been made clear by the researches of Timiriaseff and of Engelmann. They have shown that the evolution of oxygen by a plant containing chlorophyll, which is the expression of the first stages of constructive metabolism, is most active when the plant is exposed to those rays of the solar spectrum which correspond to the absorption-bands of the chlorophyll-spectrum; the more conspicuous the absorption-band, the greater is the degree of activity, so that the evolution of oxygen is most considerable in the rays between the lines B and C of the solar spectrum, at the junction of the red and the orange, which correspond to the absorption-band I in the chlorophyll-spectrum. It is, then, in consequence of this absorption by the chlorophyll that the kinetic energy of the solar rays is made available for the work of constructive metabolism in the plant. The whole of the kinetic energy absorbed by the chlorophyll is not converted into potential energy; still the chlorophyll-corpuscle appears to be a very perfect machine in this respect, for, according to Timiriaseff's calculations, it converts into the potential form as much as 40 per cent, of the absorbed energy. Inasmuch as light exercises so great an influence upon the constructive metabolism of green plants, it may be inferred that it must indirectly affect the absorption of food-materials by the roots. Rudolph Weber has, in fact, ascertained that the greatest absorption of the essential ash-constituents takes place when the plant is kept exposed to those rays of light which are most efficacious in promoting its constructive metabolism.

The effect of light upon the destructive metabolism of plants appears to be unimportant. This subject has been investigated by means of observations upon the respiration of plants; and such a method is calculated to afford the necessary information, inasmuch as the activity of respiration may be taken as a measure of the activity of destructive metabolism.

It has been generally stated that chlorophyll is not formed in the absence of light. There are, nevertheless, certain cases in which its formation in complete darkness has been observed, provided that the temperature has been sufficiently high, namely, in the cotyledons of some Conifers and in the leaves of Ferns. The coloring matter etiolin is formed in the corpuscles in darkness, but the conversion of this into chlorophyll can only take place, as a rule, under the influence of light. The formation of chlorophyll will take place in light of very low intensity, but, as Wiesner's experiments show, there is a lower limit of intensity below which light is inactive. With regard to the relative efficacy of the different rays of the spectrum in promoting the formation of chlorophyll, it appears from Wiesner's researches that all the rays between Fraunhofer's lines B and H promote it in different degrees, and further, in confirmation of older observations, that seedlings turn green more rapidly in the yellow than in any other part of the spectrum. This last statement is true only for light of moderate intensity; when the light is very intense the formation of chlorophyll takes place more rapidly in blue than in yellow light. The reason of this is that in intense light chlorophyll undergoes decomposition, or at least chemical alteration of the nature of oxidation, which goes on most actively in yellow light.

Heat a source of energy.

Heat.—Plants behave in relation to temperature like the cold-blooded animals. When they are maintained at a low temperature they cease to exhibit any signs of life. The meaning of this is that at a low temperature the activity of the metabolic processes is so reduced that they appear to be altogether arrested. But the importance of a moderately high temperature for the maintenance of the active life of the plant is not, as might be supposed, that it affords a continuous supply of energy to be converted into work; it is rather that it determines the initiation of chemical processes which are carried on by means of energy obtained from other sources. Hence the supply of energy in the form of heat is relatively small as compared, on the one hand, with the supply of potential energy afforded by their food to the plants which do not possess chlorophyll, and, on the other hand, with the supply obtained in the form of light by plants which do possess chlorophyll.

It is not possible within the limits of this article to enter fully into the relations existing between plant-life and temperature. The following statements will at least indicate their general nature. In the first place, the tolerance of extreme temperature is different for different plants, as determined in the case of any particular organ, such as the seeds for instance. Secondly, for each of the processes which can be studied separately, such as germination, growth, respiration, the formation of chlorophyll, the action of unorganized ferments, the evolution of oxygen by green plants in light, etc., there are three cardinal points of temperature to be noted—the *minimum* or *zero point*, at which the performance of the process is just possible; the *optimum point*, at which it is carried on with the greatest activity; the *maximum point*, at which it is arrested. But these different phenomena do not all stand in precisely the same relation to temperature—that is the cardinal points for the exhibition of any two or more of these phenomena by one and the same plant do not necessarily coincide. Thirdly, the larger the proportion of water in an organ, the more liable it is to be injured by exposure to extreme temperatures.

Expenditure of Energy.

We have now to ascertain what becomes of energy supplied to the plant. The matter may be briefly stated thus: a portion of it is stored up in the plant in the form of potential energy; the remainder is lost to the plant, being either spent in the performance of mechanical work in connection with growth or movement, or given off, most generally in the form of heat, occasionally in the form of light, and possibly in the form of electricity. The storing-up of energy in the potential form may be termed the "accumulation of energy," the loss as the "dissipation of energy."

Accumulation of energy.

1. *Accumulation of Energy.*—The accumulation of energy is the necessary accompaniment of constructive metabolism; the formation of more and more complex organic substances involves the conversion of kinetic into potential energy. By taking into consideration the amount of organic substance formed by a plant from its first development to its death, it is possible to arrive at some idea of the amount of kinetic energy which the plant has stored up in the potential form. For the heat which is given out by burning the organic substance is but the conversion into kinetic energy of the potential energy stored up in the substance; it is but the reappearance of the kinetic energy which was used in producing the substance. The heat, for instance, which is given out by burning wood or coal represents the kinetic energy, derived principally from the sun's rays, by which were effected the processes of constructive metabolism of which the wood or the coal was the product. The amount of energy thus stored up by plants in the potential form is very large, because they produce relatively large quantities of organic substance.

Dissipation of energy.

2. *Dissipation of Energy.*—The expenditure of energy in connection with growth and movement, and with the evolution of heat, light and electricity, is dependent upon destructive metabolism, for the conditions which are essential to destructive metabolism are also those which are essential to the exhibition of these phenomena. Taking growth, for example—that is, continuous change of form accompanied usually by increase in bulk—it appears that in an aerobiotic plant it is dependent upon the following external conditions, namely, a supply of free oxygen and an adequate temperature, conditions which are precisely those upon which the destructive metabolic processes of such a plant also depend. This is true in such plants of the other above-mentioned phenomena also. Anaerobiotic plants can grow when the conditions are such that they can induce active fermentation—that is, when their destructive metabolism is active. After what has been said in the section on the "nervous substance" above (p. 23 *sq.*) about animal movement it is hardly necessary to prove that the movements of plants, which are of essentially the same nature as those of animals, depend upon destructive metabolism and involve a dissipation of energy.

An evolution of energy in the form of heat is the inseparable result of destructive metabolism. With regard to plants, it may be stated generally that the evolution of heat is not sufficiently active to raise the temperature of the plant-body above that of the surrounding medium, it being remembered that plants are constantly losing heat, principally by radiation and in connection with transpiration. In organs, however, in which destructive metabolism is very active, it is easy to detect a rise of temperature, especially when a large number of them are collected together. A good instance of this is afforded by germinating seeds; for example, a rise of temperature is a familiar fact in the process of the malting of Barley. It can also be readily observed in the case of opening flowers in dense inflorescences; Warming observed, for example, that, at the time of the opening of the flowers, the inflorescence of an Aroid (*Philodendron bipinnatifidum*) attained a temperature of 18.5° C. above that of the air.

The evolution of light by plants is a phenomenon which has been known from the times of Aristotle and of Pliny, and is commonly spoken of as "phosphorescence." All the well-authenticated instances of luminosity are confined to the Fungi, to various Agarics, and to Schizomycetes (*Bacteria*). The so-called "phosphorescence" of decaying wood is due to the presence of the mycelium of *Agaricus melleus* (*Rhizomorpha*), and that of putrefying meat and vegetables to micrococci. See PHOSPHORESCENCE. The evolution of light is essentially dependent upon the life of the organism, and further, it is dependent upon the destructive metabolism; for it ceases when the organism is killed (as by dipping it into hot water), or deprived of its supply of free oxygen, which is essential to the metabolic processes.

In view of the changes, both chemical and physical, which are going on with greater or less activity in the various parts of a living plant it has not been unnaturally inferred that the electrical equilibrium is being constantly disturbed, and that differences of electrical potential energy may exist in different parts. Many experimenters have investigated this subject, and such differences have been apparently observed. It is impossible to enter here into a detailed consideration of the results obtained; it may suffice to state that in the majority of cases the electrical currents detected do not indicate a dissipation of the energy of the plant, but are due to physical causes, and in some cases even to the effect upon the organism of the apparatus employed for the purpose of detecting them. It has been clearly made out in certain instances that the currents persist in organs which have been suddenly killed in such a way as not to destroy their gross organization.

There is, however, one instance in which an electrical current has been detected which seems to be connected with the destructive metabolism of the plant. Burdon-Sanderson and Munk have both observed that, when the two electrodes are placed upon a mobile leaf of *Dionæa muscipula* (Venus's Fly-trap) when at rest, a certain electrical current is indicated by the galvanometer. When the leaf is stimulated, whether the stimulation be or be not followed by a movement, the direction of the observed current is suddenly reversed. This change in the direction of the current—or "negative variation," as it is termed—is, according to Burdon-Sanderson, the "visible sign of an unknown molecular process," which he considers to be "an explosive molecular change," of the same nature as the negative variation which follows upon the stimulation of the muscles and nerves of animals.

Income and expenditure of plants.

In concluding this part of the subject it may be well, for the sake of clearness, to draw up an account of the income and expenditure of a plant.

In the case of a plant possessing chlorophyll the income of matter consists of the food (salts, water, carbon dioxide, free oxygen), and the income of energy of kinetic energy in the form of light and heat, the former being the more important of the two items. The great bulk of the food absorbed is converted into organic matter, and is for the most part retained by the plant in the form of organized structures, of reserve materials, and of waste-products which are not excreted; but a certain proportion of it is lost in the form of the carbon dioxide and water exhaled in respiration, or of oxygen exhaled by green parts in sunlight, and of excreted organic or inorganic matter. Besides these items of loss there are yet others. All plants lose a certain amount of matter in connection with reproduction, for all plants throw off in the course of their lives certain portions of their structure in the form of seeds, spores, antherozoids, etc. Again, plants which persist for more than one period of growth lose matter by the falling off of certain of their organs and of portions of their structure—for example, by the falling of the leaves in autumn, and by the shedding of bark, fruits, etc. With reference to the expenditure of energy, a large proportion of the income of energy remains stored up in the potential form in the organic matter which the plant accumulates. A dissipation of energy as heat and in connection with growth is common to all plants: in some there is dissipation of energy in the form of motion, in some in the form of light, in some, probably, in the form of electricity. A loss of energy—potential energy—occurs also when the plant loses organic matter in any of the ways mentioned above. These various items may be tabulated under the two heads of "income" and "expenditure." The water lost in transpiration is not considered, for it simply traverses the plant; only that amount of water is considered which may be assumed to enter into the processes of constructive metabolism or to be produced in the processes of destructive metabolism.

Plant possessing Chlorophyll.

Income.	*Expenditure.*
Matter. Food— Inorganic salts. Carbon dioxide. Water. Free oxygen.	*Matter.* Organic substance formed. Carbon dioxide } evolved in Water } respiration. Free oxygen evolved in light. Excreted substances, organic or inorganic. Reproduction (spores, seeds, etc.). Other losses (leaves, fruits, bark, etc.
Energy. Rays of light absorbed by chlorophyll. Heat.	*Energy.* Constructive metabolism. Growth. Movement (in some cases). Heat. Light. Electricity (in some cases). Potential energy (when organic matter is excreted or thrown off).
	Balance in favor of Plant.
	Matter.—Organic substance (including tissues, reserve materials, and unexcreted waste-products).
	Energy.—Potential energy, represented by the accumulated organic substance.

Plant destitute of Chlorophyll.

Income.	*Expenditure.*
Matter. Food— Inorganic salts. Organic substances. Water. Free oxygen (in most cases).	Same as above, except that no free oxygen is given off.
Energy. Potential energy of organic food. Heat.	*Balance in favor of Plant.* Same items as above.

Movement of Plants.

Movement.

It has been pointed out above that movement, including in the conception the slow movement of growth, is an item in the expenditure of energy by the plant. The phenomena connected with movement are of such physiological importance that it will be well to consider them rather fully.

In dealing with this large subject attention will be directed for the present simply to the external phenomena, leaving the internal causes and mechanisms till subsequently, and those presented by growing organs will be taken first.

1. *Growth.*—In commencing the study of *growth* it is important to have a perfectly clear idea of what the word means. It means the continual change in form of the body of the plant, or of any organ of it, the change being frequently accompanied by increase in bulk, though this is not necessarily the case. For the purposes of this article it will be convenient to use "growth" as meaning, unless expressly stated otherwise, growth in length, that is, the elongation of the organ along the line joining its base and its apex. The conditions upon which growth are dependent are—(1) a supply of plastic material for the formation of new protoplasm; (2) favorable external conditions, especially an adequate temperature; (3) a supply of free oxygen in the case of aerobiotic plants, or, in the case of anaerobiotic plants, of fermentable substance; (4) a supply of water to maintain the turgidity of the cells. Any variation in these essential conditions will lead to a variation in the rate of growth. The capacity for growth is limited, as a rule, to a certain period of the life of an organ and of its constituent cells; when this period is passed growth ceases, however favorable the external conditions may continue to be.

Rate of growth.

The *rate* of growth of an organ is not uniform. At first the organ grows slowly, then more and more rapidly, until a maximum rapidity is reached, and then the rate diminishes until growth ceases altogether. This cycle of spontaneous variation in the rate of growth is known as the "grand period of growth." It can be conveniently studied by marking on the growing point of an organ a series of transverse zones of known length, and observing their relative elongation in a given time. It will be found that the youngest (nearest the apex) have elongated slightly, that the elongation is greater the farther each successive zone is from the apex, until a zone of maximum elongation is reached; the elongation of the zones lying behind this will be found to be less and less, until at last zones will be found which have not elongated at all. In addition to the variations in the rate of growth in length of an organ which make up its grand period it is found, if its growth be watched from hour to hour, or at even shorter intervals, that it presents irregular variations, which are likewise to be regarded as spontaneous. Variations in the rate of growth may be induced by variations in the external conditions, especially by variations of temperature and of illumination. It will be of interest to inquire briefly into these relations between growth and temperature and growth and light.

Growth and temperature.

Inasmuch as the decompositions which determine the evolution of energy in the plant are dependent upon temperature, their activity being promoted by a rise of temperature within certain limits, it will be readily understood that growth, which is one expression of the evolution of energy, should likewise be affected by variations in temperature. It has been found, in fact, that the growth of any given plant will only take place within certain limits of temperature, a lowest or minimum temperature on the one hand and a highest or maximum temperature on the other; and further, that between these two points there is one, the optimum temperature, at which the rate of growth is most rapid. Growth is more rapid at each degree as the temperature rises from the minimum to the optimum point; it is less rapid at each degree as the temperature continues to rise from the optimum to the maximum point; and conversely, growth is more rapid at each degree as the temperature falls from the maximum to the optimum, and less rapid at each degree as the temperature further falls from the optimum to the minimum. This dependence of growth on temperature, and this relation between different degrees of temperature and different rates of growth, may be conveniently spoken of as the "tonic influence" of temperature. The mere variation in temperature as such does not appear, as a rule, to affect the rate of growth. Roots exposed to rapid and considerable variations of temperature for some time are found by Pedersen to have grown to about the same extent as similar roots which had been growing for the same time at the mean temperature. The only case in which it appears that variation in temperature produces a distinct effect is afforded by Pfeffer's observations upon the opening and closing of flowers. He found that a rise of temperature caused the flowers to open and a fall to close, the opening or closing being an expression of the accelerated growth in length of the organ as a whole. This effect of variation of temperature is distinguished as the "stimulating" effect.

Growth and light.

In considering the relation of light to growth, we have principally to consider its influence as being an essential normal condition of growth, its "tonic" influence,—that is, it is a question whether or not light exercises any influence which can be regarded as "stimulating" on the rate of growth. Speaking generally, it may be stated that plant-organs, with the exception of ordinary flattened horizontally expanded leaves and other organs of similar organization, grow at least as well in darkness as in light,—that exposure to light is not an essential condition of their growth. With leaves and leaf-like organs the case is different. When plants are kept for some time in darkness one of the most striking features is the smallness of the leaves of the shoots which have been developed during that time. This is not to be ascribed to an absence of plastic material, for it is exhibited when plastic material is abundantly present in the tissues; nor can it be attributed to the fact that in darkness the leaves are not able to carry on the formation of organic substance, for it is not all leaves which remain small in darkness, but only those which have the organization described above. The long tubular leaves of the Onion, for example, continue to grow in darkness, and so do the long flattened leaves of Irises. The arrest of the growth of flattened horizontally expanded leaves in darkness is due to some peculiar effect, which we must regard as of a "tonic" nature, exercised by light upon the growing cells. Intermittent exposure to light for brief periods suffices to enable the leaves to carry on their growth in darkness, and it is not necessary that the light should be intense. The intermittent exposure induces in the leaf a condition, though it cannot be precisely stated what, which permits of the continuance of growth,—a condition which is termed "phototonus." Assuming that the organ is actually growing, we find that in all cases light retards the rate of growth, and this the more markedly the greater its intensity. Wiesner has, in fact, shown that growth may be altogether arrested by exposure of the growing organ to intense light. The effect of light in retarding growth has been ascertained by comparative measurements of similar organs growing, some in darkness others in light, and is proved negatively by the greater length usually attained by shoots which have grown in darkness for a given time as compared with that attained in an equal time by shoots growing in light. It appears that variations in the intensity of light, as such, affect the rate of growth. Pfeffer has found that exposure to light caused certain flowers to open, and to darkness to close. Probably this is accompanied, as in the parallel case of temperature, by an acceleration of the mean rate of growth.

The relation of the long axis of a growing organ to the line of action of gravity appears also to affect its rate of growth. Elfving has found that the sporangiferous hyphæ of *Phycomyces*, which normally grow vertically upwards, grow somewhat less rapidly when they are maintained in the inverse position, that their growth in length is more rapid in opposition to the action of gravity than in the same direction, and this he thinks is true of all organs which normally grow vertically upwards. Gravity would appear, therefore, to exercise a tonic influence on growth. The substitution for gravity of a considerable centrifugal force produced no apparent effect on the rate of growth.

Direction of growth.

The *direction* of growth of an organ is determined partly by inherent and partly by external causes. Beginning with the *inherent* causes, we find that, when the action of external directive influences upon growing organs is as far as possible eliminated, the axis of growth—that is, the line joining the apex and the base—is approximately a straight line. Thus Vöchting has shown that, when growing shoots are caused to grow in darkness and to rotate slowly about a horizontal axis by means of an instrument termed a "clinostat," their long axes become straight. This is the expression of an inherent tendency which he terms "rectipetality." But the line of growth is not at all times straight; for instance, the apex of an organ growing vertically upwards does not travel upwards in a straight line, but oscillates from side to side of the vertical. This oscillation is termed "nutation," and is due to the fact that growth in length is not uniformly rapid on all sides of the growing organ, but that during any given period of time one side grows more rapidly than the others. This unequal growth, which we may term "heterauxesis," is apparently spontaneous. The particular path which the apex of an organ describes in the course of its growth depends upon the properties of the organ, a point which may now be conveniently dealt with.

Inherent causes.

Properties of growing organs.

Some information as to the properties of an organ may be obtained from observation of its anatomical structure. For instance, cylindrical organs, such as many shoots, are radially symmetrical in structure, and they are in most cases found to be also physiologically radial. Some organs, again, such as the leaves of some Irises, are bilaterally symmetrical in structure, and they are found to be physiologically bilateral. Other organs, finally, such as flattened expanded leaves, prothalia of Ferns, thalloid shoots of Liverworts, though, like the bilateral organs, they present two opposed surfaces, are not bilaterally symmetrical in structure, inasmuch as the tissues in relation with the two surfaces are differently constituted. Such organs are dorsiventral both anatomically and physiologically. The properties of an organ are not, however, always to be inferred from structure. In some cases radial symmetry of structure is accompanied by dorsiventral properties. This is the case, as Sachs has shown, with the shoots of *Tropæolum majus* under certain circumstances.

The question now naturally arises, How are the peculiar properties induced? In some cases they can only be accounted for by regarding them as inherent; this is true of radial organs, of bi-lateral organs, and to a certain extent of dorsiventral organs. The lateral branches of dicotyledonous trees have, in many cases, been found to possess inherent dorsiventral properties. In other cases, however, dorsiventrality is induced. It has been found by Frank—and his observation has been corroborated by De Vries—that the dorsiventrality of the lateral shoots of Conifers is induced by their relation to gravity. When maintained in a horizontal position during their growth the side which is uppermost becomes the dorsal surface, the other the ventral surface. Again, Sachs has shown that the young shoot of *Tropæolum* is radial, but that if it be exposed to strong unilateral illumination it exhibits dorsiventral properties, the more strongly illuminated side becoming the dorsal surface, and further, that the plane of dorsiventrality may be altered by causing the light to fall on a fresh side of the shoot. A similar case of the induction of dorsiventrality is offered by the thalloid shoot of *Marchantia*. Tracing the development of the shoot from a gemma, we find the gemma to be bilaterally symmetrical in structure and in physiological properties. It falls to the earth with one surface undermost, which becomes the ventral surface, whilst the upper surface becomes the dorsal. That the dorsiventrality is in this case induced by light is proved by the fact that, if an experiment be so arranged that the light falls on the under surface of the gemma, this becomes the dorsal surface, whilst the upper surface becomes the ventral.

The further question now arises, How can the nature of the properties of an organ be determined, if, as has been shown, it cannot always be determined by an examination of the structure? The answer is, that it can be determined by observing the mode of growth of the organ, and especially its response to the action of external directive influences. Thus, the spontaneous heterauxesis of a radial organ is such that each side in turn is the one which is growing with the greatest rapidity, so that, seen from above, the apex will appear to describe a somewhat circular orbit, and its path upwards will be spiral. This kind of nutation is termed "revolving nutation," or "circumnutation" (Darwin). Similarly, in bilateral organs each of the two sides grows alternately the more rapidly, so that, seen from above, the apex appears to oscillate from side to side of the vertical, and its path will be a zigzag line. Also in dorsiventral, as in bilateral organs, each of the two sides grows alternately the more rapidly, but the period of alternation is much longer, and may occur only once during the whole period of growth. For instance, the young leaves of Ferns are rolled up upon their internal (dorsal) surfaces; they present what is known as "circinate vernation." This is due to the fact that at first the lower (ventral) surface of the leaf grows more rapidly than the upper (dorsal); it is only toward the end of the period of growth that the upper surface grows the more rapidly, and then the leaf expands. Special terms have been applied to these phases of growth; when the upper surface of the organ is growing the more rapidly the growth is said to be "epinastic," when the lower, "hyponastic."

External directive influences.

The spontaneous variations in the direction of growth of an organ thus afford some indication of the nature of its organization, but this is more clearly shown by its response to the action of external directive influences. These will now be taken in order.

Radiant Energy.—It will be convenient to consider separately the phenomena exhibited by organs of different physiological properties.

Heliotropism in radial organs.

Beginning, then, with radial shoot-organs, it is usually found that when light falls upon one side of such an organ the organ curves so as to direct its apex toward the source of light,—in other words that it tends to place its long axis parallel to the direction of the incident rays. The effect of the unilateral illumination is to cause heterauxesis of the organ such that the side upon which the light directly falls is the one which grows the most slowly, and therefore becomes concave. Inasmuch as all curvatures induced by light are included under the term "heliotropism," organs which exhibit the kind of curvature above described may be said to be "positively heliotropic." As examples of positively heliotropic radial organs may be mentioned radial stems, the multicellular stipes of some Fungi (*Coprinus*, *Claviceps*). the sporangiferous hypæ of unicellular Fungi (*Mucor*, *Pilobolus*), radial leaves, such as those of the Onion, and, as exceptional cases, some roots (Onion, *Ranunculus aquatilis*). In other cases the effect of unilateral illumination is the reverse of the above: the organ curves so as to direct its apex away from the source of light, though it still tends to place its long axis parallel to the direction of the incident rays. Organs curving in this manner are said to be "negatively heliotropic." This condition has been frequently observed in roots, and among shoots it is characteristic of the hypocotyl of the Mistletoe. Many cases of negative heliotropism in shoots have been mentioned, particularly the tendrils of *Vitis* and *Ampelopsis*, in which its existence was first detected by Knight; but the apparent negative heliotropism in these cases is probably the expression of something altogether different, as will be subsequently pointed out. There appear to be some well-authenticated cases of a reversal of heliotropic properties in the course of development of certain organs. Hoffmeister states that the floral peduncles of *Linaria Cymbalaria* are positively heliotropic, but that when the fruit has replaced the flower the peduncle is negatively heliotropic; and Wiesner states that the peduncle of *Helianthemum vulgare* is negatively heliotropic after fertilization has taken place. The nature of the heliotropic properties appears thus to vary with the biological conditions of the organs.

When organs are exposed throughout the whole period of their growth to unilateral illumination they usually take up a certain position which is termed the "fixed-light position," such that they curve towards the direction of incidence of the brightest light. In some cases this is not so. This may be explained by an absence of heliotropic sensitiveness, but in some cases it is due to the fact that the organs follow the daily course of the sun. Wiesner mentions *Sonchus arvensis* as a striking example of the latter condition. The activity of the curvature stands in a direct relation to the intensity of the incident light. The same botanist has found that for the organs of each plant there is an optimum intensity of light which produces the maximum of heliotropic effect, and that any increase or diminution of this intensity is followed by a diminished heliotropic effect.

With regard to the relative heliotropic effect of rays of different wave-length, it has long been known that the rays of high refrangibility are much more powerful than those of low refrangibility. Wiesner finds the distribution of heliotropic effect in the spectrum to be more exactly this: the greatest curvature is produced by the rays at the junction of the ultra-violet and violet; from this point the heliotropic effect diminishes until, in the yellow, it disappears; it begins to manifest itself again in the orange, and increases until it reaches a small secondary maximum in the ultra-red. Heliotropic effect is by no means confined to the luminous rays of the spectrum. Wiesner, and more recently Wortmann and Barthélemy, have shown that the dark heat-rays possess it. The curvatures produced by the dark rays are sometimes designated by the term "thermotropism."

The effect of unilateral illumination is not immediately exhibited, nor does it cease immediately upon the withdrawal of the organ from light. If an organ be exposed for only a short time to unilateral illumination, it may not exhibit any curvature during the period of exposure, but will curve subsequently in darkness. The exposure had sufficed to induce heliotropic curvature. This Wiesner terms "photo-mechanical induction," but it is simply due to the slow response of the organ to the directive influence of the incident rays,—to a long "latent period."

Turning now to the part played by the growing organ in heliotropic curvature, it is clear that the curvature will largely depend upon the heliotropic sensitiveness of the organ, and it must be borne in mind that organs vary widely in this respect. The curvature is in all cases confined to the growing region of the organ, or, to put it more generally, to the region which is capable of growing. In connection with this point, the further one naturally arises as to the seat of heliotropic sensitiveness. It is usually assumed that those zones which are growing most rapidly are those which are most sensitive, but Darwin found that in some cases (cotyledons of *Phalaris* and *Avena*, hypocotyls of Cabbage and Beet) illumination of the tip of the organ appeared to induce heliotropic curvature. This cannot at present be regarded as fully established.

With regard to the heliotropic phenomena presented by simply bilateral organs, such as the leaves of Irises, it will suffice to say that they are positively heliotropic.

Heliotropism in dorsiventral organs.

The heliotropic phenomena presented by dorsiventral organs are more complicated. It has been observed that dorsiventral branches (including the tendrils of *Vitis* and *Ampelopsis* mentioned above), when exposed to vertical light, tend to assume a horizontal position, whereas in darkness they usually grow erect. Dorsiventral leaves usually remain horizontal in darkness. A full discussion of these facts cannot be entered upon here; a few remarks must suffice. It is argued by some, especially by De Vries, that the horizontal position of dorsiventral organs when exposed to light is due to negative heliotropism; but there is no adequate proof that this is really the case. Sachs says on the subject, "So far as I can apprehend the facts, the negative heliotropism of the Marchantia-shoot, and that of many other shoots which behave in the same way, is the same phenomenon as the epinasty of foliage-leaves described by De Vries." Detmer has in fact found that exposure to light, quite independently of the direction of the incident rays, induces the rapid growth of the dorsal surface of dorsiventral leaves—in a word, induces photo-epinasty. Continued photo-epinasty would clearly cause the organ to curve downwards below the horizontal plane, and this is occasionally actually the case. But more frequently the organ remains in the horizontal plane when the light falls vertically upon it, or, to put the case more generally, the organ takes up such a fixed-light position that its long axis is at right angles to the direction of the incident rays. Moreover, it has been ascertained that it is always the dorsal surface of leaves which is directed towards the brightest incident light. It is clear that, in addition to the induction of photo-epinasty, light exercises a directive influence upon the growth of these organs. The attempt has been made to explain this by ascribing to the dorsiventral organs merely the heliotropic properties which belong to radial organs, but this explanation is quite insufficient. They can only be accounted for by attributing to dorsiventral organs, as Frank has done, a peculiar heliotropic sensitiveness, which he terms "transverse heliotropism" and Darwin "diaheliotropism," which manifests itself in the assumption of such a position that the dorsal surface of the organ is placed at right angles to the direction of the incident rays.

Gravity.—The influence of gravity in determining the direction of growth of an organ manifests itself in phenomena which are designated by the term "geotropism." We will again consider separately the phenomena which are presented by organs of different physiological properties.

Geotropism of radial organs.

Beginning with radial organs, we find that a great number of them normally grow either upwards or downwards; thus, primary shoots grow upwards and primary roots grow downwards. If any attempt is made to alter the direction of growth of these organs they at once curve so as to regain their normal direction. That the direction of growth is actually the result of the action of gravity was first demonstrated by Knight. He caused seeds to germinate on a wheel revolving with sufficient rapidity to set up a considerable centrifugal force, and he found that the roots and stems of the seedlings behaved with regard to the direction of the centrifugal force precisely as they do with regard to that of gravity: the roots grew radially outwards, and the stems radially inwards. He states his conclusion thus: "I conceive myself to have proved that the radicles of germinating seeds are made to descend, and their plumules to ascend, by some external cause, and not by any power inherent in vegetable life; and I see little reason to doubt that gravitation is the principal, if not the only, agent employed in this case by Nature."

In conformity with the terminology used with reference to heliotropism, organs which grow towards the centre of the earth are said to be "positively geotropic" and those growing in the opposite direction "negatively geotropic." As examples of positively geotropic radial organs may be mentioned, in addition to primary roots, the hyphæ of Moulds which penetrate into the substratum, the root-like filaments of *Vaucheria*, *Caulerpa*, and other *Algæ*, the rhizoids of *Muscineæ*, the rhizomes of some plants, such as *Yucca* and *Cordyline*. As examples of negatively geotropic radial organs may be mentioned, in addition to primary shoots, the stipes of Mushrooms, the sporangiferous hyphæ of Moulds, the stalks of the receptacles of Liverworts, the setæ of *Muscineæ*, the peduncles of many flowers, the climbing roots of various epiphytes. Cases of the absence of geotropic irritability are afforded by the hypocotyl of the Mistletoe, and by the aerial roots of various epiphytes. A reverse of its geotropic properties may take place in the course of the development of an organ. Vöchting has found, for instance, that the peduncle of the Poppy is negatively geotropic whilst the flower is in the bud, but positively geotropic during flowering and fruiting.

In dealing with these phenomena we have first to consider the effect of gravity acting at different angles. Sachs concludes, and his conclusion is generally accepted, that the geotropic influence of gravity is greatest when the long axis of the organ is at right angles to the vertical, and that it is zero when the long axis of the organ coincides with the vertical, whether the apex point upwards or downwards, or whether the organ be positively or negatively geotropic,—that is, if the force of gravity acting at any point of an organ be decomposed into two forces, the one acting at right angles to the long axis of the organ and the other along it, it is only the former which produces a geotropic effect. Sachs bases this view upon the fact that geotropic curvature is more rapidly produced when an organ is horizontal than when it is in any other position. Elfving has made observations which suggest a different view, namely, that the geotropic action of gravity upon an organ is greatest when that organ is removed as far as possible from its normal relation to the vertical.

The degree of geotropic sensitiveness is different in different organs. This is shown by the different directions of growth taken by different organs when grown under conditions which prevent to a sufficient extent other directive influences from producing any effect. For instance, primary roots grow vertically downward, but lateral roots grow more or less nearly horizontally. It has been ascertained, by means of centrifugal force, that lateral roots can be induced to behave like primary roots if only the force is sufficient; lateral roots grow radially outwards on the wheel when the centrifugal force is $4g$ ($g =$ force of gravity). It may be inferred that their geotropic sensitiveness is one-fourth of that of primary roots. The response of an organ to the directive influence of gravity, as in the case of heliotropism, is not immediate, but is preceded by a long latent period. An organ placed horizontally will not begin to curve for some time, and if then placed vertically the curvature will proceed for some time. Geotropic curvature, like heliotropic curvature, is a phenomenon of induced heterauxesis, the result being the assumption by the organ of such a position that gravity ceases to exert any directive influence upon it. Primary shoots and roots, for instance, find the vertical to be their position of rest, whereas lateral branches take up a more or less inclined position. It appears that, generally at least, the most rapidly growing zones of organs are those in which geotropic influence is most active. It has been hitherto generally accepted that the seat of most active curvature was also the seat of geotropic sensitiveness. Darwin recently brought forward the view, based upon the behavior of roots with their tips cut off, that, in the root at least, the tip is the seat of geotropic sensitiveness. This suggestion has given rise to a number of researches, the results of which are so conflicting that it is impossible at present to come to any definite conclusion on the subject.

With regard to the geotropic properties of simply bilateral organs (leaves of Irises, etc.) it need only be said that they are negatively geotropic.

Geotropism of dorsiventral organs.

Coming, finally, to the geotropic phenomena presented by dorsiventral organs, we find that many organs which when growing exposed to light have a more or less oblique direction of growth, grow erect in darkness. This is obviously an effect of gravity, and the organs are clearly negatively geotropic (examples are afforded by the runners of *Polygonum aviculare*, *Atriplex latifolia*, and others, by radical leaves, and by thalloid shoots of *Marchantia*). But some dorsiventral organs do not grow erect in darkness. Frank mentions the runners of *Fragaria lucida*, lateral branches of Conifers, and many dicotyledonous shrubs and trees as examples. He finds, further, that when these organs are placed otherwise than horizontally they curve until they come to lie in that plane, and, if they are placed in an inverse position so that their normally inferior surface (ventral) is uppermost, they twist on their own axis until the normal relation of their surfaces with respect to the vertical is attained; many leaves also behave in this way. Frank accounts for these phenomena by ascribing to such dorsiventral organs a peculiar geotropic sensitiveness, which he terms "transverse geotropism," and Darwin "diageotropism." De Vries has severly criticized this assumption. He regards the curvatures of shoots and branches into the horizontal plane as being, to some extent, the expression of the negative geotropism of the stems interfered with by the weight of the leaves, and, to some extent, also the expression of those forms of spontaneous heterauxesis termed epinasty and hyponasty which were alluded to above. Similarly he accounts for the torsions observed by Frank by ascribing them to the unequal twisting moment of the leaves on the two sides of the shoot when in the inverse position. In view of the existence of diaheliotropism, it may be regarded as probable that diageotropism exists also. But at present the case for the latter is not sufficiently made out. More experimental evidence must be forthcoming before the assumption of diageotropism can be regarded as fully justified.

Hydrotropism.

Moisture.—It has long been known that roots when brought into the neighborhood of a moist surface curve towards it. For instance, when seeds are sown in a box of damp sawdust, the bottom of the box being perforated with sufficiently large holes, the roots of the seedlings grow downwards into the sawdust, and ultimately project through the holes. They then no longer grow vertically downwards, but curve so as to apply themselves to the moist surface offered by the bottom of the box. To these phenomena Darwin has applied the term "hydrotropism." Organs which curve in this way are said to be "positively hydrotropic;" but there are also "negatively hydrotropic" organs. Wortmann has observed, for instance, that the sporangiferous hyphæ of *Phycomyces* curve away from a moist surface. The phenomena are precisely similar to those of heliotropism and of geotropism. The curvature is in this case also the expression of induced heterauxesis. It takes place in this case also with the greatest activity in the region of most rapid growth. Darwin came to the conclusion that the hydrotropic sensitiveness of roots at least is localized in their tips, a conclusion which, though opposed by Detlefsen and Wiesner, is so far confirmed by Molisch's results that it may be accepted as well founded.

Galvanotropism.

Electricity.—Elfving found that when a root is placed vertically between two electrodes it curves towards the positive electrode,—that is, against the direction of the current. In one case (Cabbage) the curvature was towards the negative electrode. Müller (Hettlingen), in repeating Elfving's experiments, found that the curvature was in all cases such as to tend to place the long axis of the root in the plane of the current, the curvature being towards the negative pole. These phenomena are spoken of as "galvanotropism." Müller found that the curvature was induced when the current traversed only the tip of the root, thus affording apparently another instance of localization of sensitiveness in the tip.

Substratum.

The Substratum.—Dutrochet long ago observed that the hypocotyl of the Mistletoe, in whatever position the seed may have been placed, assumes such a direction of growth that its long axis is perpendicular to the surface on which the seed has germinated. Sachs has shown, by means of rotation on the clinostat, that this position is assumed both by shoots and roots. It is clear that the substratum exercises a directive influence upon the organs growing either outwards from its surface or inwards into its surface, but the nature of this influence has not yet been investigated. It is certainly not to be ascribed, as Van Tieghem suggested, to the mere mass of the substratum. The effect of a cube of turf or a pot of earth would vanish entirely in comparison with the attraction of the earth,—in other words, with the influence of gravity. The phenomena are designated generally by the term "somatotropism.

Contact.

Contact.—The effect of contact upon the direction of growth of an organ must be clearly distinguished from the effects of considerable pressure. The latter are of two kinds: in the one case the pressure arrests the growth of that side of the organ which is exposed to it; in the other it excites the organ to active growth, particularly in thickness. Examples of the former effect are so common that they need not be specified; examples of the latter are afforded by the thickening of tendrils and of climbing stems when they have firmly grasped some support. The phenomena now to be considered are such as are induced by slight pressure. Striking instances of this are afforded by tendrils. A very slight touch suffices, in the case of the very sensitive, such as those of *Passiflora gracilis* and of *Sicyos angulatus*, to induce very perceptible curvature, which can be detected, according to Darwin, in half a minute after the touch.

Twining of tendrils.

In order to illustrate the subject adequately a brief account will be given here of the more important phenomena connected with the twining of tendrils. Darwin has shown that tendrils are not sensitive during the whole of their existence; speaking generally, they are not sensitive when they are either very young or full grown, and are most sensitive when they are about three-fourths grown. Darwin has also found that their sensitiveness is localized. In most the lower or basal part is either not at all sensitive or is sensitive only to prolonged contact. Most tendrils have their tips slightly but permanently hooked, and the sensitiveness is localized in the concavity of the hook. In some cases (*Cobæa scandens*, *Cissus discolor*) they are sensitive on all sides; in *Mutisia* the inferior and lateral surfaces are sensitive. As a rule, when in its most sensitive condition the tendril is actively circumnutating, so that it travels over a large area, and there is considerable probability that it will come into contact with some body around which it can twine. When contact takes place the tendril begins to curve round the support. As it does so new points of the sensitive surface are stimulated, and the curvature increases and extends until the whole of the tendril lying between the original point of contact and the apex is wound in a spiral coil round the support. In some cases this is all that takes place. In the great majority of cases, however, the coiling of the apical portion of the tendril round a support is followed by the spiral coiling of more or less of that portion of the tendril which lies between the original point of contact and the insertion of the tendril upon the stem, provided that this is mechanically possible. The spiral coiling of the basal part of the tendril involves, namely, a considerable shortening, and, if both the stem and the support are immovably fixed, this shortening cannot take place. The turns of the coil are not all in the same direction; they are grouped into two or more spires, separated by short straighter portions, the turns of any two successive spires being in opposite directions. This is a mechanical necessity associated with the spiral coiling of a filament attached at both ends. The spiral coiling of the basal part of the tendril usually begins just below the point of attachment to the support. The coiling of tendrils, like all the curvatures hitherto considered, is a phenomenon of induced heterauxesis. Hence it is that the possibility of the twining of a tendril round a support depends upon the thickness of the support and upon that of the tendril. Most tendrils, inasmuch as they are very thin, can twine round strings, but those which are relatively thick can only twine round a support of some thickness, for there is a mechanical limit to the excess of elongation of the convex over the concave side. The spiral coiling of the untouched portion of the tendril has an especial interest, as it offers a striking illustration of the transmission of a stimulus. It is true that the tendrils of many plants, if they fail to come into contact with a support, likewise coil spirally; but this is a much slower process, and only begins at the time when the tendrils are ceasing to grow and to be sensitive.

Tendrils are not, however, the only organs which are sensitive to contact. Other instances are afforded by the petioles of most leaf-climbers, by shoots, and apparently by roots.

In the case of sensitive shoots Dutrochet observed that the twining stem of *Cuscuta* is sensitive like a tendril. Von Mohl suggested that all climbing stems are sensitive, but both Darwin and De Vries were unable to detect the sensitiveness. This view of Von Mohl has been recently revived by Kohl, who finds that the internodes of climbing stems are sensitive to a long-continued pressure which is insufficient to produce any simply mechanical effect. Darwin found the young internodes of *Lophospermum scandens*, which is not a stem-climber, as also the peduncles of *Maurandia semperflorens*, to be sensitive to touch, and Kerner states that this is also the case with the peduncles of many flowers (Poppy, Anemone, Ranunculus, Tulip).

Darwinian curvature.

With regard to roots, Darwin was led to suspect, by observing the behavior of the radicles of seedlings in their attempts to pass over obstacles in the soil, that the tip of the radicle is sensitive to contact, and that the stimulus is transmitted from this, the sensory organ, to the growing zones behind it, in which the necessary curvature is then effected. He made experiments by attaching small objects to one side of the tip of the radicle in various plants, by touching one side of the tip with caustic, and by cutting a thin slice off one side, and found in most cases that the radicle curved away from the touched or injured side, that the curvature is precisely the opposite of that performed by tendrils when touched. The peculiar curving of radicles has been termed the "Darwinian curvature." Darwin's conclusions as to the sensitiveness of the radicle have given rise to considerable discussion. It is clear, in the first place, as he himself showed, that radicles are not perceptibly affected by brief contact or by friction; the contact must be prolonged. Those who dissent from Darwin's view, such as Wiesner, Burgerstein, and Detlefsen, urge that the curvatures induced in his experiments are pathological. It seems probable that this objection is valid. It may be admitted at once in the case of the experiments made by means of slicing the root-tip or touching it with caustic. With regard to the effect of small objects, such as pieces of card, it appears that the curvature of the radicle is due mainly, if not entirely, to the substances used in attaching them. In some cases, for instance, they were attached by a drop of shellac. It has been shown that the mere presence of the drop of shellac is sufficient to induce the Darwinian curvature, and microscopical examination has proved that the part touched by the shellac had died away. Moreover, it is known that a radicle can grow downwards against considerable resistance: it can penetrate into mercury; it can perforate tinfoil without deflection; Darwin, in fact, estimates the force of downward growth of the radicle at ¼ ℔, and its lateral pressure, in particular cases, at 8 and 3 ℔ respectively. The evidence leads to the conclusion that the Darwinian curvature of roots is not the expression of sensitiveness to contact, but that it is the result of injury of one side of the root.

Combined Effects.—Now that the influences which determine the direction of growth have been individually considered, it is possible to account for the characteristic positions taken up by organs in the course of their development. In dealing with this subject it is convenient, as Sachs suggests, to classify organs, according to their ultimate position, into two groups,—those which, under normal conditions, have their long axes vertical and those which have their long axes more or less inclined to the vertical; the former Sachs terms "orthotropic" organs, the latter "plagiotropic."

Orthotropic organs.

The direction of growth of plant-organs under normal conditions is the expression of the resultant effect of various external directive influences. To illustrate this in the case of orthotropic organs, let us consider the primary shoot and the primary root of a seedling growing under conditions which may be taken as normal. In the case of a shoot growing upwards into the air when light falls vertically upon it, its vertical upward growth is chiefly due to the action of gravity,—that is, it is the expression of the particular degree and quality of the geotropic sensitiveness of the shoot. Since the light is equally intense on all sides of the shoot, it exerts no directive influence. Orthotropism is then mainly due to negative geotropism. That this is so can be readily proved in various ways. For instance, the hypocotyl of the Mistletoe, as mentioned above, is not geotropic at all; hence it cannot be included among either orthotropic or plagiotropic organs, for it may grow vertically or it may grow obliquely, its direction of growth being determined chiefly by its somatotropism. Again, when a normally orthotropic organ is grown in darkness on a clinostat its direction of growth is horizontal. Passing now to the case of primary roots growing in the earth, when the conditions are normal—that is, especially when the earth is uniformly moist around the root—their direction of growth is vertically downwards. This is chiefly due to their strong positive geotropism. Let us suppose, now, that the conditions of growth of these organs are somewhat different from those which we have regarded as normal; let us suppose that the shoot or the root is exposed to lateral light, or that the soil about the root is not equally moist on all sides. In the former case, the action of light will tend to induce heliotropic curvature, but it will depend upon the relative strength of heliotropic and of geotropic sensitiveness whether or not a curvature actually takes place. In the case of most orthotropic shoots a curvature (positive) would take place, thus showing the heliotropic sensitiveness of shoots to be greater than the geotropic, but in some instances it would not take place; in the case of most orthotropic roots no curvature would take place, but in some instances (*Sinapis alba* and others) a curvature (negative) would take place, showing that in most cases the heliotropic sensitiveness of roots is less than their geotropic sensitiveness. The unequal moisture in the soil around the root would cause hydrotropic curvature, inasmuch as the sensitiveness of roots to the influence of moist surfaces is greater than their sensitiveness to gravity.

Plagiotropic organs.

We will deal with plagiotropic organs in a similar way. The majority of such are lateral members, as branches, leaves, etc. The direction of growth of a lateral member, certainly of branches of stems and roots and probably also of leaves, is at first determined by its relation to the parent axis. It has been found—by Dutrochet, Sachs, and others—that at their first development the long axes of lateral organs make a definite angle—termed the "proper angle"—with the long axis of the parent organ. Dutrochet thought that the proper angle was in all cases a right angle, that the relation of lateral organ to parent axis was of the nature of somatotropism; but this is a too general statement. The original direction of growth of a lateral organ determined by its proper angle would be maintained, in the absence of internal directive influences, by its rectipetality, but in nature it is affected by light, by gravity, etc. Lateral shoot-branches, for example, are either inherently dorsiventral or they become dorsiventral under the influence of gravity or of unilateral illumination; they are then diaheliotropic, though the manifestation of their diaheliotropism may be interfered with by photo-epinasty; they are usually negatively geotropic. Their direction of growth—that is, the direction of their long axes when mature—is the resultant effect of diaheliotropism and of negative geotropism. In the case of lateral root-branches these are plagiotropic but radial; they grow outwards, slightly inclined downwards below the horizontal; as they grow in the dark,—assuming that the moisture of the soil around them is uniform,—their direction of growth is affected to some extent by their slight positive geotropism. Though their geotropic sensitiveness is slight, their hydrotropic sensitiveness is great, so that their direction of growth is often very much modified by their coming into relation with moist areas of soil.

A complicated case of the action of a number of directive influences is afforded by climbing stems, and it may be worth while to specially consider it. When the stem is young and extends only a few inches above the ground it appears to be growing almost vertically upwards, but as it elongates the last-formed internodes exhibit well-marked circumnutation. It continues to grow upwards mainly in virtue of its negative geotropism, the direction of its growth being little, if at all, affected by light in consequence of its low degree of heliotropic sensitiveness. If now one of the young growing apical internodes comes into contact with a vertical support it begins to twine around it in virtue of the sensitiveness to permanent though slight pressure which, as mentioned above, these organs possess, the direction of the curvature round the support being also that of circumnutation. The coils formed are nearly horizontal when the support is thick and become more nearly vertical as the support grows thinner; in any case, the steepness of the spire always increases after it is first formed, its diameter is thus diminished, and the stem gains a firm grip of the support. As the stem twines round the support it undergoes torsion around its own axis, so that any one side maintains throughout the same position, whether it be directed inwards, towards the support, or outwards or laterally. The direction of torsion may be either the same as that of coiling or the reverse,—that is, either homodromous or antidromous. The direction of torsion appears to depend principally on the relation between the thickness of the climbing stem and that of the support, and on the smoothness or roughness of the surface of the support; when the support is relatively thin the torsion is homodromous, but when it is relatively thick the torsion is antidromous; with smooth supports, up to a certain limit of thickness, the torsion is homodromous, and with rough supports, down to a certain limit of thinness, the torsion is antidromous; in a word, the direction of torsion is determined by the degree of friction between the climbing stem and the support.

Protoplasmic movements.

2. *Movements.*—We pass now to the consideration of movements other than those associated with growth, and we take first movements exhibited by protoplasm. These may be classified into two categories,—(1) those which are performed by naked protoplasm,—by protoplasm, that is, which is not enclosed in a cell-wall; (2) those exhibited by protoplasm enclosed in a cell-wall. The movements of naked protoplasm are effected in two ways,—either by the protrusion of portions of the protoplasm, termed "pseudopodia," or by permanent flagelliform protoplasmic filaments, termed "cilia"; the first kind of movement is known as "amœboid," the second as "ciliary" movement. The amœboid movement is exhibited, though rarely, by isolated cells—for instance, by the zoospores of the *Myxomycetes*—and characteristically by those large aggregates of cells which constitute the plasmodia of this group of Fungi. The pseudopodia are thrown out at first as protrusions of the denser hyaline outer layer of the mass of protoplasm, the ectoplasm, and into this the more watery granular internal protoplasmic substance, the endoplasm, gradually flows. The repeated formation of pseudopodia in any given direction will result in locomotion taking place in that direction. The ciliary movement is characteristic of zoospores and of antherozoids. In some cases the organism, as in the case of *Volvox* and *Pandorina*, passes a large part of its existence in the mobile condition, and then the protoplasm is enclosed within a cell-wall which is perforated by the cilia. The number of cilia may be only one; more commonly in zoospores it is two, and sometimes four: occasionally the cilia are numerous, as in the zoospores of *Vaucheria* and *Œdogonium*; in antherozoids they are usually numerous. The cilia are constantly performing a lashing movement, which causes the organism to move forward and at the same time to rotate on its own axis.

In considering the movements of protoplasm when enclosed within a cell-wall, the typical structure of a plant-cell, as described at the beginning of this section (p. 50), must be borne in mind. In many cells the vacuole is found to be traversed by protoplasmic filaments which extend between one part of the primordial utricle and another. These filaments are continually varying in number, in position, and in size; they are formed and withdrawn in the same manner as the pseudopodia of naked masses of protoplasm. This kind of movement is, in fact, amœboid movement exhibited by protoplasm enclosed within a cell-wall. In all actively living protoplasm, whether naked or enclosed in a cell-wall, a streaming of the more fluid endoplasm can be observed, the direction and rapidity of the current being clearly shown by the granules which are carried along in it. This is very conspicuous in closed cells (as in leaf-cells of *Vallisneria spiralis* and root-hairs of *Hydrocharis Morsus Ranæ*) when the whole of the endoplasm rotates in a constant direction.

Movements of variation.

Movements of Mobile Organs.—With regard now to the movements exhibited by mobile organs, to the "movements of variation" as they are sometimes termed,—sometimes they are spontaneous, like the protoplasmic movements just considered; in other cases they are only performed in consequence of stimulation: they are induced. Instances of spontaneous movements of variation are, for reasons to be given hereafter, comparatively rare. A case in point is afforded by the Telegraph Plant, *Hedysarum* (*Desmodium*) *gyrans*. Under favorable conditions, particularly of temperature, the two lateral leaflets of the trifoliate leaf move upwards and downwards, their apices describing nearly a circle, a revolution taking from two to five minutes. A familiar example of an induced movement is afforded by the leaves of the Sensitive Plant (*Mimosa pudica*). When a leaf is touched the lateral leaflets close in pairs, folding upwards and forwards, and, if the stimulus be strong enough, the main petiole sinks downwards. The movement of this plant is of special interest, inasmuch as it affords an instance of the transmission of a stimulus. It suffices, namely, to touch the terminal leaflet to cause the closing of the successive pairs of lateral leaflets and the sinking down of the main petiole. Another example of induced movement is afforded by the so-called "sleep" of plants; the leaves of many plants take up during the night a position different from that which they take up during the day. Taking the Sensitive Plant as an example, during the day its leaflets are widely expanded, and its main petioles are directed obliquely upwards; at night its leaflets are folded together and its main petioles are directed obliquely downwards; it takes up at night, in fact, a position similar to that which is induced by a touch. Excessive illumination tends to induce closing. Other examples are afforded by the mobile stamens of the *Cynareæ* and of *Berberis* and *Mahonia*.

The relation of these movements to external conditions is as follows:

External conditions of these movements.

1. *Temperature.*—These movements, like the slow movement of growth, only take place within certain limits of temperature, which, however, vary in different cases. Movements of protoplasm, speaking generally, will only go on at temperatures between 0° and 50° C., and between these limits there is an optimum temperature at which they are most rapid. In the case of movements of variation the lower limit lies considerably higher, from 15° to 20° C. The foregoing illustrates the tonic relation between temperature and movement. Sudden changes of temperature have a stimulating effect. For instance, Dutrochet observed that the protoplasm of the internodal cells of a *Chara* exhibited rotation in water at 7° C., which soon ceased when the plant

was placed in water at 32° C.; after some time the movement returned, and was again arrested on replacing the plant in water at 7° C.

2. *Light.*—In most cases of protoplasmic movements light appears to exert no influence; in other cases it exerts a tonic influence. For instance, Engelmann has discovered a form of *Bacterium*, termed by him *Bacterium photometricum*, which is only mobile when exposed to light. Again, organs which exhibit spontaneous movements of variation, like the leaflets of *Hedysarum*, or induced movements, like the leaflets of *Mimosa*, lose their power of movement when kept in darkness for a day or two. Exposure to light, or, as it is termed, the state of "phototonus," is an essential condition of their movement. Bright light tends to arrest movement. For instance, the protrusion of pseudopodia by the plasmodium of *Æthalium septicum* is less active in light than in darkness. This is well shown in the sleep of plants alluded to above. The "diurnal position" of the leaves is due to exposure to light, the "nocturnal position" to its absence. This is perhaps most clearly exhibited by the Sensitive Plant. Under the normal alternation of day and night the leaves assume alternately the diurnal and nocturnal positions. If a plant be kept for some time in darkness, at a suitable temperature, it will be found that the leaves exhibit periodic movements of opening and closing. They are, in fact, endowed like those of the Telegraph Plant, with the power of spontaneous movement, which is arrested when the plant is exposed to light. Variations in the intensity of light act as stimuli. For instance, a sudden variation will cause the closing of the leaves of *Mimosa*. Light also exercises a directive influence on mobile protoplasm in some cases. For instance, when bright light falls obliquely on a plasmodium of *Æthalium septicum*, it causes it to creep away from the light. Again, the chlorophyll-corpuscles in the cells of leaves exposed to bright light are found to accumulate on those surfaces of the cells which are least exposed, to assume what is termed the position of "apostrophe," a change of position which is due to movements in the protoplasm in which the corpuscles are embedded. Finally, the direction of movement of ciliated zoospores swimming in water is affected by light. When light falls obliquely upon a vessel of water containing zoospores, they place themselves so that their long axes are more or less nearly parallel to the direction of the incident rays, and it is along this line that they move. They may either move towards the incident light or away from it, the direction being apparently determined by the intensity of the light, by the age of the zoospores, and by the amount of oxygen in the water. Protoplasmic masses which respond to the directive action of light are said to be "phototactic."

3. *Other Stimuli.*—It has been mentioned that movements may be induced in the Sensitive Plant by mechanical stimulation, by variation of temperature, and variations in the intensity of light. They may also be induced by electrical and chemical stimuli. The effect of an electrical stimulus on protoplasm exhibiting the amœboid movement is to cause retraction of the pseudopodia. It arrests also the rotating movement of the protoplasm for a time.

4. *Oxygen.*—The presence of oxygen is an essential condition of movement of any kind, in the case at least of aerobiotic plants. It appears that anaerobiotic plants (*Schizomycetes*) are mobile in the absence of oxygen.

Conditions essential to movement.

Nature and Mechanism of Movements.—On comparing the statements which have been made above as to the movements of growing organs and of mature mobile organs, their general similarity is at once apparent. The spontaneous movement of growth is comparable to the spontaneous movements of protoplasm and of mobile organs, and the performance of the former is dependent upon the same external conditions as the latter. The reaction to the influence of external agents is the same in many instances; for example, strong light arrests growth, and it arrests also the spontaneous movements of the leaves of *Mimosa* and other plants, and contact stimulates tendrils as it stimulates the leaves of the Sensitive Plant. Again, light exercises a directive influence on the growth of growing organs; it also exercises a directive influence on the movements of zoospores and plasmodia. These considerations lead to the conclusion that the causes of the movements must in all cases be the same.

It has been already pointed out that growth and movement are expressions of the expenditure of energy on the part of the organism, that they are dependent upon the decomposition of some complex substance forming part of, or at least present in, the protoplasm. The conditions which are essential to movement of any kind are, then, these: that the decomposable substance in question is formed and decomposed in sufficient quantity, in other words, that the protoplasm is irritable; that the protoplasm is capable of manifesting by a molecular change, which may be accompanied by a change in external form, the evolution of energy attending the decomposition; and, finally, in the case of protoplasm surrounded by a cell-wall, that the anatomical structure is such as to permit of a movement ensuing upon the change in the protoplasm. It is clear that, if the cell-wall is rigid, no change in the protoplasm can cause a change in form of the cell as a whole.

Spontaneous movement.

We may regard spontaneous movement as being due to the spontaneous decomposition of the decomposable substance whereby the protoplasm undergoes a molecular change. The automatic decomposition not unfrequently takes place, as in the case of the Telegraph Plant, at regular intervals, so that the movement is rhythmic or periodic. Spontaneous movement is most active when a certain favorable combination of external conditions is ensured; any variation in the combination leads to a diminution in the the activity, or even to complete arrest, of the movement. External conditions may affect the process either of formation or of decomposition of the decomposable substance. For instance, movements are arrested at a low temperature, most probably because either the formation of the decomposable substance or the necessary explosive decomposition does not take place under such circumstances with sufficient activity. Again, when movement is arrested at a high temperature, or by continuous darkness, it is probably for similar reasons. In this way the tonic effect of external conditions may be accounted for. The stimulating effect of external agents may be accounted for in a similar manner.

Movement, whether spontaneous or induced, is regarded as a phenomenon of *contractility* (see above, p. 17), but we have at present no knowledge of the exact nature of the molecular changes which constitute a contraction. It must be borne in mind not only that protoplasm contracts, but that, after contraction, it returns to its condition of rest. Spontaneous movement is the expression of automatic contraction. External tonic conditions either promote or retard movement, by either promoting or retarding contraction and recovery. Stimuli induce contraction.

Mechanism of movements.

The mechanism of the movements of protoplasm-masses appears to be as follows. Taking first the case of the amœboid movement, the protrusion of pseudopodia is due to a molecular change, of the nature of a contraction of the protoplasm, which takes place in the ectoplasm at the spot where the pseudopodium is to be formed, an elevation being gradually produced into which the more fluid endoplasm is, as it were, sucked. The rotating movement of protoplasm appears to depend upon a kind of amœboid movement taking place constantly in one direction—to be, that is, a creeping movement. Ciliary movement appears to depend on the alternate contraction of each longitudinal half of the cilium. It is not possible at present to attempt any explanation of the directive influence of light on moving protoplasm, but the fact itself is of great physiological importance.

The mechanism of the movements of organs, whether unicellular or multicellular, in which the cell-wall has to be considered is more complicated. The cells possess the structure described above; they consist of a cell-wall lined by the protoplasmic primordial utricle enclosing the cell-sap. They are, moreover, in a state of turgidity—that is, they are tensely filled with water. The state of turgidity in a cell depends upon three conditions,—(1) upon a tendency to absorb more water in consequence of the presence of osmotically active substances dissolved in the cell-sap; (2) upon the resistance offered by the primordial utricle to the escape of water from the cell; (3) upon the elasticity of the cell-wall. The elasticity of the primordial utricle is so small that it may be neglected. The growth in length of a filament of *Vaucheria* may be taken as a case illustrative of the importance of turgidity as a condition of growth in unicellular organs. This growth cannot be attributed to a greater hydrostatic pressure at the apex of the cell, for the pressure is necessarily the same at all points, and clearly it cannot be referred to a diminished resistance on the part of the primordial utricle to the passage outwards of water at that point. It must be referred to the cell-wall, and it can only be accounted for on the assumption that the elasticity of the cell-wall is less at the apex than at any other point of its surface.

Growth is not, however, to be regarded as the result merely of the mechanical expansion of the cell which is rendered permanent. There is every reason to believe that the protoplasm takes an active part in producing this expansion, and in determining the direction in which expansion shall more particularly take place. The arrest of growth by strong light is a case in point. There is no reason to believe that this is to be ascribed to an increased rigidity of the cell-wall, or to a diminution of the attraction of the cell-sap for water. It can only be ascribed to a molecular change in the protoplasm, which causes it to offer considerable resistance to any change of form, either spontaneous or such as is induced by the hydrostatic pressure. The arrest of growth which, as we have seen, usually occurs when leaves are kept in continuous darkness is another case in point. The arrest of growth of the cells under these circumstances cannot be referred to a change in the physical properties of either the cell-wall or the cell-sap, but must be attributed to a change in the molecular condition of the protoplasm.

Heterauxesis.

The phenomena of heterauxesis, spontaneous and induced, have now to be considered. It will be convenient to deal with induced heterauxesis first, and we will begin with the case of a unicellular organ. It has been mentioned that heterauxesis, in the form of curvature, is induced by the action of light, gravity, etc. Inasmuch as the hydrostatic pressure is necessarily the same at all points of the internal surface of the cell, the curvature must depend upon a local variation of the properties either of the cell-wall or of the protoplasm. In the case of the cell-wall either its rigidity is increased on one side, the concave, or its extensibility increased on the other, the convex. It is just conceivable, with regard to the action of light, that such a difference in properties might be induced by the more direct exposure of one side of a delicate filament to light, though the difference of intensity on the two sides would be very small. But it is not at all conceivable that such a difference could be induced by the action of gravity, and no explanation can be regarded as satisfactory which fails to meet all cases of curvature. The cause of the curvature is doubtless to be sought in the protoplasm. Unilateral illumination of the organ, or an abnormal relation to the line of action of gravity, acts as a stimulus on the organ and causes an alteration in the properties of its protoplasm, which is perhaps of such a nature that it becomes relatively rigid on the side which becomes concave. The induced heterauxesis of multicellular organs is certainly of essentially the same nature as that of unicellular organs. Applying the above explanation of the curvature of unicellular organs to multicellular organs, the conclusion to be drawn would be that the curvature of the latter is due to the induction of the same changes in the protoplasm in each of their growing cells.

The phenomenon of spontaneous heterauxesis, as exhibited in nutation, may be accounted for in precisely the same way, but it is possible to imagine that it may be due to some extent in the case of unicellular organs to local variations in the extensibility of the cell-wall, and in that of multicellular organs to variations in the extensibility of the cell-walls of groups of cells on different sides of the organ.

Function of pulvinus.

The phenomenon exhibited by mature mobile organs, such as the leaves of the Sensitive Plant, etc., remains finally to be considered. The movement of the leaf as a whole is effected by a group of cells, constituting a swelling, the *pulvinus*, at the insertion of the main petiole, and of each leaflet by a similar organ at its attachment to the main petiole. The structure of the pulvinus is briefly a mass of parenchymatous cells having the same structure as that described above, traversed by a strand of flexible fibro-vascular tissue. When the leaf is fully expanded, its position is maintained by an equality between the downward pressure of the portion of the pulvinus above the fibro-vascular strand and the upward pressure of the portion below it. The downward movement of the leaf as a whole is due to a sudden diminution of the upward pressure of the lower portion of the main pulvinus; similarly, the upward movement of a leaflet is due to the sudden diminution of the downward pressure of the upper portion of its pulvinus. In both cases the diminution of pressure is due to a loss of turgidity of the portion of the pulvinus concerned: the cells become flaccid. This loss of turgidity has been shown to be due to an escape of water from the cells, which can only be accounted for by ascribing it to a change in the molecular condition of their protoplasm. In spontaneous movements this change is induced automatically, in induced movements by the action of a stimulus. This molecular change is probably of such a kind that the protoplasm takes up water into itself, and at the same time allows it to pass through. The recovery of turgidity is slow. The arrest of movement which is induced by long-continued darkness or by exposure to light is probably due to the prevention of the occurrence of molecular change in the protoplasm. The conduction of a stimulus, which undoubtedly takes place in the leaves of the Sensitive Plant, and probably in many other plant-organs (see above on heliotropism, geotropism, hydrotropism, tendrils), is effected by means of the delicate filaments of protoplasm which, as Gardiner has clearly shown in the pulvinus, are continuous between the protoplasm-bodies of adjacent cells.

For the reproduction of plants, see REPRODUCTION.

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Water-culture, 55.
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PIACENZA (Fr., *Plaisance*; Lat., *Placentia*), a city of Italy, a bishop's see, and the chief town of a province, lies on the Lombard plain, 217 feet above sea-level, not far from the right bank of the Po, just below the confluence of the Trebbia. By rail it is 43 miles southeast of Milan, and 35½ northwest of Parma. Formerly a place of considerable strength, it is still surrounded by walls with bastions and fosse in a circuit of 4 miles. The cathedral was erected between 1122 and 1233, in the Lombardo-Gothic style, under the direction of Santo da Sambuceto, on the site of a church of the 9th century which had been destroyed by earthquake. The west front has three doors with curious pillared porches. The campanile is a massive square brick tower 223 feet high; the iron cage attached to one of its windows was put up in 1495 by Ludovico il Moro for the confinement of persons guilty of treason or sacrilege. The crypt is a large church supported by one hundred columns. Sant' Antonio, which was the cathedral church till 877, and occupies the spot where it was reputed that St. Barnabas preached to the people, was built by St. Victor, the first bishop of Piacenza, in 324, restored in 903, rebuilt in 1104, and altered in 1857. It was within its walls that the deputies of the Lombard League swore to the conditions of peace ratified in 1183 at Constance. The brick vestibule (Il Paradiso) on the north side is one of the older parts of the building. San Francesco, a spacious edifice begun by the Franciscans in 1278, occupies the site of Ubertino Landi's palazzo, and is famous as the place where Agostino Landi harangued the people after the murder of Pierluigi and where, in 1848, the deputies of Piacenza proclaimed the annexation of their city to the Sardinian kingdom. San Sisto, which dates from 1499, and takes the place of the church founded in 874 by Angilberga (consort of the emperor Louis II.) for the Benedictines, lost its chief attraction when Raphael's Sistine Madonna (now in Dresden) was sold by the monks in 1754 to Frederick Augustus III. San Sepolcro and Sta Maria della Campagna are both after Bramante's design; the latter is rich in works of Pordenone. Sant' Anna, dating from 1334, was the church of the barefooted Carmelites. Of the secular buildings in the city the most interesting is the Palazzo Communale, begun in 1281. In the main front the lower story, constructed of red and white marble, presents a series of five open pointed arcades; the upper story, in brick, has six very rich round-arched windows, each of five lights; and above the cornice rise forked battlements. The square in front is known as the Piazza dei Cavalli, from the two bronze equestrian statues of Ranuccio (1620) and his father Alexander, prince of Parma, governor of the Netherlands (1625). Both were designed by Francesco Mocchi. The Farnese palace was begun after Vignola's designs by Margaret of Austria in 1558; but it was never completed, and since 1800 it has been used as barracks. Other buildings or institutions of note are the old and the new bishop's palace, the fine theatre designed by Lotario Tomba in 1803, the great hospital dating from 1471, the library presented to the commune in 1846 by the marquis Ferdinando Landi, and the Passerini library founded in 1685. About a mile to the east of the city is the Collegio Alberoni, instituted in 1751 for the education of priests and missionaries. At a distance of about 2 miles in the opposite direction the Trebbia is crossed by a bridge of twenty-three arches, erected in 1825 at a cost of £47,000; the Austrians blew up two of the arches in 1859. Piacenza is an important point in the Italian railway system—the Lombardy, Piedmont, and Ligurian lines meeting there with those of Central Italy. Silk, cotton, and woollen goods, pottery, and hats are among the local manufactures. The population of the commune (which in this case is almost exactly identical with the city) was 34,985 in 1871 and 34,987 in 1881.

Piacenza, originally, it is supposed, a Ligurian, and afterwards a Gallic town, was made a Roman colony in 219 B.C. While its walls were yet unfinished it had to repulse an attack by the Gauls, whose hopes were excited by the news of Hannibal's approach, and in the latter part of 218 it afforded protection to the remains of the Roman army under Scipio which had been defeated by the Carthaginian general in the great battle on the Trebbia. In 207 it withstood a protracted seige by Hasdrubal, Hannibal's brother, and thus contributed largely to the ultimate success of the Romans. Seven years later the Gauls surprised and burned the city; and the colony was so diminished in strength that in 190 it had to be recruited with three thousand families. In 187 it was connected with Rimini and the south by the construction of the Æmilian Way. During the later republic and the empire Placentia is named in connection with a defeat of the forces of Marius in the neighborhood (82 B.C.), a mutiny of Julius Cæsar's garrison (49 B.C.), another mutiny under Augustus (41 B.C.), the defence of the city by Spurinna, Otho's general, againt Cæcina, Vitellius's general (69 A.D.), and the defeat of Aurelian by the Marcomanni outside the walls (271 A.D.). In 546 Totila reduced Piacenza by famine. Between 997 and 1035 the city was governed by its bishops, who had received the title of count from Otho III. In the latter part of the 12th century it was one of the leading members of the Lombard League. For the most part it remained Guelph, though at times, as when it called in Galeazzo Visconti, it was glad to appeal to a powerful Ghibelline for aid against its domestic tyrants. In 1447 the city was captured and sacked by Francesco Sforza. Having placed itself directly under papal protection in 1512, it was in 1545 united with PARMA (*q. v.*) to form an hereditary duchy for Pierluigi Farnese, son of Paul III. In 1746 a battle between the Franco-Spanish forces and the Austrians was fought under the city walls. In 1848 Piacenza was the first of the towns of Lombardy to join Piedmont; but it was re-occupied by the Austrians and had to wait for its emancipation till 1859. Lucius Calpurnius Piso (father-in-law of Julius Cæsar), Pope Gregory X., and Alexander Farnese, duke of Parma, were natives of the city. Among the local historians are Boselli, Rossi, Bonara, and Gemmi.

PIANOFORTE. The group of keyed stringed instruments, among which the pianoforte is latest in order of time, has been invented and step by step developed with the modern art of music, which is based upon the simultaneous employment of different musical sounds. In the 10th century the "organum" arose, an elementary system of accompaniment to the voice, consisting of fourths and octaves below the melody and moving with it; and the organ, the earliest keyed instrument, was, in the first instance, the rude embodiment of this idea and convenient means for its expression. There was as yet no keyboard of balanced key levers; batons were drawn out like modern draw-stops, to admit the compressed air necessary to make the pipes sound. About the same time arose a large stringed instrument, the organistrum, the parent of the now vulgar hurdy-gurdy; as the organ needed a blower as well as an organist, so the player of the organistrum required a handle-turner, by whose aid the three strings of the instrument were made to sound simultaneously upon a wheel, and, according to the well-known sculptured relief of St. George de Boscherville, one string was manipulated by means of a row of stoppers or tangents pressed inwards to produce the notes. The other strings were drones, analogous to the drones of the bagpipes, and differing in effect from the changing "organum" of the organ. In the 11th century, the epoch of Guido d'Arezzo, to whom the beginning of musical notation is attributed, the Pythagorean monochord, with its shifting bridge, was used in the singing schools to teach the intervals of the plain-song of the church. The practical necessity, not merely to demonstrate the proportionate relations of the intervals, but also to initiate pupils into the different gradations of the church tones, had soon after Guido's time brought into use quadruplex-fashioned monochords, which were constructed with scales, analogous to the modern practice with thermometers which are made to show both Réaumur and Centigrade, so that four lines indicated as many authentic and as many plagal tones. This arrangement found great acceptance, for Aribo, writing about fifty years after Guido, says that few monochords were to be found without it. Had the clavichord then been known, this make-shift contrivance would not have been used. Aribo strenuously endeavored to improve it, and "by the grace of God" invented a monochord measure which, on account of the rapidity of the leaps he could make with it, he named a wild-goat (*caprea*). Jean de Muris (*Musica Speculativa*, 1323) teaches how true relations may be found by a single-string monochord, but recommends a four-stringed one, properly a tetrachord, to gain a knowledge of unfamiliar intervals. He describes the musical instruments known in his time, but does not mention the clavichord or monochord with keys, which could not have been then invented. Perhaps one of the earliest forms of such an instrument, in which stoppers or tangents had been adopted from the organistrum, is shown in Fig. 1, from a wood carving of a vicar choral or organist, preserved in St. Mary's Church, Shrewsbury. The latest date to which this interesting figure may be attributed is 1460, but the conventional representation shows that the instrument was then already of a past fashion, although perhaps still retained in use and familiar to the carver.

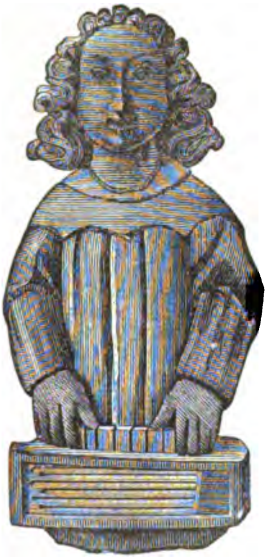

FIG. 1.—Earliest existing representation of a Keyed Stringed Instrument from St. Mary's, Shrewsbury (primitive Clavichord). Before 1460. Drawn by Miss Edith Lloyd.

A keyboard of balanced keys may have been first introduced in the little portable organ known as the regal, so often represented in old carvings, paintings, and stained windows. It derived its name regal from the rule (*regula*) or graduated scale of keys, and its use was to give the singers in religious processions the note or pitch. The only instrument of this kind known to exist in the United Kingdom is at Blair Athole, and it bears the very late date of 1630. The Brussels regal may be as modern. These are instances of how long a some-time admired musical instrument may remain in use after its first intention is forgotten. We attribute the adaptation of the narrow regal keyboard to what was still called the monochord, but was now a complex of monochords over one resonance board, to the latter half of the 14th century; it was accomplished by the substitution of tangents fixed in the further ends of the balanced keys for the movable bridges of the monochord or such stoppers as are shown in the Shrewsbury carving. Thus the monochordium or "payre of monochordis" became the clavichordium or "payre of clavichordis"—pair being applied, in the old sense of a "pair of steps," to a series of degrees. This use of the word to imply gradation was common in England to all keyed instruments; thus we read, in the Tudor period and later, of a pair of regals, organs, or virginals.

The earliest known record of the clavichord occurs in some rules of the minnesingers, dated 1404, preserved at Vienna. The monochord is named with it, showing a differentiation of these instruments, and of them from the clavicymbalum, the keyed cymbal, cembalo (Italian), or psaltery. From this we learn that a keyboard had been thus early adapted to that favorite mediæval stringed instrument, the "cembalo" of Boccaccio, the "sautrie" of Chaucer. There were two forms of the psaltery:—(1) the trapeze, one of the oldest representations of which is to be found in Orcagna's famous Trionfo della Morte in the Campo Santo at Pisa, and another by the same painter in the National Gallery, London; and (2) the contemporary "testa di porco," the pig's head, which was of triangular shape as the name suggests. The trapeze psaltery was strung horizontally, the "istromento di porco" either horizontally or vertically,—the notes, as in the common dulcimer, being in groups of three or four unisons. In these differences of form and stringing we see the cause of the ultimate differentiation of the spinet and harpsichord. The compass of the psalteries was nearly that of Guido's scale; but, according to Mersenne, the lowest interval was a fourth, G to C, which is worthy of notice as anticipating the later "short measure" of the spinet and organ.

The simplicity of the clavichord inclines us to place it, in order of time, before the clavicymbalum or clavicembalo; but we do not know how the sounds of the latter were at first excited. There is an indication as to its early form to be seen in the church of the Certosa near Pavia, which compares in probable date with the Shrewsbury example. We quote the reference to it from Dr. Ambros's *History of Music*. He says a carving represents King David as holding an "istromento di porco" which has eight strings and as many keys lying parallel to them; he touches the keys with the right hand and damps the strings with the left. The attribution of archaism applies with equal force to this carving as to the Shrewsbury one, for when the monastery of Certosa was built chromatic keyboards, which imply a considerable advance, were already in use. There is an authentic representation of a chromatic keyboard, painted not later than 1426, in the St. Cecilia panel (now at Berlin) of the famous Adoration of the Lamb by the Van Eycks. The instrument depicted is a positive organ, and it is interesting to notice in this realistic painting that the keys are evidently boxwood as in the Italian spinets of later date, and that the angel plays a common chord—A with the right hand, F and C with the left. But diatonic organs with eight steps or keys in the octave, which included the B flat and the B natural, as in Guido's scale, were long preserved, for Prætorius speaks of them as still existing nearly two hundred years later. This diatonic keyboard, we learn from Sebastian Virdung (*Musica getutscht und ausz-*

gezogen, Basel, 1511), was the keyboard of the early clavichord. We reproduce his diagram as the only authority we have for the disposition of the one short key.

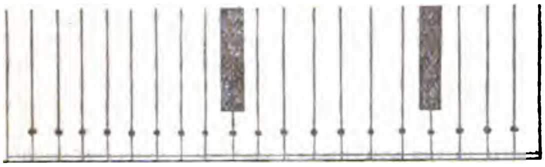

FIG. 2.—Diatonic Clavichord Keyboard (Guido's Scale) from Virdung. Before 1511.

The extent of this scale is exactly Guido's. Virdung's diagram of the chromatic is the same as our own familiar keyboard, and comprises three octaves and a note, from F below the bass stave to G above the treble. But Virdung tells us that even then clavichords were made longer than four octaves by repetition of the same order of keys. The introduction of the chromatic order he attributes to the study of Boetius, and the consequent endeavor to restore the three musical *genera* of the Greeks—the diatonic, chromatic, and enharmonic. But the last-named had not been attained. Virdung gives woodcuts of the clavicordium, the virginal, the clavicymbalum, and the claviciterium. We reproduce three of them (Figs. 3, 6, and 12), omitting the virginal as obviously incorrect. All these drawings have been continually repeated by writers on musical instruments up to the present day, but without discerning that in the printing they are reversed, which puts the keyboards entirely wrong, and that in Luscinius's Latin translation of Virdung (*Musurgia, sive Praxis Musicæ*, Strasburg, 1536), which has been hitherto chiefly followed, two of the engravings, the clavicymbalum and the claviciterium, are transposed, another cause of error. Martin Agricola (*Musica Instrumentalis*, Wittenberg, 1529) has copied Virdung's illustrations with some differences of perspective, and the addition, here and there, of errors of his own.

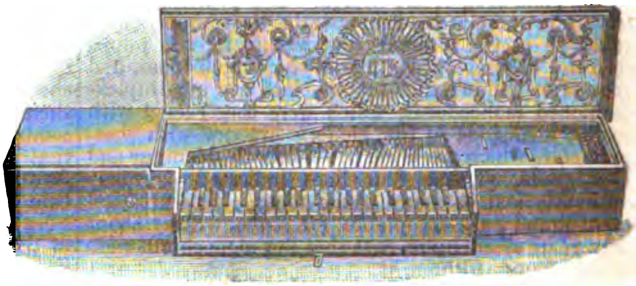

FIG. 4.—Manicordo (Clavichord) d'Eleonora di Montalvo, 1659; Kraus Museum, Florence.

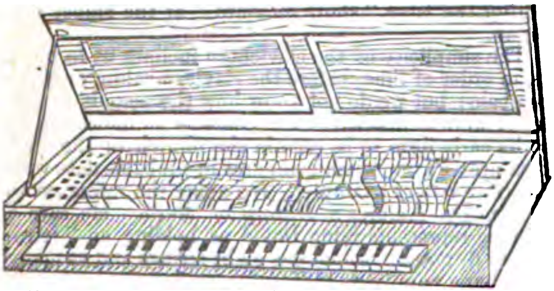

FIG. 3.—Virdung's Clavichordium, 1511; reversed *fac simile*.

Still vulgarly known as monochord, Virdung's clavichord was really a box of monochords, all the strings being of the same length. He derives the clavichord from Guido's monochord as he does the virginal from the psaltery, but, at the same time, confesses he does not know when, or by whom, either instrument was invented. We observe in this drawing the short sound-board, which always remained a clavichord peculiarity, and the straight sound-board bridge—necessarily so when all the strings were of one length. To gain an angle of striking place for the tangents against the strings the keys were made crooked, an expedient further rendered necessary by the "fretting,"—three tangents, according to Virdung, being directed to stop as many notes from each single group of three strings tuned in unison; each tangent thus made a different vibrating length of string. In the drawing the strings are merely indicated. The German for fret is *Bund*, and such a clavichord, in that language, is known as a "gebunden" one, both fret (to rub) and *Bund* (from *binden*, to bind) having been taken over from the lute or viol. The French and Italians employ "touche" and "tasto," touch. Prætorius, who wrote a hundred years later than Virdung, says two, three, and four tangents were thus employed in stopping. The oldest clavichords extant have no more than two tangents to a note formed by a pair of strings, no longer three. Thus seven pairs of strings suffice for an octave of twelve keys, the open notes being F, G, A, B flat, C, D, E flat, and by an unexplained peculiarity, perhaps derived from some special estimation of the notes which was connected with the church modes, A and D are left throughout free from a second tangent. A corresponding value of these notes is shown by their independence of chromatic alteration in tuning the double Irish harp, as explained by Galilei in his treatise on music, published in 1581. Adlung, who died in 1762, speaks of another fretting, but we think it must have been an adaptation to the modern major scale, the "free" notes being E and B. Clavichords were made with double fretting up to about the year 1700,—that is to say, to the epoch of J. S. Bach, who, taking advantage of its abolition and the consequent use of independent pairs of strings for each note, was enabled to tune in all keys equally, which had been impossible so long as the fretting was maintained. The modern scales having become established, Bach was now able to produce, in 1722, *Das wohltemperirte Clavier*, the first collection of preludes and fugues in all the twenty-four major and minor scales for a clavichord which was tuned, as to concordance and dissonance, fairly equal.

The oldest clavichord here called manicordo (as French, *manicorde*, from monochord), known to exist is that shown in Fig. 4. It will be observed that the lowest octave is here already "bundfrei" or fret-free. The strings are no longer of equal length, and there are three bridges, divisions of the one bridge, in different positions on the sound-board. Mersenne's "manicorde" (*Harmonie Universelle*, 1636), shown in an engraving in that work, has the strings still nearly of equal length, but divides the sound-board bridge into five. The fretted clavichords made in Germany in the last years of the 17th century have the curved sound-board bridge, like a spinet. In the clavichord the tangents always form the second bridge, indispensable for the vibration, as well as act as the sound exciters (Fig. 5). The common damper to all

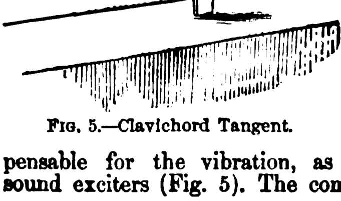

FIG. 5.—Clavichord Tangent.

the strings is a list of cloth, interwoven behind the tangents. As the tangents quitted the strings the cloth immediately stopped vibration. Too much cloth would diminish the tone of this already feeble instrument, which gained the name of "dumb spinet" from its use. The cloth is accurately painted in the clavichord Rubens's St. Cecilia (Dresden Gallery) plays upon,—interesting as perhaps representing that painter's own instrument. The number of keys there shown is three octaves and a third, F to A,—the same extent as in Handel's clavichord now in the museum at Maidstone (an Italian instrument dated 1726, and not fretted), but with a combined chromatic and short octave peculiarity in the lowest notes we shall have to refer to when we arrive at the spinet; we pass it by as the only instance in the clavichord we have met with. The clavichord must have gone out of favor in Great Britain and the Netherlands early in the 16th century, before its expressive power, which is of the most tender and intimate quality, could have been, from the nature of the music played, observed,—the more brilliant and elegant spinet being preferred to it. Like the other keyboard instruments it had no German name, and can hardly have been of German origin. Holbein, in his drawing of the family of Sir Thomas More, 1528, now at Basel, indicates the place for "Klavikordi und ander Seytinspill." But it remained longest in use in Germany—until even the beginning of the present century. It was the favorite "Klavier" of the Bachs. Besides that of Handel already noticed, there are in existence clavichords the former possession of which is attributed to Mozart and Beethoven. The clavichord was obedient to a peculiarity of touch possible on no other keyboard instrument. This is described by C. P. Emmanuel Bach in his famous essay on playing an accompaniment, entitled *Versuch über die wahre Art das Klavier zu spielen* (An Essay on the True Way to play Keyboard Instruments). It is the "Bebung" (trembling), a vibration in a melody note of the same nature as that frequently employed by violin players to heighten the expressive effect; it was gained by a repeated movement of the fleshy end of the finger while the key was still held down. The "Bebung" was indicated in the notation by dots over the note to be affected by it, perhaps showing how many times the note should be repeated. According to the practice of the Bachs, as handed down to us in the above-mentioned essay, great smoothness of touch was required to play the clavichord in tune. As with the monochord, the means taken to produce the sound disturbed the accuracy of the string measurement by increasing tension, so that a key touched too firmly in the clavichord, by unduly raising the string, sharpened the pitch, an error in playing deprecated by C. P. Emmanuel Bach. This answers the assertion which has been made that J. S. Bach could not have been nice about tuning when he played from preference on an instrument of uncertain intonation.

The next instrument described by Virdung is the virginal (*virginalis*, proper for a girl), a parallelogram in shape, with a projecting keyboard and compass of keys the same as the clavichordium. Here we can trace derivation from the psaltery in the sound-board covering the entire inner surface of the instrument and in the triangular disposition of the strings. The latter in Virdung's drawing has an impossible position with reference to the keyboard, which renders its reproduction as an illustration useless. But in the next drawing, the clavicymbalum, this is rectified, and the drawing, reversed on account of the keyboard, can be accepted as roughly representing the instrument so called (Fig. 6).

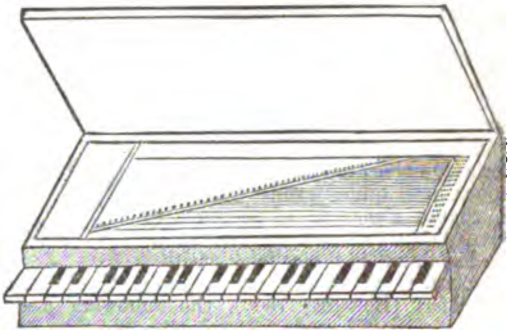

FIG. 6.—Virdung's Clavicymbalum (Spinet), 1511; reversed *fac-simile.*

There would be no difference between it and the virginal were it not for a peculiarity of keyboard compass, which emphatically refers itself to the Italian "spinetta," a name unnoticed by Virdung or by his countryman Arnold Schlick, who, in the same year 1511, published his *Spiegel der Orgelmacher* ("Organbuilders' Mirror"), and named the clavichordium and clavicymbalum as familiar instruments. In the first place, the keyboard, beginning apparently with B natural, instead of F, makes the clavicymbalum smaller than the virginal, the strings in this arrangement being shorter; in the next place it is almost certain that the Italian spinet compass, beginning apparently upon a semitone, is identical with a "short measure" or "short octave" organ compass, a very old keyboard arrangement, by which the lowest note, representing B really sounded G, and C sharp in like manner A. The origin of this may be deduced from the psaltery and many representations of the regal, and its object appears to have been to obtain dominant basses for cadences,—harmonious closes having early been sought for as giving pleasure to the ear. We have found a hitherto unnoticed authority for this practice in Mersenne, who, in 1636, expressly describes it as occurring in his own spinet (*espinette*). He says the keyboards of the spinet and organ are the same. Now, in his Latin edition of the same work he renders espinette by clavicymbalum. We read (*Harmonie Universelle*, Paris, 1636, liv. 3, p. 107)—"Its longest string [his spinet's] is little more than a foot in length between the two bridges. It has only thirty-one steps ["*marches*"] in its keyboard, and as many strings over its sound-board [he now refers to the illustration], so that there are five keys hidden on account of the perspective,—that is to say, three naturals and two sharps ["*feintes*," same as the Latin *ficti*], of which the first is cut into two (a divided sharp forming two keys); but these sharps serve to go down to the third and fourth below the first step, C *sol* [tenor clef C], in order to go as far as the third octave, for the eighteen principal steps make but an eighteenth, that is to say, a fourth more than two octaves." The note we call F he, on his engraving, letters as C, indicating the pitch of a spinet of the second size, which the one described is not. The third and fourth, reached by his cut sharp, are consequently the lower E and D; or, to complete, as he says, the third octave, the lowest note might be F, but for that he would want the diatonic semitone B, which his spinet, according to his description, did not possess.[1] Mersenne's statement sufficiently proves, first, the use in spinets as well as in organs of what we now call "short measure," and, secondly, the intention of cut sharps at the lower end of the keyboard to gain lower notes. He speaks of one string only to each note; unlike the double and triple strung clavichord, those instruments, clavicymbalum, spinet, or virginal, derived from the psaltery, could only present one string to the mechanical plectrum which twanged it. As regards the kind of plectra earliest used we have no evidence. The little crow-quill points, Scaliger, who was born in 1484 expressly says were introduced when he was a boy. They project from centred tongues in uprights of wood

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[1] Mr. A. J. Ellis (*History of Musical Pitch*, p. 318), sees the B in Mersenne's outline diagram.

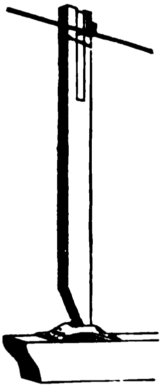


Fig. 7.—Spinet "Jack."

known as "jacks" (Fig. 7), which also carry the dampers. The quills, rising by the depression of the keys in front, set the strings vibrating as they pass them—springs at first of steel, later of bristle, giving energy to the twang and governing their return. Scaliger remembered the "harpichordum" and "clavicymbalum" being without those quill-points (*mucrones*), and attributes the introduction of the name "spinetta" to them (from *spina*, a thorn). We will leave harpichordum for the present, but the early identity of clavicymbalum and spinetta is certainly proved. Scaliger's etymology has remained unquestioned until quite recently; it is due to Signor Ponsicchi of Florence to have discovered another derivation. He has found in a rare book entitled *Conclusione nel suono dell' organo, di D. Adiano Banchieri* (Bologna, 1608), the following passage, which translated reads: "Spinetta was thus named from the inventor of that oblong form, who was one Maestro Giovanni Spinetti, a Venetian; and I have seen one of those instruments, in the possession of Francesco Stivori, organist of the magnificent community of Montagnana, within which was this inscription—*Joannes Spinetvs Venetvs fecit*, A.D. 1503." Scaliger's and Banchieri's statements may be combined, as there is no discrepancy of dates, or we may rely upon whichever seems to us to have the greater authority, always bearing in mind that neither invalidates the other. The introduction of crow-quill points, and adaptation to an oblong case of an instrument previously in a trapeze form, are synchronous; but we must accept 1503 as a late date for one of Spinetti's instruments, seeing that the altered form had already become common, as shown by Virdung, in another country as early as 1511. After this date there are frequent references to spinets in public records and other documents, and we have fortunately the instruments themselves to put in evidence, preserved in public museums and in private collections. The oldest spinet we can point out is in the Conservatoire, Paris. It is a pentagonal instrument made by Francesco di Portalupis at Verona, 1523. The Milanese Rossi were famous spinet-makers, and have been accredited (*La Nobilità di Milano*, 1595) with an improvement in the form which we believe was the recessing of the keyboard, a feature which had previously entirely projected; by the recessing a greater width was obtained for the sound-board. The spinets by Annibale Rosso at South Kensington, dated respectively 1555 (Fig. 8) and 1577, show this alteration, and may be compared with the older and purer form of one, dated 1568, by Marco Jadra (also known as Marco "dalle spinette," or "dai cembali"). Besides the pentagonal spinet, there was an heptagonal variety; they had neither covers nor stands, and were often withdrawn from decorated cases when required for performance. In other instances, as in the 1577 Rosso spinet, the case of the instrument itself was richly adorned. The apparent compass of the keyboard in Italy generally exceeded four octaves by a semitone, E to F; but we may regard the lowest natural key as usually C, and the lowest sharp key as usually D, in these instruments, according to "short measure."

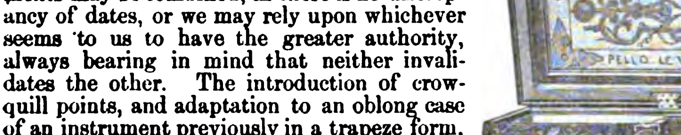
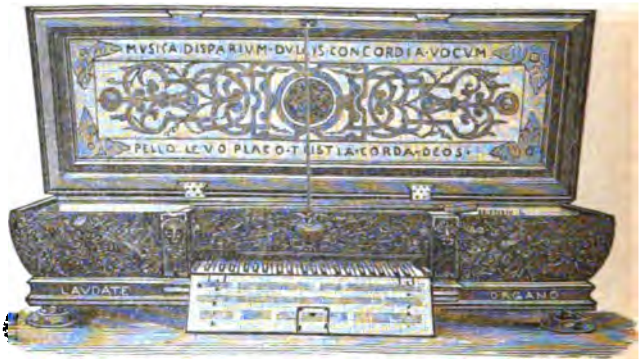


Fig. 8.—Milanese Spinetta, by Annibale Rosso, 1555; South Kensington Museum.

The rectangular spinet, Virdung's "virginal," early assumed in Italy the fashion of the large "casone" or wedding chests. The oldest we know of in this style, and dated, is the fine specimen belonging to M. Terme which figures in *L'Art Decoratif* (Fig. 9). Virginal is not an Italian name; the rectangular instrument in Italy is "spinetta tavola." In England, from Henry VII. to Charles II., all quilled instruments (*stromenti di penna*), without distinction as to form, were known as virginals. It was a common name, equivalent to the contemporary Italian *clavicordo* and Flemish *clavisingel*. From the latter, by apocope, we arrive at the French *clavecin*—the French *clavier*, a keyboard, being in its turn adopted by the Germans to denote any keyboard stringed instrument.



MVSICA DISPARIVM DVLCIS CONCORDIA VOCVM
PELLO LEVO PLACO TRISTIA CORDA DEOS
LAVDATE
ORGANO

Fig. 9.—Spinetta Tavola (Virginal), 1568; collection of M. Terme.

Mersenne gives three sizes for spinets—one 2½ feet wide tuned to the octave of the "ton de chapelle" (in his day a whole tone above the present English medium pitch), one of 3½ feet, tuned to the fourth below, and one of 5 feet, tuned to the octave below the first—the last being, therefore, tuned in unison to the chapel pitch. He says his own spinet was one of the smallest it was customary to make, but from the lettering of the keys in his drawing it would have been of the second size, or the spinet tuned to the fourth. The octave spinet, of trapeze form, was known in Italy as "ottavina" or "spinetta diserenata." It had a less compass of keys than the larger instrument, being apparently three and two-third octaves, E to C —which by the "short measure" would be four octaves, C to C. We learn from Prætorius that these little spinets were placed upon the larger ones in performance; their use was to heighten the brilliant effect. In the double rectangular clavisingel of the Netherlands, in which there was a movable octave instrument, we recognize a similar intention. There is a fine spinet of this kind at Nuremberg. Prætorius illustrates the Italian spinet by a form known as the "spinetta traversa," an approach towards the long clavicembalo or harpsichord—the tuning pins being immediately over the keyboard. This transposed spinet, more powerful than the old trapeze one, became fashionable in England after the Restoration —Haward, Keene, Slade, Player, Baudin, the Hitchcocks, Mahoon, Haxby, the Harris family and others having made such "spinnets" during a period for which we have dates from 1668 to 1784. Pepys bought his "Espinette" from Charles Haward for £5, July 13, 1668.

The spinets of Keene and Player, made about 1700, have frequently two cut sharps at the bass end of the keyboard, which Mersenne's short measure, and the realization at that time of the independence of each key in the chromatic scale, may be taken when combined to explain. Hitherto such cut sharps have been assumed to be quarter tones, but enharmonic intervals in the extreme bass can have no justification. From the tuning of Handel's Italian clavichord already mentioned, which has this peculiarity, we are led to infer that the nearer halves of the two cut sharps were the chromatic semitones, and the farther halves the lower thirds or fourths below what they appeared to be. Thomas Hitchcock (for whom we have a date 1703 upon a spinet jack in an instrument of older model with two cut sharps by Edward Blunt) and his son John made a great advance in constructing spinets, giving them the wide compass of five octaves, from G to G, with very fine keyboards in which the sharps were inlaid with a slip of the ivory or ebony, as the case might be, of the naturals. Their instruments, always numbered, and not dated as has been sometimes supposed, became models for the contemporary and subsequent English makers.

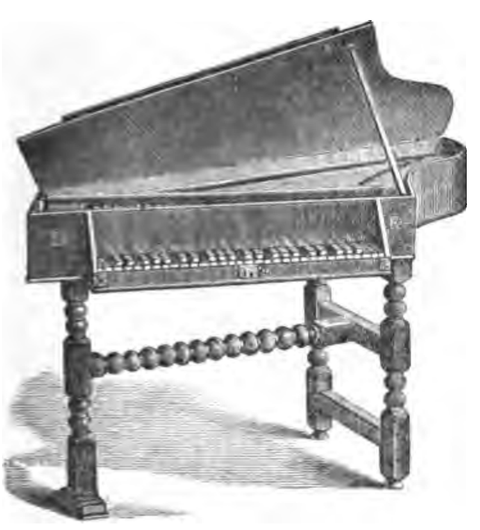


FIG. 10.—English Spinet (Spinetta Traversa), by Carolus Haward. About 1668. Collection of Mr. W. Dale, London.

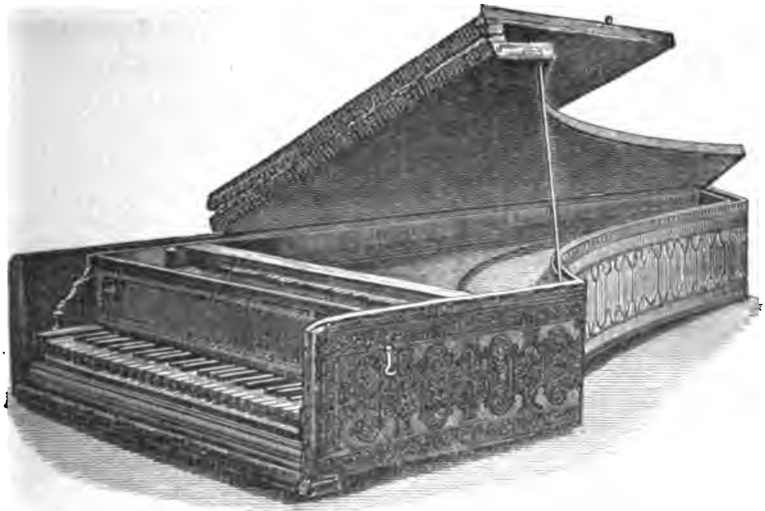


Fig. 11.—Roman Clavicembalo, by Geronimo of Bologna, 1521; South Kensington Museum.

We have now to ask what was the difference between Scaliger's harpichordum and his clavicymbal. Galilei, the father of the astronomer of that name (*Dialogo della Musica Antica e Moderna*, Florence, 1581), says that the harpichord was so named from having resembled an "arpa giacente," a prostrate or "couched" harp,—proving that the clavicymbal was at first the trapeze-shaped spinet; and we should therefore differentiate harpichord and clavicymbal as, in form, suggested by or derived from the harp and psaltery, or from a "testa di porco" and an ordinary trapeze psaltery. We are inclined to prefer the latter. The Latin name "clavicymbalum," having early been replaced by spinet and virginal, was in Italy and France bestowed upon the long harpichord, and was continued as clavicembalo (gravecembalo, or familiarly cembalo only) and clavecin. Much later, after the restoration of the Stuarts, the first name was accepted and naturalized in England as harpsichord, which we will define as the long quill instrument shaped like a modern grand piano, and resembling a wing, from which it has gained the German appellation "Flügel." We can point out no long instrument of this kind so old as the Roman cembalo at South Kensington (Fig. 11). It was made by Geronimo of Bologna in 1521, two years before the Paris Portalupis spinet. The outer case is of finely tooled leather. It has a spinet compass of keyboard of nearly four octaves, E to D. The natural keys are of boxwood, gracefully arcaded in front. The keyboards of the Italian cembalo were afterwards carried out to the normal four octaves. There is an existing example dating as early as 1526, with the bass keys carried out in long measure. It is surprising to see with what steady persistence the Italians adhered in making the instrument to their original model. As late as the epoch of Cristofori, and in his 1722 cembalo at Florence, we still find the independent outer case, the single keyboard, the two unisons, neither of which could be dispensed with by using stops. The Italians have been as conservative with their forms of spinet, and are to this day with their organs. The startling "piano e forte" of 1598, brought to light from the records of the house of D'Este, by Count Valdrighi of Modena, after much consideration and a desire to find in it an anticipation of Cristofori's subsequent invention of the pianoforte, we are disposed to regard as an ordinary cembalo with power to shift, by a stop, from two unisons (forte) to one string (piano), at that time a Flemish practice, and most likely brought to Italy by one of the Flemish musicians who founded the Italian school of composition. About the year 1600, when accompaniment was invented for monody, large cembalos were made for the orchestras to bring out the bass part—the performer standing to play. Such an instrument was called "archicembalo," a name also applied to a large cembalo, made by Vito Trasuntino, a Venetian, in 1606, intended by thirty-one keys in each of its four octaves—one hundred and twenty-five in all—to restore the three genera of the ancient Greeks. How many attempts have been made before and since Trasuntino to purify intonation in keyboard instruments by multiplying keys in the octave? Simultaneously with Father Smith's well-known experiment in the Temple organ, London, there were divided keys in an Italian harpsichord to gain a separate G sharp and A flat, and a separate D sharp and E flat.

Double keyboards and stops in the long cembalo or harpsichord came into use in the Netherlands early in the 16th century. We find them imported into England. The following citations, quoted by Rimbault in his *History of the Pianoforte*, but imperfectly understood by him, are from the privy purse expenses of

King Henry VIII., as extracted by Sir Harris Nicolas in 1827.

> "1530 (April). Item the vj daye paied to William Lewes for ii payer of virginalls in one coffer with iiii stoppes brought to Grenewiche iii li. And for ii payer of virginalls in one coffer brought to the More other iii li."

Now the second instrument may be explained, virginals meaning any quilled instrument, as a double spinet, like that at Nuremberg by Martin Van der Beest, the octave division being movable; but the first cannot be so explained; the four stops can only belong to a harpsichord, and the two pair instrument to a double-keyed one, one keyboard being over, and not by the side of the other. Again from the inventory after the king's death—

> "Two fair pair of new long Virginalls made harp-fashion of Cipres, with keys of ivory, having the King's Arms crowned and supported by his Grace's beastes within a garter gilt, standing over the keys."

Rimbault saw in this an upright instrument, and such a one was not then impossible, Virdung's claviciterium (Fig. 12) being no more than a horizontal harpsichord turned up upon its broad end, which a slight modification of the action rendered facile, but if upright, the two fair pair of new long virginalls would not have been "long" —but high. We explain "harp-fashion" according to Galilei's "arpa giacente," and are disposed to believe that we have here another double keyboard harpsichord. We read in an inventory of the furniture of Warwick Castle, 1584, "a faire paire of double virginalls," and in the Hengrave inventory, 1603, "one great payre of double virginalls." Hans Ruckers, the great clavisingel maker of Antwerp, lived then too late to have invented the double keyboard and stops, evident adaptations from the organ, but we may not withhold from him the credit of introducing the octave string, so long attributed to him, which incorporated the octave spinet with the large instrument, to be henceforth playable without the co-operation of another performer. It had been attached to the bent or angle side of harpsichords, as shown in a modern instrument which forms part of the famous Plantin Museum at Antwerp, and also in one by Hans Ruckers himself, dated 1594, preserved in the Kunst und Gewerbe Museum, Berlin. The double harpsichord by that maker at the Conservatoire, Paris, dated 1590, which is four years earlier than the above, has the octave string. From that date until the last harpsichord was made by Joseph Kirkman in 1798, scarcely an instrument of the kind was made, except in Italy, without the octaves. Hans Ruckers had two sons, Hans the younger and Andries the elder, who followed and rivalled him in skill and reputation. Another Andries, the son of the former, appears to have done but little, at least for himself; but a nephew, Jan Couchet, a grandson of old Hans Ruckers, continued the prestige of this distinguished family, Huygens being a witness to the rare ability of Couchet. All these men, and, in fact, all the clavisingel makers of Antwerp, belonged to the artist's guild of St. Luke, the affiliation being recognized from the close alliance at that time of the arts, the painter having often as much to do with the musical instrument as the maker himself. The Ruckers harpsichords in the 18th century were fetching such prices as Bologna lutes did in the 17th or Cremona violins do now. There are still many specimens existing in Belgium, France, and England. Handel had a Ruckers harpsichord, which may be the one long sought for and lately discovered by Mr. Julian Marshall in Windsor Castle; it completes the number of sixty-three existing Ruckers instruments catalogued in Grove's *Dictionary of Music and Musicians*.

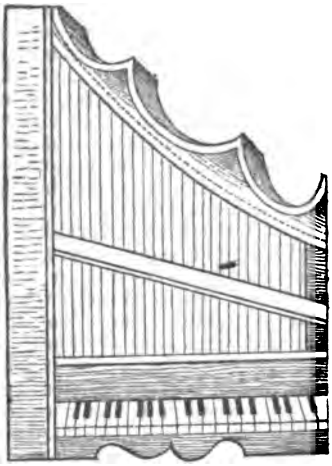


FIG. 12.—Virdung's Claviciterium (upright Harpsichord), 1511.

After the Antwerp make declined, London became pre-eminent for harpsichords,—the representative makers being Jacob Kirckmann and Burckhard Tschudi, pupils of a Flemish master, one Tabel, who had settled in London, and whose business Kirckmann continued through marriage with Tabel's widow. Tschudi was of a noble Swiss family belonging to the canton of Glarus. According to the custom with foreign names obtaining at that time, by which Haendel became Handel, and Schmidt Smith, Kirckmann dropped his final *n* and Tschudi became Shudi, but he resumed the full spelling in the facies of the splendid harpsichords he made in 1766 for Frederick the Great, which are still preserved in the New Palace, Potsdam. By these great makers the harpsichord became a larger, heavier-strung, and more powerful instrument, and fancy stops were added to vary the tone effects. To the three shifting registers of jacks of the octave and first and second unisons were added the "lute," the charm of which was due to the favoring of high harmonics by plucking the strings close to the bridge, and the "harp," a surding or muting effect produced by impeding the vibration of the strings by contact of small pieces of buff leather. Two pedals were also used, the left-hand one a combination of a unison and lute, rendered practicable by first moving the "machine," a sixth stop, with the left hand of the player; the right-hand pedal was to raise a hinged portion of the top or cover and thus gain some power of "swell" or crescendo, an invention of Roger Plenius, to whom also the harp stop may be rightly attributed. This ingenious harpsichord maker had been stimulated to gain these effects by the nascent pianoforte which, as we shall find, he was the first to make in England. The first idea of pedals for the harpsichord to act as stops appears to have been John Hayward's (? Haward) as early as 1676, as we learn from Mace's *Musick's Monument*. The French makers preferred a kind of knee-pedal arrangement known as the "genouillère," and sometimes a more complete muting by one long strip of buff leather, the "sourdine." As an improvement upon Plenius's clumsy swell, Shudi in 1769 patented the Venetian swell, a framing of louvres like a Venetian blind, which opened by the movement of the pedal, and, becoming in England a favorite addition to harpsichords, was early transferred to the organ, in which it replaced the rude "nag's-head" swell. A French harpsichord maker, Marius, whose name is remembered from a futile attempt to design a pianoforte action, invented a folding harpsichord, the "clavecin brisé," by which the instrument could be disposed of in a smaller space. One, which is preserved at Berlin, probably formed part of the camp baggage of Frederick the Great.

It was formerly a custom with kings, princes, and nobles who were well-disposed towards music to keep large collections of musical instruments,—not as now for beauty of decoration, form, and color, or historical associations, but for actual playing purposes in the domestic and festive music of their courts. There are records of their inventories, and it was to keep such a collection in playing order that Prince Ferdinand dei Medici engaged a Paduan harpsichord maker, Bartolommeo Cristofori, the man of genius who invented and produced the pianoforte. We fortunately possess the record of this invention in a literary form from a well-known writer, the Marchese Scipione Maffei; his description appeared in the *Giornale dei letterati d'Italia*, a publication conducted by Apostolo Zeno. The date of Maffei's paper was 1711. Rimbault reproduced it, with a technically imperfect translation, in his *History of the Piano-forte*. We learn from it that in 1709 Cristofori had completed four "gravecembali col piano e forte"—keyed-psalteries with soft and loud—three of them being of the long or usual harpsichord form. A synonym in Italian for the original cembalo (or psaltery) is "salterio," and if it were struck with hammers it became a "salterio tedesco" (the German *hackbrett*, or chopping board), the latter being the common dulcimer. Now the first notion of a pianoforte is a dulcimer with keys, and we may perhaps not be wrong in supposing that there had been many attempts and failures to put a keyboard to a dulcimer or hammers to a harpsichord before Cristofori successfully solved the problem. The sketch of his action in Maffei's essay shows an incomplete stage in the invention, although the kernel of it, the principle of escapement or the controlled rebound of the hammer, is already there. He obtains it by a centred lever (*linguetta mobile*) or hopper, working, when the key is depressed by the touch, in a small projection from the centred hammer butt. The return, governed by a spring, must have been uncertain and incapable of further regulating than could be obtained by modifying the strength of the spring. Moreover, the hammer had each time to be raised the entire distance of its fall. There are, however, two pianofortes by Cristofori in Florence, dated respectively 1720 and 1726, which show a much improved, we may even say a perfected, construction, for the whole of an essential piano movement is there. The earlier instrument has undergone some restoration, but the 1726 one, which is in the Kraus Museum, retains the original leather hammerheads. Both instruments possess alike a contrivance for determining the radius of the hopper, and both have been unexpectedly found to have the "check" (Ital. *paramartello*) which regulates the fall of the hammer according to the strength of the blow which has impelled it to the strings. After this discovery of the actual instruments of Cristofori, there can be no longer doubt as to the attribution of the invention to him, in its initiation and its practical completion with escapement and check. To Cristofori we are indebted not only for the power of playing *piano* and *forte*, but for the infinite variations of tone, or *nuances*, which render the instrument so delightful. But his problem was not solved by the devising of a working action; there was much more to be done to install the pianoforte as a new musical instrument. The resonance, that most subtle and yet all-embracing factor, had been experimentally developed to a certain perfection by many generations of spinet and harpsichord makers, but the resistance structure had to be thought out again. Thicker stringing, rendered indispensable to withstand even Cristofori's light hammers, demanded, in its turn, a stronger framing than the harpsichord had needed. To make his structure firm, he considerably increased the strength of the block which holds the tuning-pins, and, as he could not do so without materially adding to its thickness, he adopted the bold expedient of inverting it, driving his wrest-pins, harp-fashion, through it, so that tuning was effected at their upper, while the wires were attached to their lower ends. Then to guarantee the security of the case he ran an independent string-block round it of stouter wood than had been used in harpsichords, in which block the hitch-pins were driven to hold the farther ends of the strings, which were spaced at equal distances (unlike the harpsichord), the dampers lying between the pairs of unisons.

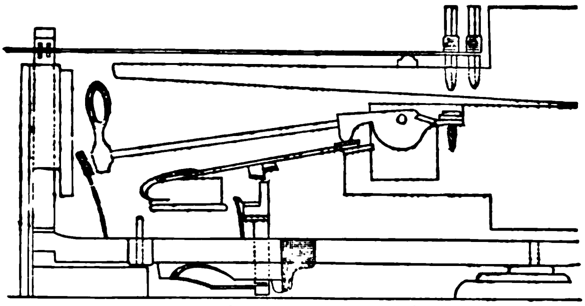


FIG. 13.—Cristofori's Escapement Action, 1720.

Cristofori died in 1731. He had pupils, but did not found a school of Italian pianoforte making, perhaps from the peculiar Italian conservatism in musical instruments we have already remarked upon.

The essay of Scipione Maffei was translated into German in 1725, by König, the court poet at Dresden, and friend of Gottfried Silbermann, the renowned organ builder and harpsichord and clavichord maker.[1] Incited by this publication, and perhaps by having seen in Dresden one of Cristofori's pianofortes, Silbermann appears to have taken up the new instrument, and in 1726 to have manufactured two, which J. S. Bach, according to his pupil Agricola, pronounced failures. The trebles were too weak; the touch was too heavy. There has long been another version to this story, viz., that Silbermann borrowed the idea of his action from a very simple model contrived by a young musician named Schroeter, who had left it at the electoral court in 1721, and, quitting Saxony to travel, had not afterwards claimed it. It may be so; but Schroeter's letter, printed in Mitzler's *Bibliothek*, dated 1738, is not supported by any other evidence than the recent discovery of an altered German harpsichord, the hammer action of which, in its simplicity, may have been taken from Schroeter's diagram, and would sufficiently account for the condemnation of Silbermann's earliest pianofortes if he had made use of it. In either case it is easy to distinguish between the lines of Schroeter's interesting communications (to Mitzler and later to Marpurg) the bitter disappointment he felt in being left out of the practical development of so important an instrument.

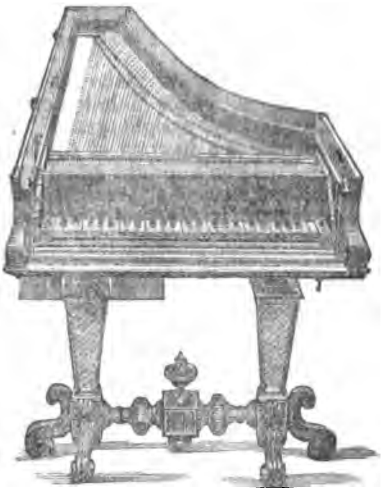


FIG. 14.—Cristofori's Piano e Forte, 1726; Kraus Museum, Florence.

But, whatever Silbermann's first experiments were based upon, it has been made certain by the personal investigations of the present writer that he, when successful, adopted Cristofori's pianoforte without further alteration than the compass and color of the keys, and the style of joinery of the case. In the Silbermann grand pianofortes, in the three palaces at Potsdam, known to have been Frederick the Great's, and to have been acquired by that monarch prior to J. S. Bach's visit to him in 1747, we find the Cristofori framing, stringing, inverted wrest-plank, and action complete. Fig. 15 represents the instrument on which J. S. Bach played in the Town Palace, Potsdam.

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[1] This translation, reproduced *in extenso*, may be read in Dr. Oscar Paul's *Geschichte des Claviers*, Leipsic, 1868.

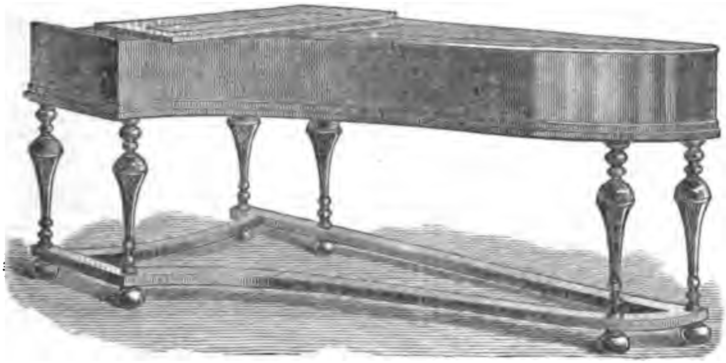

Fig. 15.—Silbermann Forte Piano; Stadtschloss, Potsdam, 1746. Engraved by permission of H.I.H. the Crown Princess of Prussia.

It has been repeatedly stated in Germany that Frederici of Gera in Saxony, an organ builder and musical instrument maker, invented the square or table-shaped piano, the "fort bien" as he is said to have called it, about 1758–60. No square piano by this maker is forthcoming, but M. Victor Mahillon of Brussels has acquired a Frederici "upright grand" piano, dated 1745, and contributes a diagram of the simple action (Fig. 16). In Frederici's upright grand action we have not to do with the ideas of either Cristofori or Schroeter; the movement is practically identical with the hammer action of a German clock, and has its counterpart in a piano at Nuremberg, a fact which needs further elucidation. We note here the earliest example of the leather hinge afterwards so common in piano actions, and only now going out of use. Where are we to look for Schroeter's copyist, if not found in Silbermann, Frederici, or, as we shall presently see, perhaps Wagner? It might be in the harpsichord we have mentioned, which, made in 1712 by one Brock for the elector of Hanover (afterwards George I. of England), was by him presented to the Protestant pastor of Schulenberg near Hanover, and has since been rudely altered into a pianoforte (Fig. 17). There is an altered harpsichord in the museum at Basel which appears to have been no more successful.

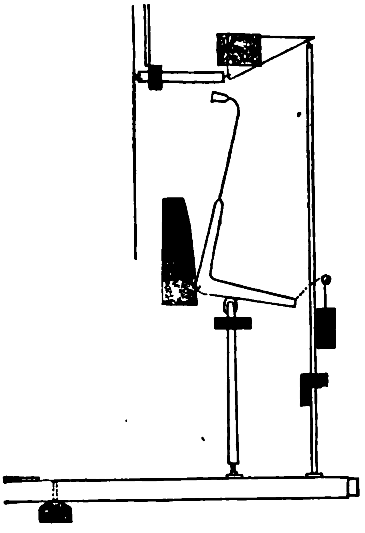

Fig. 16.—Frederici's Upright Grand Piano Action, 1745. Instrument now transferred to the museum of the Brussels Conservatoire.

But an attempted combination of harpsichord and pianoforte appears as a very early intention. The English poet Mason, the friend of Gray, bought such an instrument at Hamburg in 1755, with "the cleverest mechanism imaginable."

It was only under date of 1763 that Schroeter published for the first time a diagram of his proposed invention, designed more than forty years before. It appeared in Marpurg's *Kritische Briefe* (Berlin, 1764). Now, immediately after, Johann Zumpe, a German in London who had been one of Shudi's workmen, invented or introduced (for there is some tradition that Mason had to do with the invention of it[1]) a square piano, which was to become the most popular domestic instrument. Burney tells us all about Zumpe; and his instruments, still existing, fix the date of the first at about 1765. In his simple "old man's head" action, we have the nearest approach to a realization of Schroeter's simple idea. It will be observed that Schroeter's damper would stop all vibration at once. This defect is overcome by Zumpe's "mopstick" damper.

Another piano action had, however, come into use about that time or even earlier in Germany. The discovery of it in the simplest form is to be attributed to M. Mahillon, who has found it in a square piano belonging to M. Henri Gosselin, painter, of Brussels. The principle of this action is that which was later perfected by the addition of a good escapement by Stein of Augsburg, and was again later experimented upon by Sebastian Erard. Its origin is perhaps due to the contrivance of a piano action that should suit the shallow clavichord and permit of its transformation into a square piano; a transformation, Schroeter tells us, had been going on when he wrote his com-

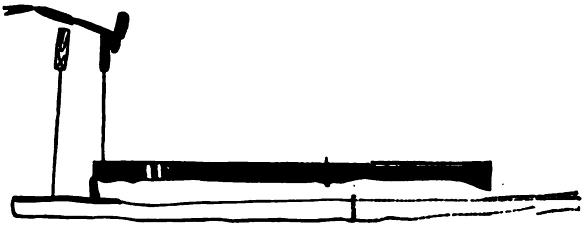

Fig. 17.—Hammer and Lifter of altered Harpsichord by Brock. Instrument in the collection of Mr. Kendrick Pyne, Manchester.

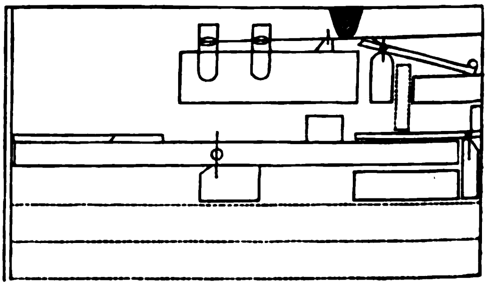

Fig. 18.—Schroeter's Model for an Action, 1721.

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[1] Mason really invented the "celestina," as we know from the correspondence of Mary Granville. Under date of the 11th January, 1775, she describes this invention or improvement of the poet as a short harpsichord in form, 2 feet long, but played with the right hand only. The left hand controlled a kind of violin-bow, which produced a charming *sostinente*, in character of tone between the violin tone and that of musical glasses. Mason played upon it with great expression.

plaint. It will be observed that the hammer is, as compared with other actions, reversed, and the axis rises with the key, necessitating a fixed means for raising the hammer, in this action effected by a rail against which the hammer is jerked up. It was Stein's merit to graft the hopper principle upon this simple action; and Mozart's approbation of the invention, when he met with it at Augsburg in 1777, is expressed in a well-known letter addressed to his mother. No more "blocking" of the hammer, destroying all vibration, was henceforth to vex his mind. He had found the instrument that for the rest of his short life replaced the harpsichord. M. Mahillon has secured for his museum the only Johann Andreas Stein piano which is known to remain. It is from Augsburg, dated 1780, and has Stein's escapement action, two unisons, and the knee pedal, then and later common in Germany.

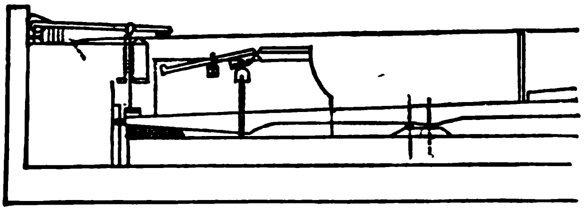

Fig. 19.—Zumpe's Square Piano Action, 1766.

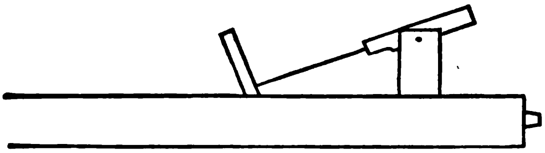

Fig. 20.—Old Piano Action on the German principle of Escapement. Square Piano belonging to M. Gosselin, Brussels.

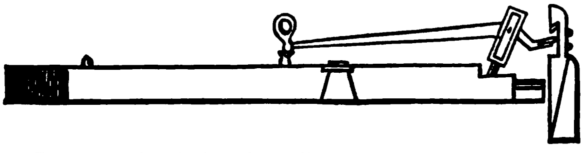

Fig. 21.—Stein's Action (the earliest so-called Viennese), 1780.

Mozart's own grand piano, preserved at Salzburg, and the two grand pianos (the latest dated 1790) by Huhn of Berlin, preserved at Berlin and Charlottenburg, because they had belonged to the Prussian Queen Louise, follow Stein in all particulars. These instruments have three unisons upwards, and the muting movement known as *celeste*, which no doubt Stein had also. The wrest-plank is not inverted; nor is there any imitation of Cristofori. We may regard Stein, coming after the Seven Years' War which had devastated Saxony, as the German reinventor of the grand piano. Stein's instrument was accepted as a model, as we have seen, in Berlin as well as Vienna, to which city his business was transferred in 1794 by his daughter Nanette, known as an accomplished pianist and friend of Beethoven, who at that time used Stein's pianos. She had her brother in the business with her, and had already, in 1793, married J. A. Streicher, a pianist from Stuttgart, and distinguished as a personal friend of Schiller. In 1802, the brother and sister dissolving partnership, Streicher began himself to take his full share of the work, and on Stein's lines improved the Viennese instrument, so popular for many years and famous for its lightness of touch, which contributed to the special character of the Viennese school of pianoforte playing. The firm of Streicher still exists in Vienna, but since 1862, when Steinway's example caused a complete revolution in German and Austrian piano-making, the old wooden cheap grand piano has died out. We will quit the early German piano with an illustration (Fig. 22) of an early square piano action in an instrument made by Johann Gottlob Wagner of Dresden, in 1783. This interesting discovery of M. Mahillon's introduces us to a rude imitation (in the principle) of Cristofori, and it appears to have no relation whatever to the clock hammer notion seen in Frederici's.

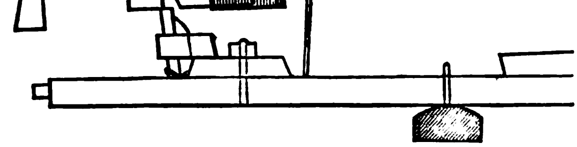

Fig. 22.—German Square Action, 1783. Piano by Wagner, Dresden.

Burney, who lived through the period of the displacement of the harpsichord by the pianoforte, is the only authority we can refer to as to the introduction of the latter instrument into England. He tells us,[1] in his gossiping way, that the first hammer harpsichord that came to England was made by an English monk at Rome, a Father Wood, for an English gentleman, Samuel Crisp of Chesington; the tone of this instrument was superior to that produced by quills, with the added power of the shades of *piano* and *forte*, so that, although the touch and mechanism were so imperfect that nothing quick could be executed upon it, yet in a slow movement like the Dead March in Saul it excited wonder and delight. Fulke Greville afterwards bought this instrument for 100 guineas, and it remained unique in England for several years, until Plenius, the inventor of the lyrichord, made a pianoforte in imitation of it. In this instrument the touch was better, but the tone was inferior. We have no date for Father Wood. Plenius produced his lyrichord, a *sostinente* harpsichord, in 1745. When Mason imported a pianoforte in 1755, Fulke Greville's could have been no longer unique. The Italian origin of Father Wood's piano points to a copy of Cristofori, but the description of its capabilities in no way supports this supposition, unless we adopt the very possible theory that the instrument had arrived out of order and there was no one in London who could put it right, or would perhaps divine that it was wrong. Burney further tells us that the arrival in London of J. C. Bach in 1759 was the motive for several of the second-rate harpsichord makers trying to make pianofortes, but with no particular success. Of these Americus Backers, said to be a Dutchman, appears to have gained the first place. He was afterwards the inventor of the so-called English action, and, as this action is based upon Cristofori's, we may suppose he at first followed Silbermann in copying the original inventor. There is an old playbill of Covent Garden in Messrs. Broadwood's possession, dated the 16th May, 1767, which has the following announcement:

> "End of Act 1. Miss Brickler will sing a favorite song from Judith, accompanied by Mr. Dibdin, on a new instrument call'd Piano Forte."

The mind at once reverts to Backers as the probable maker of this novelty. Be that as it may, between 1772 and 1776, the year of his death, he produced the action continued in the direct principle to this day by the firm of Broadwood, or with a reversed lever and hammer-butt introduced by the firm of Collard in 1835.

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[1] Rees's *New Cyclopædia*, article "Harpsichord."

The escapement lever is suggested by Cristofori's first action, to which Backers has added a contrivance for regulating it by means of a button and screw. The check is from Cristofori's second action. No more durable action has been constructed, and it has always been found equal, whether made in England or abroad, to the demands of the most advanced virtuosi. John Broadwood and Robert Stodart were friends, Stodart having been Broadwood's pupil; and they were the assistants of Backers in the installation of his invention. On his death-bed he commended it to Broadwood's care, but Stodart appears to have been the first to advance it,—Broadwood being probably held back by his partnership with his brother-in-law, the son of Shudi, in the harpsichord business. (The elder Shudi had died in 1773.) Stodart soon made a considerable reputation with his "grand" pianofortes, a designation he was the first to give them. In Stodart's grand piano we first find an adaptation from the lyrichord of Plenius, of steel arches between the wrest-plank and bellyrail, bridging the gap up which the hammers rise, in itself an important cause of weakness. These are not found in any contemporary German instruments, but may have been part of Backers's. Imitation of the harpischord by "octaving" was at this time an object with piano makers. Zumpe's small square piano had met with great success; he was soon enabled to retire, and his imitators, who were legion, continued his model with its hand stops for the dampers and sourdine, with little change but that which straightened the keys from the divergences inherited from the clavichord. John Broadwood took this domestic instrument first in hand to improve it, and in the year 1780 succeeded in entirely reconstructing it. He transferred the wrest-plank and pins from the right-hand side, as in the clavichord, to the back of the case, an improvement universally adopted after his patent, taken out in 1783, expired. In this patent we first find the damper and piano pedals, since universally accepted, but at first in the grand pianofortes only. Zumpe's action remaining with an altered damper, another inventor, John Geib, about this time patented the hopper with two separate escapements, one of which soon became adopted in the grasshopper of the square piano, it is believed by Geib himself; and Petzold, a Paris maker, appears to have taken later to the escapement effected upon the key. We may mention here that the square piano was developed and continued in England until about the year 1860, when it went out of fashion.

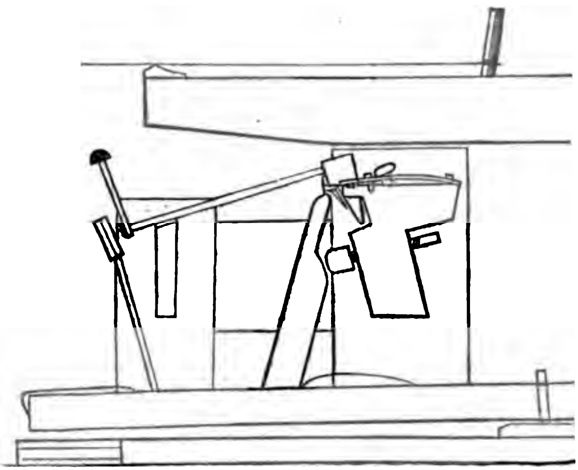

FIG. 23.—Grand Piano Action, 1776. The "English" action of Americus Backers.

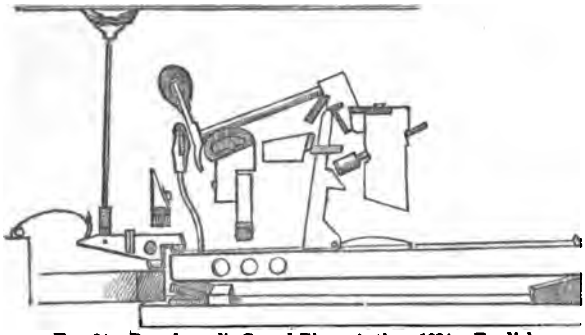

FIG. 24.—Broadwood's Grand Piano Action, 1884. English direct mechanism.

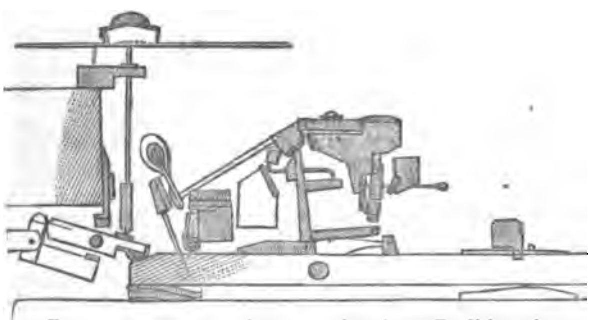

FIG. 25.—Collard's Grand Piano Action, 1884. English action with reversed hopper and contrivance for repetition added.

To return to John Broadwood,—having launched his reconstructed square piano, he next turned his attention to the grand piano to continue the improvement of it from the point where Backers had left it. The grand piano was in framing and resonance entirely on the harpsichord principle, the sound-board bridge being still continued in one undivided length. The strings, which were of brass wire in the bass, descended in notes of three unisons to the lowest note of the scale. Tension was left to chance, and a reasonable striking line or place for the hammers was not thought of. Theory requires that the notes of octaves should be multiples in the ratio of 1 to 2, by which, taking the treble clef C at one foot, the lowest F of the five-octave scale would require a vibrating length between the bridges of 12 feet. As only half this length could be conveniently afforded, we see at once a reason for the above-mentioned deficiencies. Only the three octaves of the treble, which has lengths practically ideal, could be tolerably adjusted. Then the striking-line, which should be at an eighth or not less than a ninth or tenth of the vibrating length, and had never been cared for in the harpsichord, was in the lowest two octaves out of all proportion, with corresponding disadvantage to the tone. John Broadwood did not venture alone upon the path towards rectifying these faults. He called in the aid of professed men of science—Cavallo, who in 1788 published his calculations of the tension, and Dr. Gray of the British Museum. The problem was solved by dividing the sound-board bridge, the lower half of which was advanced to carry the bass strings, which were still of brass. The first attempts to equalize the tension and improve the striking-place were here set forth, to the great advantage of the instrument, which in its wooden construction might now be considered complete. The greatest pianists of that epoch, except Mozart and Beethoven, were assembled in London,—Clementi, who first gave the pianoforte its own character, raising it from being a mere variety of the harpsichord, his pupils, Cramer and for a time Hummel, later on John Field, and also the brilliant virtuosi Dussek and Steibelt. To please Dussek, Broadwood in 1791 carried his five-octave, F to F, keyboard, by adding keys upwards, to five and a half octaves, F to C. In 1794 the additional bass half octave to C, which Shudi had first introduced in his double harpsichords, was given to the piano. Steibelt, while in England, instituted the familiar signs for the employment of the pedals, which owes its charm to excitement of the imagination instigated by power over an acoustical phenomenon, the sympathetic vibration of the strings. In 1799 Clementi founded a pianoforte manufactory to be subsequently developed and carried on by Messrs. Collard.

The first square piano made in France is said to have been constructed in 1776 by Sebastian Erard, a young Alsatian. In 1786 he came to England, and founded the London manufactory of harps and pianofortes bearing his name. That eminent mechanician and inventor is said to have at first adopted for his pianos the English models. However, in 1794 and 1801, as is shown by his patents, he was certainly engaged upon the elementary action described as appertaining to M. Gosselin's piano, of probably German origin. In his long-continued labor of inventing and constructing a double escapement action, Erard appears to have sought to combine the English power of gradation of tone with the German lightness of touch. He took out his first patent for a "repetition" action in 1808, claiming for it "the power of giving repeated strokes without missing or failure, by very small angular motions of the key itself." He did not, however, succeed in producing his famous repetition, or double escapement action, until 1821; it was then patented by his nephew Pierre Erard, who, when the patent expired in England in 1835, proved a loss from the difficulties of carrying out the invention, which induced the House of Lords to grant an extension of the patent.

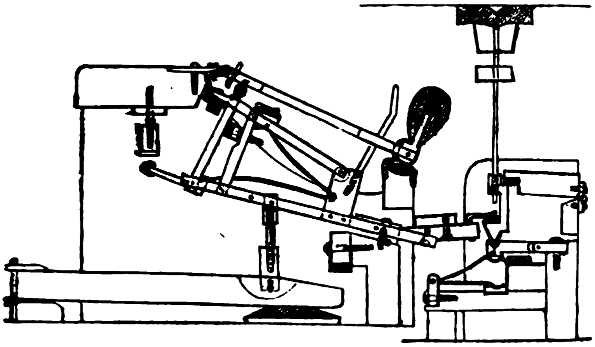

FIG. 26.—Erard's Double Escapement Action, 1884. The double escapement or repetition is effected by a spring in the balance pressing the hinged lever upwards, to allow the hopper which delivers the blow to return to its position under the nose of the hammer, before the key has risen again.

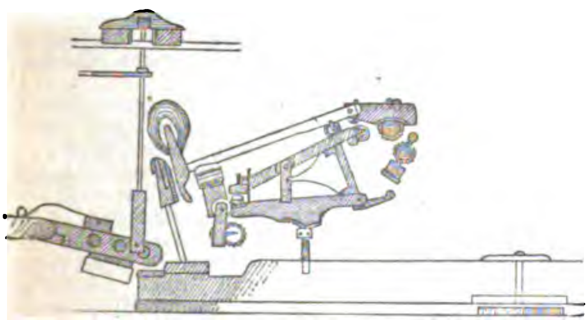

FIG. 27.—Steinway's Grand Piano Action, 1884. The double escapement as in Erard's, but with shortened balance and usual check.

Although some great pianists have been opposed to double escapement, notably Kalkbrenner, Chopin, and Dr. Hans von Bülow, Erard's action, in its complete or a shortened form as introduced by Herz, is now more extensively used than at any former period Erard invented in 1808 an upward bearing to the wrest-plank bridge, by means of agraffes or studs of metal through holes in which the strings are made to pass, bearing against the upper side. The wooden bridge with down-bearing strings is clearly not in relation with upward-striking hammers, the tendency of which must be to raise the strings from the bridge, to the detriment of the tone. A long brass bridge on this principle was introduced by William Stodart in 1822. A pressure-bar bearing of later introduction is claimed for the French maker, M. Bord, and is very frequently employed, by German makers especially. The first to see the importance of iron sharing with wood (ultimately almost supplanting it) in pianoforte framing was a native of England and a civil engineer by profession, John Isaac Hawkins, who had been best known as the inventor of the ever-pointed pencil. He was living at Philadelphia, U. S., when he invented and first produced the familiar cottage pianoforte, "portable grand" as he then called it. He patented it in America, his father, Isaac Hawkins, taking out the patent for him in England in the same year, 1800. It will be observed that the illustration here given (Fig. 28) represents a wreck; but a draughtsman's restoration might be open to question.

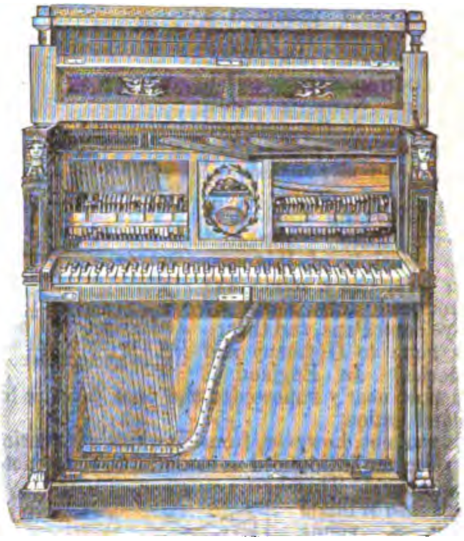

FIG. 28.—Hawkins's Portable Grand Piano, 1800. An upright instrument, the original of the modern cottage piano or pianino. In Messrs. Broadwood's museum and unrestored.

There had been upright grand pianos as well as upright harpsichords, the horizontal instrument being turned up upon its wider end and a keyboard and action adapted to it. William Southwell, an Irish pianomaker, had, in 1798, tried a similar experiment with a square piano; to be repeated in later years by W. F. Collard of London; but Hawkins was the first to make a piano, or pianino, with the strings descending to the floor, the keyboard being raised, and this, although at the moment the chief, was not his only merit. He anticipated nearly every discovery that has since been introduced as novel. His instrument is in a complete iron frame, independent of the case; and in this frame, strengthened by a system of iron resistance rods combined with an iron upper bridge, his sound-board is entirely suspended. An apparatus for tuning by mechanical screws regulates the tension of the strings, which are of equal length throughout. The action, in metal supports, anticipates Wornum's in the checking, and still later ideas in a contrivance for repetition. This remarkable bundle of inventions was brought to London and exhibited by Hawkins himself, but the instrument being poor in the tone failed to bring him pecuniary reward or the credit he deserved. Southwell appears to have been one of the first to profit by Hawkins's ideas by bringing out the high cabinet pianoforte, with hinged sticker action, in 1807. All that he could, however, patent in it was the simple damper action, turning on a pivot to relieve the dampers from the strings, which is still frequently used with such actions. The next steps for producing the lower or cottage upright piano were taken by Robert Wornum, who in 1811 produced a diagonally and in 1813 a vertically strung one. Wornum's perfected crank action was not complete until 1826, when it was patented for a cabinet piano; but it was not really introduced until three years later, when Wornum applied it to his little "piccolo." The principle of this centred lever check action was introduced into Paris by Pleyel[1] and Pape, and thence has gone to Germany and America. In England it has now nearly superseded the once favorite leather-hinged action.

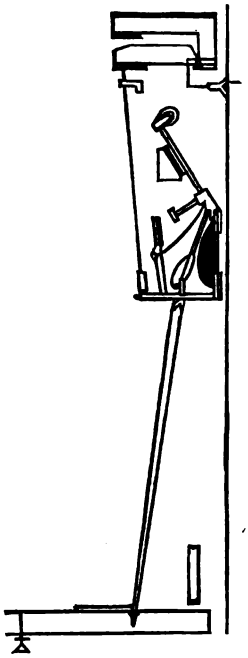
FIG. 29.—Wornum's Upright Action, 1826. The original of the now universal crank action in upright pianos.

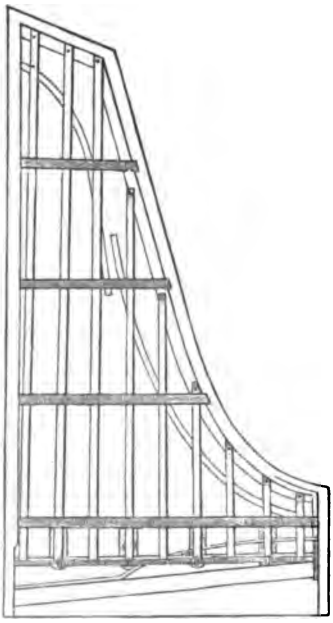
FIG. 30.—Allen's compensating Grand Piano, 1820. The first complete metal framing system applied over the strings.

It was not, however, from Hawkins's invention that iron became introduced as essential to the structure of a pianoforte. This was due to William Allen, a young Scotsman in the employ of the Stodarts. He devised a metal system of framing intended primarily for compensation, but soon to become, in other hands, a framing for resistance. His idea was to meet the divergence in tuning caused in brass and iron strings by atmospheric changes by compensating tubes and plates of the same metals, guaranteeing their stability by a cross batoning of stout wooden bars and a metal bar across the wrest-plank. Allen, being simply a tuner, had not the full practical knowledge for carrying out the idea. He had to ally himself with Stodarts' foreman, Thom; and Allen and Thom patented the invention in January, 1820. The firm of Stodart at once acquired the patent. We have now arrived at an important epoch in pianoforte construction,—the abolition, at least in England and France, of the wooden construction in favor of a combined construction of iron and wood, the former material gradually asserting pre-eminence. Allen's design is shown in Fig. 30. The long bars shown in the diagram are really tubes fixed at one end only; those of iron lie over the iron or steel wire, while those of brass lie over the brass wire, the metal plates to which they are attached being in the same correspondence. At once a great advance was made in the possibility of using heavier strings than could be stretched before, without danger to the durability of the case and frame. The next step was in 1821 to a fixed iron string-plate, the invention of one of Broadwoods' workmen, Samuel Hervé, which was in the first instance applied to one of the square pianos of that firm. The great advantage in the fixed plate was a more even solid counterpoise to the drawing or tension of the strings and the abolition of their undue length behind the bridge, a reduction which Isaac Carter[2] had tried some years before, but unsuccessfully, to accomplish with a plate of wood. So generally was attention now given to improved methods of resistance that it has not been found possible to determine who first practically introduced those long iron or steel resistance bars which are so familiar a feature in modern grand pianos. They were experimented on as substitutes for the wooden bracing by Joseph Smith in 1798; but to James Broadwood belongs the credit of trying them first above the sound-board in the treble part of the scale as long ago as 1808, and again in 1818; he did not succeed, however, in fixing them properly. The introduction of fixed resistance bars is really due to observation of Allen's compensating tubes, which were, at the same time, resisting. Sebastian and Pierre Erard seem to have been first in the field, in 1823, with a complete system of nine resistance bars from treble to bass, with a simple mode of fastening them through the sound-board to the wooden beams beneath, but, although these bars appear in their patent of 1824, which chiefly concerned their repetition action, the Erards did not either in France or England claim them as of original invention, nor is there any string-plate combined with them in their patent. James Broadwood, by his patent of 1827, claimed the combination of string-plate and resistance bars, which was clearly the completion of the wood and metal instrument, differing from Allen's in the nature of the resistance being fixed. Broadwood, however, left the bass bars out, but added a fourth bar in the middle to the three in the treble he had previously used. It must be borne in mind that it was the trebles that gave way in the old wooden construction before the tenor and bass of the instrument. But the weight of the stringing was always increasing, and a heavy close overspinning of the bass strings had become general. The resistance bars were increased to five, six, seven, eight, and, as we have seen, even nine, according to the ideas of the different English and French makers who used them in their pursuit of stability.

The next important addition to the grand piano in order of time was the harmonic bar of Pierre Erard, introduced in 1838. This was a gun-metal bar of alternate pressing and drawing power by means of screws which were tapped into the wrest-plank immediately above the treble bearings, making that part of the instrument nearly immovable; this favored the production of higher harmonics to the treble notes, recognized in what we commonly call "ring." A similar bar, subsequently extended by Broadwood across the entire wrest-plank, was to prevent any tendency in the wrest-plank to rise, from the combined upward drawing of the strings. A method of fastening the strings on the string-plate depending upon friction, and thus dispensing with "eyes," was a contribution of the Collards, who had retained James Stewart, who had been in America with Chickering, and was a man of considerable inventive power. This invention was introduced in 1827. Between 1847 and 1849 Mr. Henry Fowler Broadwood, son of James, and grandson of John Broadwood, and also great-grandson of Shudi (Tschudi), invented a grand pianoforte to depend practically upon iron, in which, to avoid the conspicuous inequalities caused by the breaking of the scale with resistance bars, there should be no bar parallel to the strings except a bass bar, while another flanged resistance bar, as an entirely novel feature, crossed over the strings from the bass corner of the wrest-plank to a point upon the string-plate, where the greatest accumulation of tension strain was found. Mr. Broadwood has not continued, without some compromise, this extreme renunciation of ordinary resistance means. Since the Great Exhibition of 1851 he has employed an ordinary straight bar in the middle of his concert grand scale, his smaller grands having frequently two such as well as the long bass bar. From 1862 he has covered his wrest-plank with a thick plate of iron into which the tuning pins screw as well as into the wood beneath, thus avoiding the crushing of the wood by the constant pressure of the pin across the pull of the string, an ultimate source of danger to durability.

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[1] Pleyel exhibited a small upright piano in Paris in 1827. Pierre Erard did not turn his attention to upright pianos until 1831.

[2] Sometime foreman to the pianoforte maker Mott, who attracted much attention by a piano with sostenente effect, produced by a roller and silk attachments in 1817. But a sostenente piano, however perfect, is no longer a true piano such as Beethoven and Chopin wrote for.

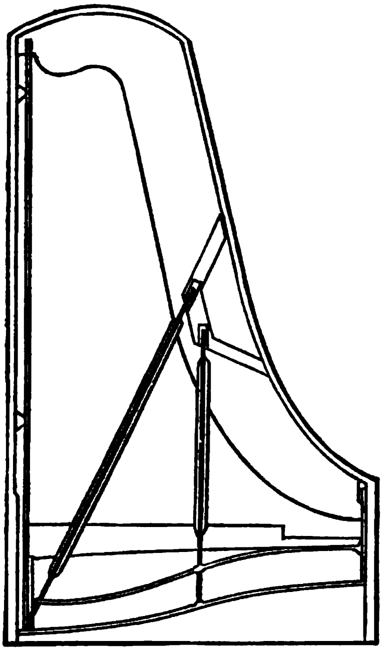
FIG. 31.—Broadwood's Iron Grand Piano, 1884. Complete iron frame, with diagonal resistance bar.

The introduction of iron into pianoforte structure has been differently and independently effected in America, the fundamental idea there being a single casting for the metal plate and bars, instead of forging or casting them in separate pieces. Alphæus Babcock was the pioneer to this kind of metal construction. He also was bitten with the compensation notion, and had cast an iron ring for a square piano in 1825, which is not said to have succeeded, but gave the clue to a single casting resistance framing, which was successfully accomplished by Conrad Meyer, in Philadelphia, in 1833, in a square piano which still exists, and was shown in the Paris Exhibition of 1878. Meyer's idea was taken up and improved upon by Jonas Chickering of Boston, who applied it to the grand piano as well as to the square, and brought the principle up to a high degree of perfection,—establishing by it the independent construction of the American pianoforte.

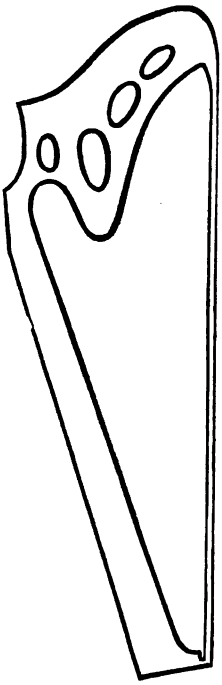
FIG. 32.—Meyer's Metal Frame for a Square Piano, 1833. In a single casting.

We have now to do with over- or cross-stringing, by which the bass division of the strings is made to cross over the tenor part of the scale in a single, double, or treble disposition at diverging angles,—the object being in the first instance to get longer bass strings than are attainable in a parallel scale, and in the next to open out the scale and extend the area of bridge pressure on the sound-board. In the 18th century clavichords were sometimes overstrung in the lowest octave to get a clearer tone in that very indistinct part of the instrument (strings tuned an octave higher being employed). The first suggestion for the overstringing in the piano was made by the celebrated flute player and inventor Theobald Boehm, who carried it beyond theory in London, in 1831, by employing a small firm located in Cheapside, Gerock & Wolf, to make some overstrung pianos for him. Boehm expected to gain in tone; Pape, an ingenious mechanician in Paris, tried a like experiment to gain economy in dimensions, his notion being to supply the best piano possible with the least outlay of means. Tomkinson in London continued Pape's model, but neither Boehm's nor Pape's took permanent root. The Great Exhibition of 1851 contained a grand piano, made by Lichtenthal of St. Petersburg, overstrung in order to gain symmetry by two angle sides to the case. It was regarded as a curiosity only. A few years later, in 1855, Henry Engelhard Steinway (originally Steinweg), who had emigrated from Brunswick to New York in 1849, and had established the firm of Steinway & Sons in 1853 in that city, effected the combination of an overstrung scale with the American iron frame, which, exhibited in grand and square instruments shown in London in the International Exhibition of 1862, excited the attention of European pianoforte makers, leading ultimately to important results. The Chickering firm claim to have anticipated the Steinways in this invention. They assert that Jonas Chickering had begun a square piano on this combined system in 1853, but, he dying before it was completed, it was brought out later. It is often difficult to adjudicate upon the claims of inventors, so rarely is an invention the product of one man's mind alone. However, the principle has been taken up and generally adopted in America and Germany, and has found followers elsewhere, not only in grand but in upright pianos, to the manufacture of which it has given, and particularly in Germany, a powerful impetus. But, in spite of this general recognition, the overstringing, as at present effected, is attended with grave disadvantages, in disturbing the balance of tone by introducing thick, heavy basses, which, like the modern pedal organs, bear no just relation to that part of the keyboard where the part-writing lies. The great increase also of tension which is held up as a gain, acts prejudicially upon the durability of the instrument, as no artificial screwing up of the sound-board can always preserve the elasticity of the fibres of the fir tree (*Abies excelsa* in Europe, *Abies alba* in America) of which it is made. The remarkable improvements in the drawing of the cast-steel wire produced in Birmingham, Vienna, and Nuremberg (this last initiated by Boehm) have rendered very high tensions practicable. We believe they have been overstated in figures; it is certain, however, that Broadwood's seven-octave concert grands have a tension of not less than sixteen tons when at the English orchestral pitch,—the notes of the ideal lengths each drawing 450 lb. We have no such accurate statement to offer of the American and German concert grands, but we regard Steinway's as of not less than twenty-two tons tension.

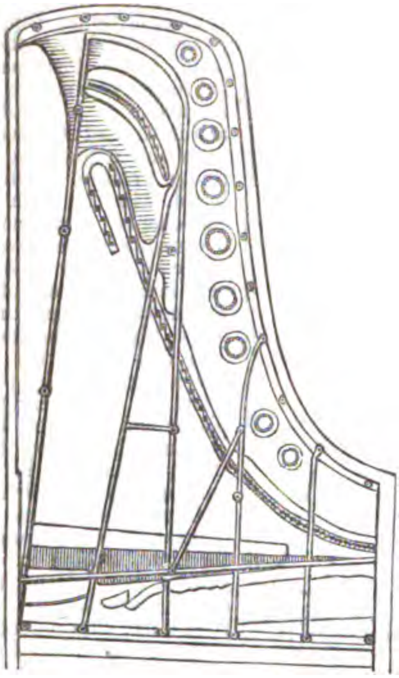

Fig. 33.—Steinway's Grand Piano, 1884. Metal framing in a single casting and overstrung.

Whatever of importance has been introduced in the structure of the pianoforte we believe we have attributed to its legitimate inventor, or to the manufacturer who has placed it in the light of day. It would be impossible within reasonable limits to chronicle the variations which have taken place in the barrings of sound-boards on which their resonant structure depends, the disposition of wooden beams or metal bars, the adaptation of mechanical action, or any of those countless modifications upon which finally depends the individual character of an instrument worthy to be presented and upheld as a work of art. There are many names of first-rate pianoforte makers whose place has not been in this record, simply because they have not ranked with the initiators or perfecters of inventions that have been accepted as of paramount importance.

The earliest keyboard instrument makers were to be found in monasteries or collegiate foundations, and such lay help as may have been employed was at best of the roughest kind. In the next epoch the artists' guilds in cities absorbed lay musical instrument makers, notably on account of the then universal practice of making such instruments beautiful; and, indeed, we are indebted to this for the preservation of many spinets and harpsichords in museums and private collections. The full members of the craft-guilds were all masters who had terminated their apprenticeships by producing complete instruments as "master-pieces," made according to the rules and to the satisfaction of the wardens or deacons of the guilds. A trial of this kind lasted long in many crafts,—for instance, in the case of Scottish cabinetmakers' indentures, an apprentice's freedom was only gained after the test production of an "essay" piece of work, duly authenticated and admitted. Spinets and harpsichords were bound to bear the inscription of the maker's name, or to show his trade mark as a guarantee for honest workmanship. The master's sons and apprentices were, in the master's workshops, probationers of the guild and protected by it. Even in the 17th century we hear little about journeymen, who, as the name implies, would be paid by the day. But the extension of musical instrument workshops about the beginning of the 18th century was one of the signs of the weakened power of the guilds—particularly in Great Britain. In France it needed the Revolution to entirely abolish them.

Throughout the 18th century journeywork and apprenticeship were general. Wages, compared with the cost of living, were meagre, and the day's work, not unfrequently extended by overtime, was a long one. The result was a slow production. The English cabinet-makers, however, owing to disputes which at last called for judicial interference, in the year 1788 brought out their book of prices, which was the foundation of the present piece-work system. Pianoforte makers in course of time adopted this new departure with the result of quicker work and higher wages, benefiting alike the master and man. The next industrial revolution was inaugurated somewhere about 1815, by the introduction of machinery to save manual labor, the division of which had already been instituted, and by the use of steam. Machinery has, as yet, been extended to its furthest limit in America, where labor-saving is relied upon as a powerful ally against strikes, which are more frequently victorious in the New than in the Old World. Simultaneously a dislike has arisen to apprenticeships; and even in Germany, the traditional land of the apprentice, this mode of acquirement has weakened.

Turning to the commercial importance of the pianoforte, we find that we have to face great difficulties in order to obtain anything like trustworthy information. It is true official blue-books give yearly statements of exports and imports, but as they do not separate the pianoforte from other musical instruments, an analysis is impossible. Personal inquiry again among pianoforte makers brings but scattered information, partly from the natural inclination to enhance business returns, and partly from an equally natural disinclination to impart that which, if spoken of at all, should be confidential. From this dilemma we fall back upon gleanings of intelligence either of our own gathering or as afforded by the leading pianoforte trade organs in England and Germany—the London *Music Trades Review* and the Leipsic *Zeitschrift für Instrumentenbau.*

The chief centres of the pianoforte trade are London, Paris, Berlin, Leipsic, Dresden, Stuttgart, Hamburg, Vienna, St. Petersburg, Brussels, New York, Boston, and Baltimore. The greatest centralizations are found in London and Paris,—very few pianofortes being made in the United Kingdom or France, excepting perhaps at Marseilles, out of those cities. But in Germany and the United States there are pianoforte makers in many towns besides those we have named. Pianofortes are made in Italy at Turin, Milan, Florence, Naples, and Palermo, and in Spain at Barcelona (principally), Madrid, and Saragossa. The large export trade belonged formerly to England and France, but it has been weakened of late years by the commercial activity of the Germans, who have besides copied successfully and with the advantage of much lower wages recent American models. German pianofortes are now much found in Great Britain, where free trade has favored their introduction, and in the Australian colonies; they have also outrivalled the French in Holland; but we believe France still keeps the trade of southern Europe, as the United States mainly supply Canada. English exports of good makers will be found all over the world; but some important markets have been lost through the inferior instruments consigned or sold because they were cheap, and were supposed to be good enough.

The United States and Germany appear to employ the greatest number of workmen in the pianoforte handicraft, Germany producing the largest numbers of instruments. In adopting, however, the statistics given, we must not forget to take into account that custom of advertising which leavens nearly every statement. There are said to be upwards of 8000 workmen employed in piano-making in America. The Messrs. Steinway claim for America an annual production of about 25,000 pianofortes of all kinds. We hardly feel disposed to allow Germany 73,000, with a less number of workmen, viz., 7834; but such is the statement put forward, it is said, by a semi-official source, the *Deutsche Consulats-Zeitung.* It must be borne in mind that machinery adds its power indefinitely to the number of men employed, but this occurs more in America than in Germany. A recent strike in Paris represented the pianoforte trade society as consisting of 5000 members; and we shall not be far out in crediting that city with a production of 20,000 instruments yearly. The number made in London annually may be taken as reaching at least 35,000.

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PIARISTS, the popular name of the "clerici regulares scholarum *piarum*," the Pauline Congregation of the Mother of God, which was founded by Joseph Calasanza (Josephus a Matre Dei) at Rome in the beginning of the 17th century. Calasanza, a native of Calasanz in the province of Huesca in Aragon, was born on September 11, 1556, studied at Lerida and Alcala, and after his ordination to the priesthood removed to Rome. Here he became zealously interested in the education of poor and orphan children, and with this end he organised, in 1607, a brotherhood which ultimately, in 1617, became an independent Congregation, numbering at that time fifteen priests, under Calasanza as their head. To the three usual vows they added a fourth, that of devotion to the gratuitous instruction of youth. In 1622 the Congregation received a new constitution from Gregory XV., and had all the privileges of the mendicant orders conferred upon it, Calasanza being recognized as general. In this capacity he busied himself with the extension of the order, not only in Italy, but also in Germany, Poland, and other countries, until 1643, when the jealousy of the Jesuits led to conflicts which resulted in his removal from office; owing to the same cause the Congregation was deprived of its privileges by Innocent X. in 1646. Calasanza, who died on August 22, 1648, was beatified in 1748, and canonized in 1767. The privileges of the Congregation were successively restored in 1660, 1669, and 1698. The Piarists, who are not a numerous body, are found chiefly in Italy, Spain, the West Indies, Germany, and especially in Austria-Hungary.

PIATRA, a town of Roumania (Moldavia) at the head of the department of Neamtsu, on the left bank of the Bistritza, an affluent of the Sereth. It is about 45 miles by road from Roman, a station on the railway from Galatz and Czernowitz. The population of the prefecture in 1878 was 25,383 (9887 Jews). It contained seven Orthodox churches,—the most remarkable being St. John's, or the Prince's Monastery, founded by Stephen the Great in 1497. There are five annual fairs, and a large trade is done in grain and timber—the latter being rafted down the Bistritza from the mountains to Galatz.

PIAZZA ARMERINA (Sicilian, *Chiazza*), a city of Italy, in the province of Caltanisetta, Sicily, on a hill 39 miles by road east-southeast of the city of that name, and 30 miles north of Terranova on the coast. It is a flourishing and populous place (17,038 inhabitants in the city and 19,591 in the commune in 1881), has an 18th-century cathedral, an episcopal palace, and a communal library (1859). The church of Sant' Andrea, less than a mile distant, has a fresco of date 1486, and other objects of interest.

Of the ancient city, which old local antiquaries held to have been built by a colony of refugees from Platæa, little is known. The name sometimes occurs as Plutia. In 1095 Piazza was taken by Count Roger of Sicily, who bestowed on it a banner reputed to bear a likeness of the Virgin painted by St. Luke. William I. destroyed the city in 1160, but it was rebuilt on a new site in 1163.

See *Piazza antica, etc.*, by J. P. Chiaranda (a native), of which a Latin translation by Mosheim is given in Grævius's *Thesaurus ant. et hist. Sic.*, vol. xii.

PIAZZI, Giuseppe (1746–1826). See Astronomy.

PICARDY (*La Picardie*) one of the old feudal provinces of France, was bounded N. by Hainault, Artois, and the English Channel, E. by Champagne, S. by Ile-de-France, and W. by Normandy and the Channel. Northern Picardy (subdivided into Upper and Lower Picardy) was formed into one of the great military governorships of the kingdom, while Southern Picardy was included in the governorship of Ile-de-France. Upper Picardy comprised the districts (*pays*) of Amienois, Santerre, Vermandois, and Thierache; Lower Picardy Boulonnais, Ponthieu, Vimeu, and the Pays Reconquis (or Calais, Guines, Ardre, and Oye); and Southern Picardy Beauvaisis, Soissonais, and Laonnais. The territory is now divided among the departments of Pas-de-Calais, Somme, Aisne, Oise, and Nord.

The name Picardy does not appear before the 13th century. Under the Romans the country formed part of Belgica Secunda, and was inhabited by various Belgian tribes—the Morini, Ambiani, Veromandui, Bellovaci, and Suessiones, whose names still appear in Amiens, Vermandois, Beauvais, and Soissons. After forming part of the kingdom of Soissons and of Neustria, Picardy (that is, the countship of Vermandois, etc.) passed to the counts of Flanders. It was finally united with the French crown by Louis XI.

See De Verité (1770–74), Du Belloy (1770), La Bourt (1840), Roger (1842–43), and Cocheris (1854). V. de Beauvillé has published a magnificent *Recueil de documents inédits concernant la Picardie*, 1861, 1867, etc.

PICCINI, or Piccinni, Niccola (1728–1800), musical composer, was born at Bari in 1728, and educated, under Leo and Durante, at the Conservatorio di San Onofrio in Naples. His first opera, *Le Donne dispettose*, produced in 1754, won him a high reputation, which he maintained creditably until 1760, when he composed at Rome, the *chef d'œuvre* of his early life, *La Cecchina, ossia la Buona Figliuola*, an *opera buffa* which attained a European success, little less remarkable than that of Pergolesi's *Serva Padrona*. In a very short time this charming piece found its way not only to every theatre in Italy, but to Paris, to

London, and to every great city on the Continent. It was even represented by marionettes; and every new fashion was named *alla Cecchina*. Six years after this Piccini was invited to Paris. He knew nothing of French, but his librettist, Marmontel, assisted him to such good purpose that, after the production of his first French opera, *Roland*, he was carried home from the theatre in triumph. All his next works were successful; but, unhappily, the directors of the Grand Opéra conceived the mad idea of deliberately opposing him to Gluck, by persuading the two composers to treat the same subject—*Iphigénie en Tauride*—simultaneously. The Parisian public now divided itself into two rival parties which, under the names of Gluckists and Piccinists, carried on an unworthy and disgraceful war, equally ruinous to both artists, who would gladly have withdrawn from its violent excesses. That the final victory should be obtained by the Gluckists was inevitable; for Piccini, though a brilliant ornament of the Italian school, was no match for his illustrious antagonist. Gluck's masterly *Iphigénie* was first produced on May 18, 1779. Piccini's *Iphigénie* followed on January 23, 1781, and though performed seventeen times, was afterwards consigned to oblivion. The fury of the rival parties continued unabated, even after Gluck's departure from Paris in 1780; and an attempt was afterwards made to inaugurate a new rivalry with Sacchini. Still, Piccini held a good position, and on the death of Gluck, in 1787, proposed that a public monument should be erected to his memory,—a suggestion which the Gluckists themselves declined to support. On the breaking out of the Revolution in 1789, Piccini returned to Naples, where he was at first well received by King Ferdinand IV.; but the marriage of his daughter to a French democrat brought him into irretrievable disgrace. For nine years after this he maintained a precarious existence in Venice, Naples, and Rome; but, deriving new hope from the declaration of peace, he returned in 1798 to Paris, where the fickle public received him with enthusiasm, but left him to starve. He died at Passy, May 7, 1800.

Fétis gives a complete list of Piccini's works, including eighty operas, and much choral music. It is certain that the list of operas is very far from complete.

PICENUM. See Italy, vol. xiii. pp. 454, 456.

PICHEGRU, Charles (1761–1804), the conqueror of Holland, was born at Arbois in the Jura on February 16, 1761. His father was only a laborer, but the friars who managed the college of Arbois gave the boy a good education, and one of his masters, the Père Patrault, took him to the military school of Brienne.

In 1783 he entered the first regiment of artillery, where he rapidly rose to the rank of adjutant-sub-lieutenant. When the Revolution began he at once became leader of the extreme revolutionary party in Besançon, where he was stationed; and, when a regiment of volunteers of the department of the Gard marched through the city, the popular society recommended him for the rank of lieutenant-colonel, to which he was at once elected. The fine condition of his regiment was soon remarked in the army of the Rhine, to which it was attached, and his organizing ability was made use of by an appointment on the staff, and finally by his promotion to the rank of general of brigade. In 1793, when Dumouriez had deserted, and all generals of noble birth had been superseded, Carnot and Saint Just were sent to find *roturier* generals who could be successful; Carnot discovered Jourdan, and Saint Just discovered Hoche and Pichegru. In coöperation with Hoche and the army of the Moselle, Pichegru, now general of division and in command of the army of the Rhine, had to reconquer Alsace and reorganize the disheartened troops of the republic. They succeeded; Pichegru, instead of fighting great battles, made use of the *élan* of his soldiers to win innumerable small engagements, and with Hoche forced the lines of Haguenau, and relieved Landau. In December, 1793, he superseded Hoche, became commander-in-chief of the united armies of the Rhine and Moselle, whence he was summoned to succeed Jourdan in the army of the North in February, 1794. It was now that he fought his three great campaigns of one year. The English and Austrians held a strong position along the Sambre to the sea. After vainly attempting to break the Austrian centre, Pichegru suddenly turned their left, and defeated Clerfayt at Cassel, Menin, and Courtrai, while Moreau, his second in command, defeated Coburg at Turcoing in May, 1794; then after a pause, during which Pichegru feigned to besiege Ypres, he again dashed at Clerfayt and defeated him at Rousselaer and Hooglede, while Jourdan came up with the new army of the Sambre and Meuse, and utterly routed the Austrians at Fleurus on June 27, 1794. After a pause Pichegru began his second campaign by crossing the Meuse on October 18, and after taking Nimeguen drove the Austrians beyond the Rhine. Instead of going into winter-quarters, he prepared his army for a winter campaign. On December 28th he crossed the Meuse on the ice, and stormed the island of Bommel, then crossed the Waal in the same manner, and, driving the English before him, entered Utrecht on January 19, and Amsterdam on January 20, and soon occupied the whole of Holland. This grand feat of arms was marked by many points of interest, such as the capture of the Dutch ships which were frozen in the Helder by the French hussars, and the splendid discipline of the ragged battalions in Amsterdam, who, with the richest city of the Continent to sack, yet behaved with perfect self-restraint. This conquest aroused a storm of admiration in France. The former friend of Saint Just now offered his services to the Thermidorians, and after receiving from the Convention the title of Sauveur de la Patrie, subdued the *sans-culottes* of Paris, when they rose in insurrection against the Convention on 12 Germinal (1 April). Honored by the republicans, and with the greatest military reputation in France, Pichegru then took command of the armies of the North, the Sambre and Meuse, and the Rhine, and crossing the Rhine in force took Mannheim in May, 1795. When his fame was thus at its height he became a traitor, and for the promise of a marshal's baton, the governorship of Alsace, the castle of Chambord, 1,000,000 francs in cash, and 200,000 francs a year, sold his army and his country. He allowed Jourdan to be beaten before Mannheim, and betrayed all his plans to the enemy. His intrigues were suspected, and when he offered his resignation to the Directory in October, 1795, it was to his surprise promptly accepted. He retired in disgrace, but hoped to serve the royalist cause by securing his election to the Council of Five Hundred in May, 1797. He was there the royalist leader, and planned a *coup d'état*, but on the 18th Fructidor he was arrested, and with fourteen others deported to Cayenne in 1797. Escaping, he reached London in 1798, and served in the archduke Charles' staff in the campaign of 1799. He went to Paris in August, 1803, with Georges Cadoudal to head a royalist rising against Napoleon; but, betrayed by a friend, he was arrested on February 28, 1804, and on April 15th[1] was found strangled in prison. It has often been asserted, but without a shadow of probability, as he was certain to have been condemned if brought to trial, that he was murdered by the orders of Napoleon.

Pichegru's campaigns of 1794 are marked by traits of an audacious genius which would not have disgraced Napoleon; like him, he perceived the intrinsic fitness of the French soldiers for strokes of daring rather than for sustained battles. But a more thorough traitor never commanded an army. He flattered in turn Saint Just and the Terrorists, the Thermidorians and the Directors, and seemed altogether unmoved by considerations of loyalty or patriotism.

There is no really good life of Pichegru; perhaps the best is

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[1] [Lanfrey's *Histoire de Napoleon*, Paris, 1869, vol. iii. p. 149, says Pichegru was found dead 6th April. See also Art. Napoleon in this Encyclopædia, vol. xvii. p. 214.—Am. Ed.]

Gassier's *Vie du Général Pichegru*, Paris, 1814. For his treason, trial, and death consult Montgaillard's *Mémoires concernant la trahison de Pichegru*, 1804; Fauche-Borel's *Mémoires*, Savary, *Mémoires sur la Mort de Pichegru*, Paris, 1825; and G. Pierret, *Pichegru, son Procès et son Mort*, 1826.

PICKLES. The term pickle was originally applied to herrings preserved in salt brine, and by a pickle is still meant any preservative solution for either animal or vegetable food, that for flesh and fish being a brine of common salt, usually with saltpetre, sugar, and certain spices added, while for vegetable substances vinegar is the principal pickling medium. Preparations of the latter description—vegetables saturated with vinegar—constitute the ordinary pickles of domestic use. Acid fruits and succulent fleshy vegetables are the proper materials for pickles. The vegetable substances principally treated in this way are—beetroot, cabbage, cauliflower, gherkins (small cucumbers), capers, French beans, onions, shallots, mushrooms, green peaches, mangoes, green walnuts, and several tropical fruits besides those mentioned. These are variously dealt with. Such as are soft and in themselves hot and spicy require simply to have vinegar of the proper strength poured over them, after the materials have been carefully selected, washed, and, if necessary, shred. Vegetable substances of a harder and tougher character, require first to be steeped in salt brine for some time, then washed, and the vinegar poured over them hot; and yet more leathery and fibrous vegetables must be softened with boiling brine, and then prepared with boiling vinegar. The vinegar employed may be either wood or strong malt vinegar; the former, being free from mucilage, has no tendency to fermentation, and can be obtained of greater strength than that prepared from malt. The vinegar is commonly flavored with spices or aromatic herbs, flavors being chosen with special reference to the fruit or vegetable operated on. The flavoring materials, of which pepper, allspice, red pepper, cloves, horseradish, garlic, and ginger are examples, are either added whole to the pickle or may be separately infused in the vinegar. For the preservation of pickles it is necessary that the jars in which they are stored should be secured with stoppers tied over with bladder and sealed, so as to render them as far as possible air-tight. It is of the utmost consequence that in the compounding and storing of these acid preparations no vessels or fittings of copper, brass, zinc, or lead, which yield, with acetic acid, poisonous products, should be used. Contamination with copper is especially to be avoided; yet, as small quantities of acetate of copper give to pickled vegetables a fine, fresh green, natural color, such an adulteration is not unfrequently practiced; and some of the older cookery books actually recommend the use of copper vessels, and even the addition of small pieces of verdigris, to improve the color of the pickles. As food adjuncts, pickles should be sparingly used, their chief merit being piquancy, though the acid they contain exercises a solvent influence on the more directly nutritious constituents of food, and, the added spices having a stimulating effect, they thus aid the process of digestion.

PICO, GIOVANNI, OF MIRANDOLA (1463–1494), was the youngest son of Giovanni Francesco Pico, prince of Mirandola, a small territory about 30 Italian miles west of Ferrara, afterwards absorbed in the duchy of Modena. The family was illustrious and wealthy, and claimed descent from Constantine. From his childhood Pico was remarkable for his quick and tenacious memory, and gave promise of his future distinction as a scholar. In his fourteenth year he went to Bologna, where he studied for two years, and was much occupied with the Decretals. The traditional studies of the place, however, disgusted him; he was eager to know all the secrets of nature, and devoting himself wholly to speculative learning he spent seven years wandering through all the schools of Italy and France and collecting a precious library. Like most men with brilliant faculties of acquisition and assimilation, Pico was constitutionally an eclectic; and he owes his place in the history of learning and thought to the indefatigable spirit of inquiry which left him dissatisfied with current teaching and drove him to studies then new and strange. Besides Greek and Latin he knew Hebrew, Chaldee, and Arabic; and his Hebrew teachers (Eliah del Medigo, Leo Abarbanel, and Jochanan Aleman—see L. Geiger, *Johann Reuchlin* [1871], p. 167) introduced him to the Kabbalah, which had great fascination for one who loved all mystic and theosophic speculation. His learned wanderings ended at Rome, where he set forth for public disputation a list of nine hundred questions and conclusions in all branches of philosophy and theology. He remained a year in Rome, but the disputation he proposed was never held. He was an object of envy to many for the range of attainments which earned him the title of the Phœnix of his age, and detractors found it easy to fix on his conclusions a suspicion of heresy. The pope prohibited the little book in which they were contained, and Pico had to defend the impugned theses in an elaborate *Apologia*. His personal orthodoxy was, however, finally vindicated by a brief of Alexander VI., dated 18th June, 1493. The suspected theses included such points as the following:—that Christ descended *ad inferos* not in his real presence but *quoad effectum;* that no image or cross should receive *latreia* even in the sense allowed by Thomas; that it is more reasonable to regard Origen as saved than as damned; that it is not in a man's free will to believe or disbelieve an article of faith as he pleases. But perhaps the most startling thesis was that no science gives surer conviction of the divinity of Christ than "magia" (*i.e.*, the knowledge of the secrets of the heavenly bodies) and Kabbalah. Pico was the first to seek in the Kabbalah a proof of the Christian mysteries, and it was by him that Reuchlin was led into the same delusive path.

Pico had been up to this time a gay Italian nobleman; he was tall, handsome, fair-complexioned, with keen gray eyes and yellow hair, and a great favorite with women. But his troubles led him to more serious thoughts; he burned his amorous verses and gave himself wholly to sacred letters, publishing as the first fruits of his studies, in his twenty-eighth year, the *Heptaplus*, a mystical exposition of the creation. Next he planned a great sevenfold work against the enemies of the church, of which only the section directed against astrology was completed. After leaving Rome he again lived a wandering life, often visiting Florence, to which he was drawn by his friends Politian and Marsilius Ficinus, and where also he came under the influence of Savonarola. It was at Florence that he died in 1494. Three years before his death he parted with his share of the ancestral principality, and gave much of his wealth to the poor. He was now increasingly absorbed in ascetic exercises and religious meditation, and designed, when certain literary plans were completed, to give away all he had and wander barefoot through the world preaching Christ, or perhaps to join the preaching friars. But these plans were cut short by a fever which carried him off just at the time when Charles VIII. was at Florence. Pico's attainments and the beauty of his character and piety produced a profound impression on his contemporaries, but his works, published by his nephew, Giov. Fran. Pico, with a biography, at Bologna in 1496, and more than once reprinted, cannot now be read with much interest. The man himself, however, is still interesting, partly from his influence on Reuchlin and partly from the spectacle of a truly devout mind in the brilliant circle of half-pagan scholars of the Florentine renaissance.

PICTON, SIR THOMAS (1758–1815), general under Wellington in the Peninsular War, was the younger son of Thomas Picton, of Poyston, Pembrokeshire, where he was born in August, 1758. In 1771 he obtained an ensign's commission in the 12th regiment of foot, but he did not join until two years afterwards.

The regiment was then stationed at Gibraltar, where he remained until he was made captain in the 75th in January, 1778, when he returned to England. The regiment was shortly afterwards disbanded, and in 1794 he embarked for the West Indies without an appointment, on the strength of a slight acquaintance with Sir John Vaughan, who made him his aide-de-camp and gave him a captaincy in the 17th foot. Shortly afterwards he was promoted major. Under Sir Ralph Abercromby he took part in the capture of St. Lucia and St. Vincent. After the reduction of Trinidad he was made governor of the island, and in October, 1801, he was gazetted brigadier-general.. Resigning the governorship of Trinidad in 1803, he took part in an expedition against St. Lucia and Tobago, and he held the governorship of the latter island until forced to resign it by public clamor in England. In 1807 he was put upon his trial for applying torture to a female slave in Trinidad to extort confession respecting a robbery, and a general verdict of guilty was returned. A new trial was, however, granted, and after protracted litigation the court, on 10th February, 1810, ordered "the defendant's recognizance to be respited until they should further order." Previous to this he had taken part in the capture of Flushing, of which in 1809 he was made governor. At the special solicitation of Wellington he was named to the command of a division of the army in Spain, and during the Peninsular campaign he was placed in the post of honor, and so distinguished himself that he seven times received the thanks of the House of Commons. The capture of Badajoz was effected chiefly through his daring self-reliance and penetration in converting what was intended to be only a feint attack into a real one. At the battle of Quatre Bras on the 16th June, 1815, he was dangerously wounded, and at Waterloo on the 18th, while repulsing with impetuous valor what Wellington denominated "one of the most serious attacks made by the enemy on our position," he was struck dead by a ball on the temple. A public monument was erected to his memory in St. Paul's Cathedral.

See Robinson, *Life of Sir Thomas Picton*, 2d ed., London, 1836.

PICTOR, FABIUS. See FABIUS PICTOR; also LIVY, vol. xiv. p. 735.

PICTS. See SCOTLAND.

PIEDMONT (Italian, *Piemonte;* Low Latin, *Pedemons* and *Pedemontium*), a region of northern Italy, bounded N. by Switzerland, W. by France, S. by Liguria, and E. by Lombardy. Physically it may be briefly described as the upper gathering-ground and valley of the river Po, inclosed on all sides except towards the Lombard plain by the vast semicircle of the Pennine, Graian, Cottian, Maritime, and Ligurian Alps. In 1859 it was divided into the four provinces of Alessandria, Cuneo, Novara, and Torino (Turin), which still remain as provinces of the kingdom of Italy. In 1858 its population was 2,738,814.

The name of Lombardy was used as inclusive of the upper valley of the Po as late as 1091, when the house of Savoy lost most of its Italian possessions by the death of Adelaide; but in the time of Thomas I. (1177–1233), duke of Savoy, while the name Savoy was applied more especially to the ducal territory on the French side of the Alps, that of Piedmont came into use as a collective term for the territory on the Italian side. Thomas II. of Savoy, count (not Thomas II., Count of Savoy, as he is often wrongly called), son of Thomas I., obtained (1255) part of Piedmont as an apanage from his brother Amadeus IV., and was appointed imperial vicar in Piedmont by Frederick II.; and, though he was afterwards obliged to renounce all the concessions he had received alike from pope and emperor, his son, Thomas III., became the founder of the line which bore the title "Princes of Achaia and Morea, and lords of Piedmont." Louis, the last of these lords, dying in 1418, left his possessions to Amadeus VIII.

PIERCE, FRANKLIN (1804–1869), fourteenth president of the United States, was descended from an old yeoman family of New England, and was born at Hillsborough, New Hampshire, 23d November, 1804. His father, Benjamin Pierce, served through the revolutionary war, afterwards attaining the rank of major-general, and became governor of his State. The son entered Bowdoin College, Brunswick, Maine, in 1820. Nathaniel Hawthorne, who was in the class below him, and was his intimate friend, mentions as his most notable characteristic at this time his "fascination of manner, which has proved so magical in winning him an unbounded popularity." The same characteristic remained with him through life, and was the chief cause of his success. His abilities did not greatly impress his classmates, and, although he took at length a good position, he was not distinguished for scholarship. After leaving college in 1824 he studied law with Judge Woodbury at Portsmouth, and afterwards in the law school at Northampton, Mass., and with Judge Parker at Amherst, and came to the bar in 1827. His first appearance as a pleader was a failure, but this only incited him to redoubled perseverance and determination. From the first he was a zealous supporter of the Democratic party, and he took an active part in promoting the election of Andrew Jackson to the presidency. In 1829 he was elected by his native town to the State legislature, of which he was speaker in 1832–33. In the latter year he was chosen a member of Congress, and in 1837 he was elected to the senate of the United States. He displayed no striking oratorical gifts, but as a member of the judiciary and other committees gained general respect. In 1842 he resigned his seat in the senate, and returned to the practice of law. His reputation at the bar was very high, his success being largely due to his power of identifying himself with his client's cause, and his strong personal influence over a jury. In 1846 he was offered the position of attorney-general of the United States, but declined it. On the outbreak of the Mexican War he joined as a volunteer one of the companies raised in Concord. He was soon after appointed colonel of the 9th regiment, and in March, 1847, brigadier-general. At the battle of Contreras on the 19th August, he was severely injured by the fall of his horse. At the close of the war in December, 1847, he resigned his commission. In 1850 he was president of the convention for revising the constitution of New Hampshire. In 1852, as candidate of the Democratic party, he was elected president of the United States by 254 electoral votes against 42 given to General Scott. The special feature of his inaugural address was the support of slavery in the United States, and the announcement of his determination that the Fugitive Slave Act should be strictly enforced. This was the keynote of his administration, and pregnant with vital consequences to the country. From it came during his term the Ostend conference and "manifesto," the repeal of the Missouri compromise, and the troubles in Kansas and Nebraska, which crystallized the opposing forces into the Republican party, and led later to the great rebellion. President Pierce, surrounded by an able cabinet, among them Jefferson Davis as Secretary of War, firmly adhered throughout his administration to the pro-slavery party. He failed, notwithstanding, to obtain re-nomination, but was succeeded by James Buchanan, March 4, 1857, and retired to his home in Concord, N. H., after spending some years in Europe. During the war of 1861–65 his sympathies were wholly with the South, but, with the exception of delivering a strong speech at Concord in 1863, he took no very active part in politics. He died 8th October, 1869.

Among several lives of General Pierce, published during his candidature for the presidency, special mention may be made of that by his friend Nathaniel Hawthorne.

PIERO (or PIETRO) DE FRANCESCHI (1415–1492), a leading painter of the Umbrian school. This master is generally named Piero della Francesca (Peter, son of Frances), the tradition being that his father, a woollen-draper, named Benedetto, had died before his birth. This is not correct, for the mother's name was Romana, and the father continued living during many years of Piero's career. The painter is also named Piero Borghese, from his birthplace, Borgo San Sepolcro, in Umbria. The true family name was as above stated, Franceschi, and the family still exists under the name of Martini-Franceschi.

Piero first received a scientific education, and became an adept in mathematics and geometry. This early bent of mind and course of study influenced to a large extent his development as a painter. He had more science than either Paolo Uccello or Mantegna, both of them his contemporaries, the former older and the latter younger. Skilful in linear perspective, he fixed rectangular planes in perfect order and measured them, and thus got his figures in true proportional height. He preceded and excelled Domenico Ghirlandajo in projecting shadows, and rendered with considerable truth atmosphere, the harmony of colors, and the relief of objects. He was naturally, therefore, excellent in architectural painting, and in point of technique he advanced the practice of oil-coloring in Italy.

The earliest trace that we find of Piero as a painter is in 1439, when he was an apprentice of Domenico Veneziano, and assisted him in painting the chapel of S. Egidio, in S. Maria Novella of Florence. Towards 1450 he is said to have been with the same artist in Loreto; nothing of his, however, can now be identified in that locality. In 1451 he was by himself, painting in Rimini, where a fresco still remains. Prior to this he had executed some extensive frescos in the Vatican; but these were destroyed when Raphael undertook on the same walls the Liberation of St. Peter and other paintings. His most extensive extant series of frescos is in the choir of S. Francesco in Arezzo,—the History of the Cross, beginning with the legendary subjects of the death and burial of Adam, and going on to the entry of Heraclius into Jerusalem after the overthrow of Chosroes. This series is, in relation to its period, remarkable for effect, movement, and mastery of the nude. The subject of the Vision of Constantine is particularly vigorous in chiaroscuro; and a preparatory design of the same composition was so highly effective that it used to be ascribed to Giorgione, and might even (according to one authority) have passed for the handiwork of Correggio or of Rembrandt. A noted fresco in Borgo San Sepolcro, the Resurrection, may be later than this series; it is preserved in the Palazzo de' Conservatori. An important painting of the Flagellation of Christ, in the cathedral of Urbino, is later still, probably towards 1470. Piero appears to have been much in his native town of Borgo San Sepolcro from about 1445, and more especially after 1454, when he finished the series in Arezzo. He grew rich there, and there he died, and in October, 1492, was buried.

Two statements made by Vasari regarding "Piero della Francesca" are open to much controversy. He says that Piero became blind at the age of sixty, which cannot be true, as he continued painting some years later; but skepticism need perhaps hardly go to the extent of inferring that he was never blind at all. Vasari also says that Fra Luca Pacioli, a disciple of Piero in scientific matters, defrauded his memory by appropriating his researches without acknowledgment. This is hard upon the friar, who constantly shows a great reverence for his master in the sciences. One of Pacioli's books was published in 1509, and speaks of Piero as still living. Hence it has been propounded that Piero lived to the patriarchal age of ninety-four or upwards; but, as it is now stated that he was buried in 1492, we must infer that there is some mistake in relation to Pacioli's remark—perhaps the date of writing was several years earlier than that of publication. Piero was known to have left a manuscript of his own on perspective; this remained undiscovered till a recent date, when it was found by E. Harzen in the Ambrosian Library of Milan, ascribed to some supposititious "Pietro, Pittore di Bruges." The treatise shows a knowledge of perspective as dependent on the point of distance.

In the London National Gallery are four paintings attributed to Piero de' Franceschi. One of them, a profile of Isotto de Rimini, may safely be rejected. The Baptism of Christ, which used to be the altarpiece of the Priory of the Baptist in Borgo San Sapolcro, is an important example; and still more so the Nativity, with the Virgin kneeling, and five angels singing to musical instruments. This is a very interesting and characteristic specimen, and has indeed been praised somewhat beyond its deservings on æsthetic grounds.

Piero's earlier style was energetic but unrefined, and to the last he lacked selectness of form and feature. The types of his visages are peculiar, and the costumes (as especially in the Arezzo series) singular. He used to work assiduously from clay models swathed in real drapery. Luca Signorelli was his pupil, and probably to some extent Perugino; and his own influence, furthered by that of Signorelli, was potent over all Italy. Belonging as he does to the Umbrian school, he united with that style something of the Sienese and more of the Florentine mode.

PIETISM. Pietism is the name of an exceedingly influential, instructive, and interesting movement in the Lutheran Church which arose towards the end of the 17th and continued during the first half of the following century. The name of Pietists was given to the adherents of the movement by its enemies, as a term of ridicule, like that of "Methodists" somewhat later in England. The origin and nature of the movement itself may be both traced to defects in the Lutheran Church of the time and to isolated efforts to correct them. That church had in the 17th century become a creed-bound theological and sacramentarian institution, which orthodox theologians ruled with almost the absolutism of the papacy. Correctness of creed had taken the place of deep religious feeling and purity of life. Christian faith had been dismissed from its seat in the heart, where Luther had placed it, to the cold regions of the intellect. The dogmatic formularies of the Lutheran Church had usurped the position which Luther himself had assigned to the Bible alone, and as a consequence they only were studied and preached, while the Bible was neglected in the family, the study, the pulpit and the university. Instead of advocating the priesthood of all believers, so powerfully proclaimed by Luther, the Lutheran pastors had made themselves a despotic hierarchy, while they neglected the practical pastoral work of caring for the moral and spiritual welfare of their flocks. One of the consequences, as the Pietists believed, of all this was that immorality, irreligion, and heathenish ignorance of Christianity abounded in the land, and cried to heaven against an unfaithful church. As forerunners of the Pietists in the strict sense, not a few earnest and powerful voices had been heard bewailing the shortcomings of the church and advocating a revival of practical and devout Christianity. Amongst them were Jacob Boehme (Bemen), the theosophic mystic; Johann Arndt, whose principal devotional work on *True Christianity* is universally known and appreciated; Heinrich Müller, who described the font, the pulpit, the confessional, and the altar as the four dumb idols of the Lutheran Church; the theologian Johann Valentin Andrea, the court chaplain of the landgrave of Hesse; Schuppius, who sought to restore to the Bible its place in the pulpit; and Theophilus Grossgebauer of Rostock, who from his pulpit and by his writings raised "the alarm cry of a watchman in Sion." The direct originator of the movement was Philip Jacob Spener. Born in Alsace, January 13, 1635, as a child trained in piety under the influence of a devout godmother and books of devotion recommended by her, particularly Arndt's *True Christianity*, accustomed to hear the sermons of a pastor who preached the Bible more than the Lutheran creeds, he was early convinced of the necessity of a moral and religious reformation of the German church. He studied theology, with a view to the Christian ministry, at Strasburg, where the professors at the time were more inclined to practical Christianity than to theological disputation. He afterwards spent a year in Geneva, and was powerfully influenced by the strict moral life and rigid ecclesiastical discipline prevalent there, and also by the preaching and the piety of the Waldensian professor Antoine Leger and the converted Jesuit preacher Jean de Labadie. During a stay in Tübingen he read Grossgebauer's *Alarm Cry*, and in 1666 he entered upon his first pastoral charge at Frankfort-on-the-Main, profoundly impressed with a sense of the danger of the Christian life being sacrificed to zeal for rigid orthodoxy. Pietism, as a distinct movement in the German church, was then originated by Spener by religious meetings at his house (*collegia pietatis*), at which he repeated his sermons, expounded passages of the New Testament, and induced those present to join in conversation on religious questions that arose. These meetings were largely attended, produced a great sensation, and were soon imitated elsewhere. They gave rise to the name "Pietists." In 1675 Spener published his *Pia Desideria*, or *Earnest Desires for a Reform of the True Evangelical Church*, the public literary exposition and defence of his position and aims. In this publication Spener made six proposals as the best means of restoring the life of the church:—(1) the earnest cultivation of a more general and thorough familiarity with the Holy Scriptures by means of private meetings, *ecclesiolæ in ecclesia*; (2) a practical carrying out of the principle of the universality of the Christian priesthood by a participation of the laity in the spiritual government of the church and by the holding of family worship; (3) a serious laying to heart of the fact that a knowledge of Christianity must be attended by the practice of it as its indispensable sign and supplement; (4) the conversion of the habit of making merely didactic, and often bitter, attacks on the heterodox and unbelievers into a treatment of them instigated by genuine affection and animated by the simple desire of doing them good; (5) a reorganization of the theological training of the universities, in such a way that young divines should be urged not only to diligence in their studies but above all to lead devout lives; and (6) a different style of preaching, namely, in the place of pleasing rhetoric, the implanting of Christianity in the inner or new man, the soul of which is faith, and its effects the fruits of life. This work produced a great impression throughout Germany. Although large numbers of the orthodox Lutheran theologians and pastors were deeply offended by it, its complaint and its demands were both too well justified to admit of their being point-blank denied. A large number of pastors at once practically adopted Spener's proposals. In 1686 Spener accepted an appointment to the court-chaplaincy at Dresden, which opened to him a wider though more difficult sphere of labor. He succeeded in reviving the catechetical instruction of the young in religious truth in Saxony. In Leipsic, where Scriptural exegesis had almost wholly disappeared, a society of young theologians was formed under his influence, for the learned study and devout application of the Bible. Three *magistri* belonging to that society, one of whom was August Hermann Francke, subsequently the founder of one of the noblest works of Pietism—the orphanage at Halle—commenced courses of expository lectures on the Scriptures of a practical and devotional character and in the German language, which were zealously frequented by both students and townsmen. The lectures aroused, however, the ill-will of the other theologians and pastors of Leipsic, and their promoters, charged with having slighted the established worship of the land as well as true learning, were ordered to discontinue them. Francke and his friends left the city, and with the aid of Christian Thomasius and Spener founded the new university of Halle, which became the chief home of the Pietists, and the object of the jealousy and unsparing attacks of the older universities of Wittenberg and Leipsic. The theological chairs in the new university were filled in complete conformity with Spener's proposals. The main difference between the new Pietistic school and the orthodox Lutherans was not one affecting doctrine directly, inasmuch as Spener adhered in every point to the Lutheran faith. The difference arose from his conception of Christianity as chiefly consisting in a change of heart and consequent holiness of life, while the orthodox Lutherans of the time made it to consist mainly in correctness of doctrine. At the same time, the greater importance which he attached to the religious life and to practical godliness than to correctness of belief, and his restoration of the Bible to its place of superiority over the creeds, involved numerous possible departures from and advances beyond the Lutheranism of the 17th century. Again, the earnestness with which he had insisted on the necessity of a new birth, and on a separation of Christians from the world, led to exaggeration and fanaticism among followers less distinguished than himself for wisdom and moderation. Many Pietists soon maintained that the new birth must always be preceded by agonies of repentance, and that only a regenerated theologian could teach theology, while the whole school shunned all common worldly amusements, such as dancing, the theatre, and public games, and affected a severe austerity with regard to dress, meals, and conversation. Through these extravagances a reactionary movement arose at the beginning of the 18th century, one of the most distinguished leaders of which was Loescher, superintendent at Dresden. But it was only as the opponents of Pietism gradually ceased their attacks that the movement lost its strength and by degrees handed over its vital truths and truest work to various representatives of a new and better age of the church. As a distinct movement it had run its course before the middle of the 18th century. The spirit of the school of Spener long made itself felt amongst the Protestants of north and south Germany, and particularly at Halle. Pietism could claim to have contributed largely to the revival of Biblical studies in Germany, and to have given a Biblical basis once more to theology. It also made religion once more an affair of the heart and the life, and not merely of the intellect, to which theologians had reduced it. It likewise vindicated afresh the rights of the Christian laity in regard to their own beliefs and the work of the church, against the assumptions and despotism of an arrogant clergy. It thus revived eternal elements of Christianity that had been long neglected, and was a distinct agent in preparing the way for modern advance in religion and theology. But it sprang from a temporary necessity, and, like similar phases of Christian life, lacked the philosophical and scholarly depth, the human and secular breadth, and the progressive impetus of a permanent and world-subduing religious movement.

The two most recent German writers on the history of Pietism—Heppe and Ritschl—have given a much wider meaning to the term, including under it nearly all religious tendencies amongst Protestants of the last three centuries in the direction of a more serious cultivation of personal piety than that prevalent in the various established churches, and manifesting itself particularly in the ascetic shunning of "worldly" practices. The term then embraces the Anabaptist, Moravian, Methodistic, and other kindred tendencies of the religious life, which are generally regarded rather as simply related than genetically connected phenomena. Ritschl, too, treats Pietism as a retrograde movement of Christian life towards Catholicism. It is also customary with some German writers to speak of a later or modern Pietism, characterizing thereby a party in the German church which was probably at first influenced by some remains of Spener's Pietism in Westphalia, on the Rhine, in Würtemberg, and at Halle and Berlin, and which at the commencement worked to some extent on the lines of the earlier movement. The party was chiefly distinguished by its opposition to an independent scientific study of theology, its principal theological leader being Hengstenberg, and its chief literary organ the *Evangelische Kirchenzeitung*. The party originated at the close of the wars with Napoleon I.

Amongst older works on Pietism are Walch's *Historische und theologische Einleitung in die Religionstreitigkeiten der Evangelisch-*

Lutherischen Kirche, 1780; Tholuck's *Geschichte des Pietismus und des ersten Stadiums der Aufklärung*, 1865; H. Schmid, *Die Geschichte des Pietismus*, 1863; Goebel's *Geschichte des christlichen Lebens in der Rheinisch-Westfälischen Kirche*, 3 vols., 1849-60; and the subject is dealt with at length in Dorner's and Gass's *Histories* of Protestant theology. The two chief recent works which use the term in the wider sense just referred to are Heppe's *Geschichte des Pietismus und der Mystik in der reformirten Kirche*, (1879) which is sympathetic, and Ritschl's *Geschichte des Pietismus* (vol. i. only yet published, 1880), which is hostile. See also Nippold's article in *Theol. Stud. und Kritiken*, 1882, pp. 347-392, and Riggenbach's article "Pietismus," in Herzog's *Encyklopädie*, 2d ed.

(J. F. S.)

PIETRO. See Piero.

PIG. See Swine.

PIGALLE, Jean Baptiste (1714–1785), French sculptor, was born at Paris on 26th January, 1714. Although he failed to obtain the Great Prize, after a severe struggle he entered the Academy and became one of the most popular sculptors of his day. His earlier work, such as Child with Cage (model at Sèvres) and Mercury Fastening his Sandals (Berlin, and lead cast in Louvre), is less commonplace in character than that of his mature years, but his statue of Voltaire (Institut) and his tombs of Comte d'Harcourt (Notre Dame) and of Marshal Saxe (Lutheran church, Strasburg) are good specimens of French sculpture in the 18th century. He died on 21st August, 1785.

See Tarbé, *Vie et œuv. de Pigalle*; Suard, *Éloge de Pigalle*; *Mélanges de littérature*; Dussieux, *Les artistes français à l'étranger*; Barbet de Jouy, *Sculptures mod. Louvre.*

PIGAULT-LEBRUN, Charles Antoine Guillaume, sometimes called Pigault de l'Épinoy (1753–1835,) the chief fiction writer of the first Empire, and the most popular light novelist of France before Paul de Kock, was born at Calais (he is said to have traced his pedigree on the mother's side to Eustache de St. Pierre) on April 8, 1753. His youth was decidedly stormy. He twice carried off young ladies of some position, and was in consequence twice imprisoned by *lettre de cachet*. His first love, a Miss Crawford, the daughter of an English merchant whose office Pigault had entered, died almost immediately after her elopement; the second, Mademoiselle de Salens, he married. Besides his commercial and criminal experiences, he was a soldier in the queen's guards, an actor, and a teacher of French. At the breaking out of the great war he re-enlisted and fought at Valmy. It should be said, however, that the romantic incidents of his life are differently related by different authorities, and are open to not a little suspicion. Although he had tried dramatic writing, he does not seem to have attempted prose fiction till he was forty, but from that time he was a fertile writer of novels for nearly thirty years. In his old age he took to graver work, and executed an abridgment of French history in eight volumes, besides some other work. His *Œuvres Complètes* were published in twenty volumes between 1822 and 1824. He died on July 24, 1835. Pigault's numerous novels, though still occasionally reprinted, are not much read: and none of them is much better or worse than any other. Their style is insignificant, and their morality very far from severe. But Pigault deserves the credit, such as it is, of being almost the first writer of numerous light novels calculated to hit, and which succeeded in hitting, the taste of his day. Nor was he by any means without wit. As almost the father of a kind of literature which has since developed itself enormously, and which, whatever may be its intrinsic merits, has maintained and increased its popularity for a century, Pigault-Lebrun deserves a certain place in literary history.

PIGEON[1] French *Pigeon*, Italian *Piccione* and *Pipione*, Latin *Pipio*, literally a nestling-bird that pipes or cries out, a "Piper"—the very name now in use among Pigeon-fanciers. The word Pigeon, doubtless of Norman introduction as a polite term, seems to bear much the same relation to Dove, the word of Anglo-Saxon origin, that mutton has to sheep, beef to ox, veal to calf, and pork to bacon; but, as before stated, (Dove, vol. vii. p. 328), no sharp distinction can be drawn between the two, and the collective members of the group *Columbæ* are by ornithologists ordinally called Pigeons. Perhaps the best known species to which the latter name is exclusively given in common speech[2] is the Wild Pigeon or Passenger-Pigeon of North America, *Ectopistes migratorius*, which is still plentiful in many parts of Canada and the United States, though no longer appearing in the countless numbers that it did of old, when a flock seen by Wilson was estimated to consist of more than 2230 millions. The often-quoted descriptions given by him and Audubon of Pigeon-haunts in the then "back woods" of Kentucky, Ohio, and Indiana, need not here be reproduced. That of the latter was declared by Waterton to be a gross exaggeration if not an entire fabrication; but the critic would certainly have changed his tone had he known that, some hundred and fifty years earlier, Passenger-Pigeons so swarmed and ravaged the colonists' crops near Montreal that a bishop of his own church was constrained to exorcise them with holy water, as if they had been demons.[3] The rapid and sustained flight of these Pigeons is also as well established as their former overwhelming abundance—birds having been killed in the State of New York whose crops contained undigested grains of rice that must have been not long before plucked and swallowed in South Carolina or Georgia. The Passenger-Pigeon is about the size of a common Turtle-Dove, but with a long, wedge-shaped tail. The male is of a dark slate-color above, and purplish-bay beneath, the sides of the neck being enlivened by gleaming violet, green, and gold. The female is drab-colored above and dull white beneath, with only a slight trace of the brilliant neck-markings.[4]

Among the multitudinous forms of Pigeons very few can here be noticed. A species which seems worthy of attention as being one that might possibly repay the trouble of domestication, if any enterprising person would give it the chance, is the Wonga-wonga or White-fleshed Pigeon of Australia, *Leucosarcia picata*, a bird larger than the Ring-Dove, of a slaty-blue color above and white beneath, streaked on the flanks with black. It is known to breed, though not very freely, in captivity, and is said to be excellent for the table. As regards flavor, however, those who have been so fortunate as to eat them declare that the Fruit-Pigeons of the genus *Treron* (or *Vinago* of some authors) and its allies surpass all birds. These inhabit tropical Africa, India, and especially the Malay Archipelago; but the probability of domesticating any of them is very remote. Hardly less esteemed are the Pigeons of the genus *Ptilopus* and its kindred forms, which have their headquarters in the Pacific Islands, though some occur far to the westward, and also in Australia. Among them are found the most exquisitely colored of the whole family. There may be mentioned the strange Nicobar Pigeon, *Calœnas*, an inhabitant of the Indian Archipelago, not less remarkable for the long lustrous hackles with which its neck is clothed than for the structure of its gizzard, which has been described by Prof. Flower (*Proc. Zool. Society*, 1860, p. 330), though this peculiarity is matched or even surpassed by that of the same organ in the *Phænorrhina goliath*, of New Caledonia (*Rev.*

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[1] See further under the heading Poultry.

[2] It may be observed that the "Rock-Pigeons" of Anglo-Indians are Sand-Grouse (*q. v.*), and the "Cape Pigeon" of sailors is a Petrel (*q. v.*).

[3] *Voyages du Baron de la Hontan dans l' Amerique septentrionale*, ed. 2, Amsterdam, 1705, vol. i. pp. 93, 94. In the first edition, published at The Hague in 1703, the passage, less explicit in details but to the same effect, is at p. 80. The author's letter, describing the circumstances, is dated May, 1687.

[4] There are several records of the occurrence in Britain of this Pigeon, but in most cases the birds noticed cannot be supposed to have found their own way hither. One which was shot in Fife in 1825, may, however, have crossed the Atlantic unassisted by man.

de Zoologie, 1862, p. 138) and in the *Carpophaga latrans* of Fiji. In this last the surface of the epithelial lining is beset by horny conical processes, adapted, it is believed, for crushing the very hard fruits of *Onocarpus vitiensis* on which the bird feeds (*Proc. Zool. Society*, 1878, p. 102). The modern giants of the group, consisting of about half a dozen species of the genus *Goura* and known as Crowned-Pigeons, belong to New Guinea and the neighboring islands, but want of space forbids further notice of their characteristics, of which the most conspicuous are their large size and the reticulated instead of scutellated covering of their "tarsi."

A very distinct type of Pigeon is that represented by *Didunculus strigirostris*, the "Manu-mea" of Samoa, still believed by some to be the next of kin to the Dodo (vol. vii. p. 278), but really presenting only a superficial resemblance in the shape of its bill to that effete form, from which it differs osteologically quite as much as do other Pigeons (*Phil. Transactions*, 1869, p. 349). It remains to be seen whether the Papuan genus *Otidiphaps*, of which several species are now known, may not belong rather to the *Didunculidæ* than to the true *Columbidæ* (see ORNITHOLOGY, vol. xviii. p. 50).

At least 500 species of Pigeons have been described, and many methods of arranging them suggested. That by Garrod (*Proc. Zool. Society*, 1874, pp. 249–259) is one of the most recent; but, for reasons before assigned (vol. xviii. p. 43), it is not satisfactory. Temminck's great work on the group with its continuation by M. Florent-Provost, already mentioned (vol. xviii. p. 15), is of course wholly out of date, as also Selby's more modest *Natural History of the Columbidæ* (forming vol. ix. of Jardine's *Naturalist's Library*). Schlegel's catalogue of the specimens contained in the museum at Leyden (*Muséum des Pays-Bas*, livr. 10, 1873) contains much useful information, but a new monograph of the Pigeons, containing all the recent discoveries, is much wanted. (A. N.)

PIGMENTS are colored powders which, when mixed with oil, water, or other fluids, in which they are insoluble, form paints. They are distinguished from dyes and washes by their entire insolubility in the media in which they are mixed, whereas dye-stuffs are tinctorial substances applied in solution. Insoluble colors, when used in printing textile fabrics, are distinguished as pigment colors. The sources of materials available as pigments are numerous; many are native colored earths, others are separated from native metallic compounds and other mineral substances; a large number are artificially prepared from inorganic—principally metallic—sources; an important class consist of animal and vegetable coloring principles, forming with earthy bodies insoluble powders called lakes; and the dye-stuffs artificially obtained from organic sources are also similarly utilized. In fact all substances, colored or neutral, capable of being presented in the form of impalpable powder, which at the same time are insoluble and unalterable under ordinary atmospheric influences, may be regarded as possible pigments. But there are many qualities practically essential in a pigment which limit the range of available substances. A consideration of the first importance is the "body" or covering power of a pigment—that is, the property of fully covering and concealing with an opaque coating the surface over which it is spread. It is also important that the material should work well in, and be unaffected in appearance and constitution by the medium with which it is made into a paint, and that it should spread in an even uniform coat, which should dry well and quickly in the air and adhere firmly to the surface to which it is applied. When dry it should possess durability and resist change under the action of weather and other influences to which paint is exposed. These are the principal qualities requisite in paints in their important function of preservative coatings for the surfaces to which they are applied. On their artistic side, as decorative and pictorial materials, pigments should possess purity and brightness of color with intensity of tinting power, capacity for mixing or coming into contact with other colors without injuriously affecting these or being themselves deteriorated, and permanence and unalterability of tone after long exposure.

Pigments being so numerous and so diverse in their origin, the industries connected with their production and preparation are of necessity varied in character. Many of the substances employed being used in large quantities in other important industrial relations, as well as for paints, are manufactured on a large scale and constitute the basis of considerable chemical industries, as, for example, the manufacture of white lead, Prussian blue, ultramarine, the chrome materials, etc. In other cases the materials require no preparation other than that given to them by the paint-grinder or the artists' colorman, according to the purpose for which the substances are to be prepared.

The color trade embraces two distinct departments:—that of the paint-grinder, who manufactures and compounds the pigments used by artisans, house-painters, and paper-stainers; and that of the artists' colorman, who prepares and supplies the finer, more brilliant, and extensive assortment of pigments used for artistic purposes. The pigments employed for pottery painting and glass and enamel work are a special class of preparations to suit the requirements of these trades. Leaving out of account the chemical reactions involved in preparing raw materials, the ordinary manufacturing operations connected with the preparation of painters' colors are simple, and consist essentially of a careful system of grinding. Formerly, when painters ground their own colors, a stone slab and muller formed the entire apparatus; but now, when paint-grinding has become a separate industry, efficient machinery has been devised for grinding and its collateral operations. Bulky and rough colors such as whiting and common ochres are dry-ground under heavy edge stones which revolve in a strong iron bed. Ordinary dry colors requiring to be pulverized with more care are mixed to a thin cream with water, which is fed into and ground principally between a pair of millstones dressed and mounted like the ordinary horizontal stones of a flour mill, but smaller in diameter. For fine colors the pigment so ground is levigated, or floated into a vat in which the heavier particles sink, and the lighter, more finely divided portion is run into another vessel at a lower level, where it is deposited as a fine sediment. The sediment is dried in a uniformly heated stove, and when thoroughly dry is again pulverized under a pair of edge stones, and sifted or winnowed; so treated it is ready for use as dry color. The greater proportion of the white lead and the other common oil paints are ground in oil. For this purpose the raw material is mixed in a machine with oil (sometimes boiled) to the consistence of a stiffish paste, and in this state it is ground in horizontal paint millstones, after which it requires no further preparation than the necessary thinning with oil when to be used for painting. There are many varieties of apparatus used for grinding both dry and oil colors.

The artists' colorman grinds his pigments with much greater labor, and selects his materials in a more careful manner, than is necessary in the case of the ordinary paint-grinder. Pigments for artistic painting in oil are ground in that medium to a definite consistency, and are put up for use in convenient compressible tubes of tin. For water colors the pigments are prepared principally in the form of small indurated cakes or as "moist colors" contained in small porcelain dishes. Water colors may also be obtained thin in tin tubes like oil colors, or as "pastilles," which are thin round cakes intermediate in condition between cake and moist colors.

In enumerating the principal commercial pigments it is usual and convenient to classify them according to their tints. They are not, as a rule, definite chemical compounds: many indeed are mixed substances prepared by processes and according to recipes known only to their makers; and, while the same commercial name is frequently given to substances quite dissimilar in character, the confusion is further increased by applying many different titles to substances which are practically identical. Thus white lead is known by at least a dozen names, and distinct and even conflicting qualities are by authorities attributed to this one substance under its various aliases.

It would be impossible to catalogue all the paints met with in commercial lists and it would serve no good purpose to enumerate the whole of the pigments which might be and are occasionally used. Premising that details regarding many of the substances will be found under the heading of the metals, etc., whence they are derived, we shall here simply classify, according to their color, the principal well-recognized pigments of commerce, adding brief remarks regarding each class.

White Pigments.—The whites are the most important pigments used by painters, forming as they do the basis or body of nearly all paints, excepting only certain dark hues. Good available whites are limited in number, and all of real importance are included in the following list:—white lead, a carbonate of lead (chiefly); zinc white, oxide of zinc, called also Chinese white; antimony white, oxide of antimony; fixed white, sulphate of baryta; "silicate" white, sulphate of baryta, or strontia and sulphide of zinc; mineral white, powdered gypsum (with alumina it forms satin white); chalk or whiting carbonate of lime and china clay, silicate of alumina.

White Lead (see Lead, vol. xiv. p. 374) is the most important of all pigments, and forms the basis of nearly all ordinary oil paints, which when colored consist of white lead tinted with the necessary colored pigments. It possesses the greatest amount of body or covering power, and works beautifully in oil, with which it partially combines, drying as a hard homogeneous adherent plaster. On the other hand it is a most poisonous body, very injurious to the persons connected with many of the processes by which it is prepared. As an oil color it darkens gradually in an atmosphere containing traces of sulphur; it cannot be used at all as a water or distemper color; and it acts injuriously on the color of several important pigments. Notwithstanding these drawbacks no white has yet been made that can compete with white lead, although paint manufacturers go far to provide a substitute by adulterating it to such an extent that the white lead frequently bears only a small ratio to the adulterant. Baryta white is the ordinary adulterant, and among respectable manufacturers the intermixture is a well-understood fact, and the relative proportions of white lead and baryta are regulated by a series of grades passing from "genuine" to No. 5 or No. 6 white lead. Many efforts have been made to substitute for ordinary white lead lead carbonates made by other processes, and other lead salts such as the oxychloride (Pattinson's), sulphate, tungstate, antimoniate, etc.; but none of these has proved permanently successful.

Zinc White.—Next in importance to white lead, is an oxide of zinc prepared by the sublimation and combustion of metallic zinc. The pigment is deficient in covering power and it dries but slowly when mixed with oil. On the other hand it is not injurious to health, its purity of tone is not affected by sulphurous air, it does not affect tints added to it or with which it comes in contact, and it can be used in water as well as in oil. Like white lead it is very much adulterated, and generally with the same agent—baryta white.

Baryta White plays an important independent part as well as acting so extensively as a sophisticator of other pigments. It is prepared by grinding to a fine powder the pure white native sulphate of baryta (heavy spar), and the same substance artificially prepared is known as permanent white or *blanc fixé*. The artificial preparation is much superior, as a pigment, to the powdered spar; but both are deficient in body, notwithstanding which they are of great value to paper-stainers and for distemper painting.

Under the name of *Charlton White* or silicate paints, Mr. J. B. Orr prepares a range of white paints which have come into extensive use. The pigment as originally prepared under Mr. Orr's patent of 1874 consisted of an intimate mixture of artificial sulphate of baryta and sulphide of zinc in certain proportions, made by the double decomposition of solutions of barium sulphide and sulphate of zinc. In 1881 a patent was secured by Mr. Orr for a combination in which strontia takes the place of baryta. It is claimed for these pigments that they possess body greater than white lead, that they are non-poisonous, and that with certain modifications in the manufacture they can be made quite as valuable for distemper painting as for oil colors.

The oxides of antimony, tin, bismuth, etc., form white pigments; but these possess no peculiarities which render them valuable for painters' use. The carbonate of lime, more or less pure and in various degrees of pulverulence under several names, such as *Chalk White, Paris White, Whiting*, etc., is very extensively used in distemper work for walls, roofs, etc., and in paper-staining, occupying in these relations the important place held by white lead in oil painting. Mineral white or satin white consists of powdered gypsum and alumina, a preparation very largely used by paper-stainers for their glossy satin bodies. There are several other white earths of relatively little importance as pigments.

Blue Pigments.—The list of blue colors of real importance is not extensive, comprising, as principal items, ultramarine, Prussian blue, the cobalt blues, and indigo. The following list embraces the names and varieties ordinarily recognized in commerce: ultramarine (native), powdered lapis lazuli; ultramarine (artificial), silicates of alumina and soda with sulphide of sodium; Prussian blue, cyanide of iron; Paris blue, modified Prussian blue; Antwerp blue, fine Prussian blue; smalts, a cobalt glass; azure blue, a preparation of smalts; cobalt or Thenard's blue, sub-phosphate of cobalt; cæruleum, stannate of cobalt and sulphate of lime; mountain blue, native carbonate of copper; lime blue, carbonate of copper and lime; Verditer or Bremen blue, hydrated oxide of copper; indigo from species of *Indigofera;* indigo carmine, preparation of indigo.

Apart from the important colors Ultramarine, Prussian Blue, and Indigo, separately noticed, these blues, which are not of much value for painters, owe their color principally to cobalt and copper. The principal cobalt color is *Smalts*, called also strewing smalts, cobalt glass, zaffre, Saxony blue, etc. It is prepared by smelting together the mineral arsenide of cobalt, pure sand, and carbonate of potash into a glass. The molten glass is cast into cold water, then ground fine and levigated. Smalts is chiefly available for distemper and fresco painting, and is not much used as an oil color. *Azure Blue* is generally recognized as a preparation of smalts, but the name is given to several compounds. *Cæruleum* is a light blue color of durable quality with a greenish tinge, consisting of a combination of cobalt oxide with stannic acid; and *Cobalt Blue*, the sub-phosphate of cobalt, a color discovered by Thenard, possesses a purple tinge. Carbonate of copper, either in the form of the mineral azurite or artificially prepared, is a principal source of the copper blues, which, however, possess little value as pigments owing to their tendency to blacken under exposure. *Blue Verditer*, a greenish blue which passes into green verditer, is a hydrated oxide of copper.

Yellow Pigments.—The following list includes the ordinary yellow colors of commerce: ochres and sienna earth, native earths tinted with iron; Mars yellow, hydrated ferric oxide; chromes, chromates of lead and other metals; massicot, protoxide of lead; Naples yellow, antimoniate of lead; mineral yellow, basic chloride of lead; aureolin, nitrate of potassium and cobalt; cadmium yellow, sulphide of cadmium; orpiment, trisulphide of arsenic; Indian yellow, urio-phosphate of calcium; gamboge, resin of *Garcinia;* Dutch pink, a vegetable lake; yellow lakes.

Of these colors the more important are the ochres and the various combinations containing chromium. The *Yellow Ochres* are native earths colored with hydrated ferric oxide, the brownish yellow substance that colors, and is deposited from highly ferruginous water. These ochres are of two kinds—one having an argillaceous basis, while the other is a calcareous earth, the argillaceous variety being in general the richer and more pure in color of the two. Both kinds are widely distributed, fine qualities being found in Oxfordshire, the Isle of Wight, near Jena and Nuremberg in Germany, and in France in the departments of Yonne, Cher, and Nièvre. The original color of these ochres can be modified and varied into browns and reds of more or less intensity by calcination. The high heat expels the water of hydration from the iron oxide, changing it into red ferric oxide. The nature of the associated earth also influences the color assumed by an ochre under calcination, aluminous ochres developing red and violet tints while the calcareous varieties take brownish-red and dark-brown hues. The well-known ochre *Terra da Sienna* which in its raw state is a dull-colored ochre, becomes when burnt a fine warm mahogany brown hue highly valued for artistic purposes. Yellow ochres are also artificially prepared—*Mars Yellow* being either pure hydrated ferric oxide or an intimate mixture of that substance with an argillaceous or calcareous earth, and such compounds by careful calcination can be transformed into *Mars Orange*, *Violet*, or *Red*, all highly important, stable, and reliable tints. The metal chromium owes its name to the intense coloration produced by the combination of its oxide, chromic acid, with various metals and alkaline earths. Several of these salts are soluble, but those which form pigments are insoluble compounds. The principal chrome pigments—the various shades of lemon and yellow chrome deepening to orange tints—are composed of the neutral chromate of lead, the difference of hue depending on the greater or smaller proportion of lead used in the preparation. The basic chromate of lead has a deep orange color passing into the minium-red-like hue of chrome red. *Strontia Chrome*, the chromate of strontium, is a pale lemon pigment of fine quality and permanence. With zinc, chromic acid forms two combinations, neutral and basic, both possessed of an intense yellow color; and chromate of barium also furnishes a useful yellow color. Lead itself, without chromium, is the basis of several valuable yellows. *Massicot*, the protoxide of lead, is a clear yellow pigment deficient in body. *Naples Yellow*, a color highly esteemed by early artists, is an antimoniate of lead which in early times was obtained from native sources; and *Mineral Yellow* is an oxychloride of lead. The sulphide of cadmium forms the fine durable *Cadmium Yellow*, a color now much appreciated for artistic use. The arsenical yellow, *Orpiment*, is now little used as a pigment, although formerly, under such names as *King's Yellow*, *Imperial Yellow*, and *Chinese Yellow*, it was held in high esteem by artists. *Aureolin*, a nitrate of potassium and cobalt, is a color of recent origin which has come into high favor among artists. *Indian Yellow* is a color of animal origin of no permanence, and *Gamboge* is a gum resin yielded by trees of the genus *Garcinia*, principally employed as a water color. The yellow lakes are comparatively unimportant, but some, known, rather absurdly, as *Dutch*, *English*, or *Italian Pink*, are largely used in paper-staining.

Red Pigments embrace two distinct series of substances—the reds of inorganic origin, and red lakes obtained from animal and vegetable colors. The principal commercial varieties are as follows: rouge, Turkey red, and Indian red, red ferric oxide; Venetian red, ochreous ferric oxide; ochres, earths colored by ferric oxide; vermilion and cinnabar, sulphide of mercury; antimony vermilion, red sulphide of antimony; Derby red, a form of chrome red; red lead or minium, red oxide of lead; chrome red, basic chromate of lead; realgar, bisulphide of arsenic; madder lake, alizarin and alumina; madder carmine, preparation of alizarin; carmine lake, cochineal red and alumina; carmine, preparation of cochineal; wood lakes, from various red dyewoods.

The principal mineral reds owe their color to oxides of iron and to compounds of mercury. The reds due to iron are closely allied to the yellow ochres and other ferruginous pigments. As already explained in connection with these yellows, tints passing through orange to deep purple reds are obtained by calcination of yellow hydrated ferric oxide, and in this way a great variety of ruddy and red tints are prepared. The proportion of ferric oxide in these compounds ranges from pure oxide to combinations in natural ochres containing not more than 2 or 3 per cent. of iron. *Rouge* or *Mars Red*, *Crocus*, *Indian Red*, and *Turkey Red* are all pure ferric oxide, varying in depth of tint from having undergone different degrees of calcination, or from being made from different artificial or natural sources. The other iron reds are all of the nature of ochres—some of them, such as *Venetian Red*, being artificial compounds. These reds form exceedingly useful durable colors which do not injuriously affect the tints with which they are associated. Of red colors from mercury, *Cinnabar* and *Vermilion* are the most important, the former being the native and the latter an artificial sulphide of mercury (see Mercury, vol. xvi. p. 38). Vermilion is one of the most pure, brilliant, solid, and durable of all colors. Its beauty is largely affected by the smoothness of the powder to which it is reduced, and in this respect that obtained from China is of the highest excellence. Being a costly pigment, vermilion is freely adulterated with other reds, a fraud easily detected by the perfect volatility of the genuine substance. From mercury combined with iodine is prepared a pigment of unequalled vivacity and brilliance, *Iodine Scarlet*, but unfortunately as fugitive as it is bright, and consequently not available for work requiring permanence. The principal red color from lead is *Minium* or *Red Lead*, a pigment of great antiquity obtained as a product of the oxidation of massicot, or by the calcination and oxidation of white lead. It is orange red in color, of good opacity and body, but it has the fault of white lead and lead colors generally, blackening in contaminated air and injuring colors with which it comes in contact. By itself it is a valuable paint for first coating exposed iron surfaces to prevent their oxidation, and it is an excellent dryer, on which account it is much used in preparing boiled oil for painters. *Chrome Red*, a basic chromate of lead known also as *Persian* or *Derby Red*, is a brilliant pigment ranging in tone from orange to a deep vermilion hue. It is obtained by precipitating a solution of acetate of lead with bichromate of potash, with the addition of more or less of caustic potash or soda,—the proportion of the latter addition determining the depth of resultant tone. *Antimony Vermilion* is the red variety of the sulphide of antimony which, as found in nature (stibnite), is a dark gray body with metallic lustre. This, when fused and kept some time at a high heat and suddenly cooled, by allotropic modification becomes a fine vermilion red. The color is artificially prepared by acting on solutions of the butter of antimony (antimony chloride) with hyposulphite of soda or lime. It is a color of excellent purity and body as a water color, but unfortunately it becomes brown by exposure. The lakes form a numerous and important class of red pigments. A lake is a combination of a color of organic origin with a metallic oxide or salt, commonly with alumina. Originally all lakes were red colors, the name being derived from the lac insect *Coccus lacca*, the coloring matter of which forms the lake now known as *Lac Lake*. But lakes of any color or tint are now made. The most important lake pigment is *Madder Lake*, a compound of alumina and the tinctorial principle of madder root, *Rubia officinalis*, but now made with artificial alizarin. *Scarlet* or *Carmine Lake* has cochineal for its color basis, and there are corresponding lakes from lac, kermes, etc. *Wood Lakes* colored with several of the red dyewoods have little durability, but they are nevertheless largely used by paper-stainers. *Carmine*, a coloring matter from cochineal, and *Madder Carmine* or *Field's Carmine*, from madder, are exceedingly brilliant colors; but the first of them is of a fugitive character.

Green Pigments form an extensive group embracing two sections:—(1) simple greens, in which green is a primary inherent or natural color; and (2) compound greens, made up of intimate mixtures of blue and yellow pigments. The latter class it is obvious are capable of indefinite modification by simply varying the proportions of the compound ingredients. The following list embraces the principal commercial greens:—Brunswick green, oxychloride of copper; malachite green or mountain green, hydrated carbonate of copper; verdigris, sub-acetate of copper; verditer or Bremen green, hydrated oxide of copper; Scheele's green, arsenite of copper; Schweinfurt green, mixed acetate and arsenite of copper; emerald green, a variety of Schweinfurt green; mineral green, mixed copper oxide and arsenite; chrome green, oxide of chromium; Guignet green or veridian, hydrated oxide of chromium; Cassel green, manganate of baryta; cobalt green, oxides of cobalt and zinc; ultramarine green, modified artificial ultramarine; Veronese earth or terra verde, a form of ochre; green lakes.

The greater proportion of these greens are copper compounds—the most brilliant of them containing also arsenic. They are all poisonous colors, the latter especially being dangerous poison; and there can be no doubt that their free use in wall papers, the coloring of toys, artificial flowers, etc., is frequently the source of dangerous disease and even death. *Brunswick Green*, the most important non-arsenical green, is an oxychloride of copper, but factitious Brunswick greens are not uncommon. *Scheele's Green*, the arsenite of copper, and *Schweinfurt Green*, mixed arsenite and acetate of copper, are very powerful and brilliant colors. These copper greens all blacken in foul gases and when mixed with oil, and thus, although they possess great body, they are much more useful to the paper-stainer than the painter. The sesquioxide of chromium both water-free and hydrated, prepared in various ways, forms important stable green colors which resist atmospheric influences; and chromium is further the basis of several other green colors, which, however, are not of importance. *Cobalt Green*, a mixed oxide of cobalt and zinc, discovered by the Swedish chemist Rinman, is a valuable and durable but expensive color. *Cassel Green*, called also *Rosenstiehl's Green*, is a fine innocuous pigment made by melting together sulphate of baryta and oxide of manganese, and carefully washing the resulting mass in water. *Verona Green* or *Terra Verde*, a natural celadon green highly valued by artists for permanence, is a mixed earthy body colored by ferrous oxide, and *Ultramarine Green*, also a stable body, is an intermediate product of the manufacture of ultramarine blue.

Brown Pigments.—Many of the painters' browns are simply tints obtained by mixture. In the case of simple pigments the shades pass by fine gradations into yellows and reds, so that the limits of classification are not well defined. The following are generally classed as pure browns:—umber, silicate of iron and manganese; brown ochres called Mars brown, iron brown, etc., native and artificial earths; Vandyke brown and Cologne or Cassel brown, peaty ochres; purple brown, ferric oxide; Spanish brown or tiver, a brown iron ochre; bistre, washed beechwood soot; sepia, secretion of cuttle-fish; brown lake; asphaltum, natural and artificial pitch.

Iron and manganese, separately or combined, earthy or pure, are the sources of the principal brown pigments. Some of them are intermediate products between yellow ochres and red ochres by calcination of the yellow, and, as they are ochreous in their nature, their colors may be heightened or otherwise modified by calcining. Thus *Umber*, which properly is a hydrated silicate of manganese and iron, is brightened in color by calcination into *Burnt Umber*. The finest umber comes from the island of Cyprus, and is known as Turkey umber. Large quantities also of "English" umber are mined in Devonshire and Cornwall. Real *Vandyke Brown*, a very celebrated pigment, ought to be a kind of bituminous peaty earth of a fine rich semitransparent color, allied to which are *Cologne* and *Cassel Earth*. But under the name Vandyke brown pure ferric oxide and ferruginous earths of a clear brown hue are also sold. *Cappagh Brown* is a peaty earth colored by manganese, found at Cappagh near Cork, Ireland, and is a valuable artists' color, as is also *Bistre*, a brown washed from the soot of beechwood. *Sepia*, a much valued warm brown, is a substance secreted by the cuttle-fish, *Sepia officinalis*, which emits it to cloud the water for concealing its whereabouts when alarmed.

Black Pigments form a numerous class of bodies, though those in common use are easily enumerated. They appear in commerce principally under these names: vegetable black, carbonized vegetable matter; lamp black, soot of oils and fats; Indian ink, preparation of lamp black; ivory black, carbonized ivory and bone; bone black, carbonized bone; blue black, washed wood charcoal; charcoal black, carbonized wood; black wad, a native oxide of manganese; black lead, a form of carbon; tar, from distillation of organic substances.

Most of these blacks owe their color to carbon. From the charring of vegetable substances are prepared *Charcoal Black*, *Blue Black*, and *Vegetable Black*, but these take many names according as they are prepared from carbonized wood, twigs of the grape vine, peach and other fruit stones, cork, the lees of wine, etc. *Bone* and *Ivory Blacks* again are carbonized animal substances, principally bone, which when skilfully burned yield dense durable blacks. *Lamp Black* of the best quality is the soot deposited from the imperfect combustion of oils and fats, and the soots of resin and tar are also collected and used under this name. *Indian Ink* (see vol. xiii. p. 87) is a form under which lamp black of the finest quality occupies an important position among pigments. Of the other blacks *Tar* is the most important, owing to its extensive use as a preservative and antiseptic coating.

Several pigments are prepared on account of special properties apart from the protective and decorative purposes for which ordinary paints are applied. Among such may be mentioned Balmain's luminous paint, a preparation in oil or water of certain of the phosphorescent sulphides. Objects coated with this material have the property of continuing to emit light in dark situations for some time after they have been exposed in daylight or to high artificial light. The luminous paint has been proposed for coating buoys, signals, public notice boards, clock and watch dials, playing balls, match boxes, etc., but it has not come into extensive use. Powdered asbestos has been introduced as a fire-proof paint for wood; but all common paints applied as distemper color are equally fire-proof in the sense that they themselves are incombustible, and when they coat wood thickly they offer great resistance to an incipient fire, and even retard combustion under very high heat. Numerous anti-fouling compositions for the painting of ships' sides and bottoms and anti-corrosive, inoxidizable, damp-proof and water-proof paints have been patented, some of which are in extensive use. (J. PA.)

[The pigments imported into the United States bear a very small proportion to those which are produced in that country. Even artists' colors (oil) are now largely manufactured in Philadelphia, New York, and Boston.

Ochre is very abundant in the United States, but Pennsylvania produces more of the marketable pigment than any other State. It is worked up chiefly at Bethlehem, Easton, and the neighborhood. The iron mines of Bermuda Hundred, Va., also yield ochre which compares favorably with that of Europe. At present the domestic ochres are not worked up as finely as the foreign.

The umber of Pennsylvania is inferior both in strength and tint to the foreign. The home manufacture of vermilion almost excludes the foreign product, and the white lead and red lead used are almost exclusively of American make.

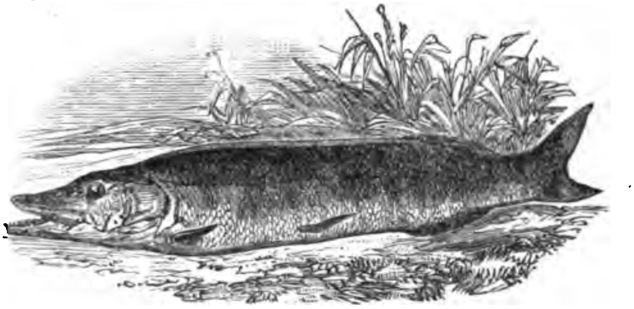
Oxide of zinc is largely made at Oxford, N. J., also at Bethlehem, and at Belleville, Illinois; and most of the zinc colors used are manufactured in the country.

All the chrome colors, yellows, greens, and blues, are principally of American manufacture, and improved machinery is employed.

Venetian red was until recently imported, but is now largely made from the waste product of galvanized iron works.

Oxide of cobalt (used at the potteries) and cobalt blue, are also made in considerable quantities.—Am. Ed.]

PIKE, freshwater fishes generally distributed over the rivers and lakes of Europe, northern Asia, and North America, and forming a small family (*Esocidæ*) of soft-rayed Fishes. They are readily recognized by their elongate compressed body covered with small scales, a long head, long and spatulate snout, and very large mouth armed with strong and long teeth in the jaws and broad bands of smaller teeth on the palate and tongue. The teeth point backwards or can be depressed so as to offer no obstruction to any object entering the gape, but prevent its withdrawal in the opposite direction. The dorsal and anal fins are placed far back on the tail, thus greatly increasing the propelling power of the fish, and, although pike are bad swimmers and lead rather a sedentary than a roving life, they are excelled by no other freshwater fish in rapidity of motion when, by a single stroke of the tail, they dash upon their prey or dart out of reach of danger. In the Old World one species only is known (*Esox lucius*), which prefers lakes and sluggish reaches of rivers to strong currents or agitated waters. Its eastward range in northern Asia is not known; it extends into Lapland in the north and into central Italy and the vicinity of Constantinople in the south, but is absent in the Iberian Peninsula. The European species occurs also in North America, and is common in the eastern United States southwards to northern Ohio. But North America is tenanted by other species of pike besides, of which the largest is the Muskelunge or Maskinonge of the Great Lakes (*Esox nobilior*); it commonly attains to the large size which is exceptionally recorded of *Esox lucius*. The other American pike are of smaller size, and generally named "Pickerel;" but opinions as to the distinction of the species differ widely among American ichthyologists. The European pike, like its brethren, is the most voracious of freshwater fishes; it probably exceeds the shark, to which it has been compared by many writers, in the relative quantity of food it consumes. Ponds would soon be depopulated but for its cannibal propensities, no pike being safe from another of its own kind large enough to swallow it. To the young of waterfowl pike are most destructive, and large specimens will seize rats or rabbits when they take to the water, and are said to attack even foxes and small dogs. Individuals of from forty to fifty pounds are not scarce, but captures of much larger ones are on record.


European Pike (*Esox lucius*).

Pike are wholesome food, and much esteemed in inland countries,—the smaller (of 20 to 24 inches in length) being preferred to the larger individuals. They are prolific, and not easily exterminated in a water in which they have been once allowed to spawn. According to season and climate they spawn in April or May, and sometimes as early as February.

PIKE-PERCH (*Lucioperca*), freshwater fishes closely allied to the perch, but with strong canine teeth standing between the smaller teeth of the jaws and palate. As indicated by the name, these fishes show some slight resemblance to the pike in their elongate body and head, and like that fish they are most dangerous enemies to other freshwater fishes. Their acclimatization therefore in waters intended for the culture of valuable food fishes is not advisable, though they compensate in some measure for their destructiveness by the excellent flavor of their flesh. In Europe two species occur, the more celebrated being the "Zander" of North Germany or "Schiel" of the Danube (*Lucioperca sandra*); strange to say, it is absent in the system of the Rhine. It prefers the quiet waters of large rivers and clear deep lakes, in which it reaches a weight of twenty-five or thirty pounds; it does not thrive in small and confined waters. The second European species (*Lucioperca wolgensis*) is limited to rivers in southern Russia and Hungary. In North America several pike-perches have been described, but in the most recent works only two are distinguished, viz., *Lucioperca americana*, which grows to a weight of twenty pounds, and the much smaller *Lucioperca canadensis*; both are abundant in the Canadian lakes and upper Mississippi, and the latter also in the Ohio.

PILATE,[1] PONTIUS, the fifth Roman procurator or "governor" (ἐπίτροπος, ἡγεμών) of Judea, Samaria, and Idumæa, succeeded Valerius Gratus in 26 A.D. By rank he was a Roman eques, possibly of Samnite extraction; his official appointment he owed to the influence of Sejanus. His ordinary residence as procurator was at Cæsarea, the capital, but from time to time he visited Jerusalem, especially at the greater feasts, and on these occasions he had his *bema* in the magnificent palace of Herod the Great, hence called the *prætorium*. Apart from the supreme (to him, likely enough, most trivial) incident in his life ("suffered under Pontius Pilate") the few facts that are known of him indicate a somewhat exceptional recklessness about awakening Jewish fanaticism, and unscrupulousness as to the means used in quelling its manifestations. Not long after his appointment he allowed his soldiers to carry their eagles and other insignia to Jerusalem, and did not give way until an excited mob had stormed for five whole days and nights around his palace at Cæsarea. At a later date, in order to provide for the completion of his aqueduct for bringing water to the city from the "Pools of Solomon," he appropriated funds from the Corban or sacred treasury; but, profiting by his former experience, when this conduct was resented by the populace he caused some of his soldiers, disguised as Jewish citizens but armed with staves and daggers, to mingle in the crowd, when many casual spectators as well as rioters were trampled to death. For having hung up in Herod's palace certain gilt shields dedicated to Tiberius he was in vain remonstrated with by the Jews, but Tiberius, on being appealed to, ordered their transference to the temple of Augustus at Cæsarea. Of the circumstances under which he "mingled the blood" of certain Galilæans "with their sacrifices" nothing is known; but his cruelty in causing a number of Samaritans to be attacked and massacred when assembled on Mount Gerizim led to a complaint being lodged with Vitellius the legate of Syria, and ultimately to his being deprived of his office early in 36 A.D. According to Eusebius (*H. E.*, ii. 7) he was banished to Vienne in Gaul, where various misfortunes caused him at last to commit suicide; the *Chronicle* of Malalas alleges, with less probability, that he was beheaded under Nero. Later legend (see, for example, the apocryphal *Mors Pilati* mentioned below) has a good deal more to say: his suicide was anticipatory of Caligula's sentence; the body was thrown into the Tiber and there caused disastrous tempests and floods; it afterwards produced similar effects in the Rhine at Vienne, and finally had to be consigned to a deep pool among the Alps. Local tradition points to a little tarn on Mount Pilatus near Lucerne; if anything is thrown into it the water is forthwith strangely agitated. The devil takes the body from the water on Good Fridays and sets it on a throne where it goes through the gesture of washing its hands. The fact that Pilate allowed Jesus to be crucified is by no means out of keeping with what we know of his indifference to the claims alike of justice and of mercy; that he obviously wished to spare him if this could be done without too much inconvenience to himself has, however, gained him in some quarters very generous recognition; thus Tertullian speaks of him as "jam pro sua conscientia Christianum," the Copts regard him as a martyr, and the Abyssinian Church has given him a place in its calendar (June 25). This view is reflected in the spurious *Paradosis Pilati*. Pilate's wife, known to tradition as Procla or Claudia Procula, is represented as having been a proselyte of the gate and a secret disciple of Jesus. She is commemorated as a saint in the Greek Church (Oct. 27).

There is a considerable body of apocryphal literature connected with the name of Pilate. The *Acta Pilati*, which forms part of the *Evangelium Nicodemi*, gives a copious account of the trial of Jesus, intermingled with legendary details of uncertain and very unequal value. It exists in a variety of texts, but in substance is supposed with most probability to date from about the middle of the 2d century, and to be the work of a Jewish Christian, written for Jews. The *Epistola Pilati*, of which there are two differing forms, contains what purports to be Pilate's account to Tiberius of the resurrection of Jesus. The *Paradosis Pilati* relates his trial, condemnation, and execution at the emperor's command; Pilate appeals in prayer to Jesus, and, along with Procla, his wife, is received as a true penitent into the number of the faithful. The *Mors Pilati* relates the circumstances of his suicide, the casting of his body into the Tiber, its removal to Vienne (explained as "Via Gehennæ"), and the final disposal of it at "Losania." For all these apocryphal writings see Tischendorf's *Evangelia Apocrypha* (1863).

PILCHARD (*Clupea pilchardus*), a fish of the herring family (*Clupeidæ*), abundant in the Mediterranean and on the Atlantic coasts of Europe, northwards to the British Channel. Sardine is another name for the same fish, which on the coast of Brittany and Normandy is also called *Célan* or *Célèren*. It is readily distinguished from the other European species of *Clupea* or herrings. The operculum is sculptured with ridges radiating and descending towards the suboperculum; the scales are large, about thirty along the lateral line, deciduous; the ventral fins are inserted below, or nearly below, the middle of the base of the dorsal fin; the dorsal fin has seventeen or eighteen, the anal from nineteen to twenty-one rays. A small blackish spot in the scapulary region is very constant, and sometimes succeeded by other similar marks. There are no teeth on the palate; pyloric appendages exist in great numbers; the vertebræ number fifty-three. The pilchard is one of the most important fishes of the English Channel (see article FISHERIES, vol. ix. p. 221 *sq.*). It spawns at a distance from the shore, and, according to Couch, the spawn has been seen to extend several miles in length, and a mile or more in breadth floating on the surface of the sea, of the thickness of brown paper, and so tough as not to be readily torn in pieces. The spawning takes place at two periods of the year, viz., in April or May, and again in the early part of autumn; but it is not probable that the same individuals or shoals spawn twice in the same year. When commencing their migrations towards the land, the shoals consist of countless numbers, but they break up into smaller companies in close vicinity to the shore. Pilchards feed on minute crustaceans and other animalcules, and require two or three years before they attain their full size, which is about 10 inches in length. On the Pacific coasts of America, in New Zealand, and in Japan a pilchard occurs (*Clupea sagax*) which in its characters and habits is so similar to the European pilchard that its general utilization is deserving of attention, and there is every reason to believe that New Zealand could produce its own sardines and fumadoes. Immense shoals are reported to visit the east coast of Otago every year in February and March.

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[1] *I.e.*, *Pilatus*, either derived from *pilum*, and thus analogous with the surname *Torquatus*, or a contraction of *pileatus*. The pileus was the badge of manumitted slaves, and if this etymology be accepted, the name probably indicates that Pilate was a *libertus*, or the descendant of a libertus, of a member of the Samnite gens of the Pontii.

PILES. See HÆMORRHOIDS.

PILGRIMAGE. The word Pilgrimage (derived from the Latin *pereger*, *i.e.*, *per-ager*, "one who traverses a region," through the intermediate forms *peregrinus*, *pellegrino*, *pelegrin*) denotes the act of journeying to some place esteemed sacred, for the purpose of discharging a religious obligation, or to obtain some supernatural assistance or benefit. The practice is common to many religions, and mounts back to prehistoric ages. It is ultimately traceable to the nature of tribal religion, in its early form of worship of a deity regarded as purely local in the sphere of his special influence. As community in religious acts was one of the principal ties between members of the same tribe, to the exclusion of outsiders, it would naturally become the rule, and then the duty, of the tribesmen to present themselves at recurrent intervals at the sanctuary of their tribal god. As they scattered away from their own settlements, and became travellers or sojourners amongst aliens, the belief that they were in some sense cut off from the protection of their tribal deity, and subjected to the influence of others in whose worship they had no share, would induce visits from a distance to the seat of their own religion, not merely for the purpose of keeping up their tribal relations, but to propitiate a power which perhaps could not hear supplications addressed from a distance, and would in any case be more ready to hear and answer prayers made in his own special shrine, attended with the appropriate rites performed by his own body of ministers. This latter consideration would operate even in the case of cults directed to the Sun-God, the Moon-Goddess, and the planetary bodies, which could hardly be regarded as localized within earthly boundaries, but might well be supposed more placable in shrines of exceptional splendor and sanctity, officered by a trained and numerous priesthood. And wherever it was believed that the deity not merely responded to prayer, but gave direct answers by omen or by oracle to inquirers, the frequentation of the prophetic seat would naturally increase. Further, as the political strength of any tribe grew, that would be attributed in a multitude of cases to the superior power of its tutelary god, or, where they worshipped the same deity as their neighbors, to some more acceptable mode of paying that worship, whence the custom would grow of making the principal temple of the most powerful tribe the meeting-place of the confederacy, as well for political deliberation as for the more directly religious purpose of reaffirming the common pact with sacrificial ceremonies. And if the strongest tribe passed from the stage of hegemony to that of sovereignty, whether by cession or by conquest, so becoming the nucleus of a nation or kingdom, the same feelings would operate yet more powerfully—the subject tribes being either compelled to accept the gods of their conquerors, or voluntarily adopting them from a conviction of their superior might. Certain temples would in this wise become national from having been tribal, and in large empires, such as Egypt and Assyria, would collect worshippers from all the various peoples ruled under a common sceptre. The second stage in the genesis of special sanctuaries is peculiar to religions with a real or supposed historical basis, and takes the form of devotion towards localities which have been the scenes of important events in the lives of personages reverenced in the creeds of those religions. And the third stage, belonging to a much later period than either of the former, when self-consciousness had become more developed, is that where the aim of the pilgrims is primarily subjective, to stir up certain emotions in their own minds, through the means of the associations connected with special localities. But in each and all of these the fundamental underlying thought is the same, the localization of deity, the almost insuperable difficulty which the ideas of omniscience and omnipresence offer to undeveloped intellects.

It will be convenient, in tracing the history of pilgrimages, to begin with those which belong to the various forms of heathenism, ancient and modern, as pertaining, whatever be their actual date, to an earlier stage of mental evolution than the Jewish, Christian, and Mohammedan ones.

Egyptian.

The first pilgrimages, then, of which we have any trustworthy knowledge, are those of ancient Egypt. The mythology of the Egyptians is even yet but imperfectly understood, but it is at any rate clear that, just as the votaries of Vishnu and of Siva keep apart in modern Hindustan, so the chief deities of the Egytian pantheon had cults which were as often rival as complementary, and that the emulation of the competing temples took the form of bidding against each other for popular favor by the splendor of their chief yearly festivals. We are obliged to have recourse to Herodotus and Plutarch for information as to the general cycle of feasts nationally observed; for, although local calendars and rubrics of festivals have been discovered in several places, nothing cognate with Ovid's *Fasti* has yet been found in Egypt. Herodotus notices that, instead of having but one yearly national festival (πανήγυρις), the Egyptians had six, the principal of which was that of Artemis (*i.e.*, Bast or Sekhet) at Bubastis, to which the pilgrims went in boats crowded with both sexes, playing on castanets and flutes, and singing to this accompaniment. They landed at every town along the river to perform orgic dances, and at Bubastis itself offered great sacrifices, besides feasting copiously, in particular consuming vast quantities of grape-wine. He states the numbers assembling on this occasion, exclusive of children, to average 700,000. Next to this ranked the festival of Isis at Busiris, attended with ceremonies of mourning; most probably in memory of the sufferings of Osiris. Third in order was the feast of Athene (Neith) at Sais, celebrated at night, with illuminations. Fourth was the festival of the Sun (Ra) at On or Heliopolis; fifth that at Buto in honor of Latona (Buto or Uat). These two were attended with simply sacrificial rites, and there were no symbolical ceremonies in addition. Last came the festival of Ares (Har-tash, the Hertosi of Cedrenus) at Papremis, at which there was a rough tussle, symbolizing war, between the temple-attendants and the pilgrims, in which lives were sometimes lost. There was another high festival, that of Apis at Memphis, not included by Herodotus in his list, perhaps because not of yearly recurrence, besides the much frequented oracle of Ammon at Thebes, whither it had been transferred from Meroe, its first seat in Egypt. And it is noticeable that there was no pilgrimage at all to the most sacred spot in Egypt, the island of Philæ, the burial-place of Osiris, because its very sanctity made it "tabu" to lay folk. The mysteries, in like manner, being rigidly confined to a few, did not form an occasion of pilgrimage.

Assyrian and Babylonian. As regards the great Mesopotamian empires, our knowledge does not yet enable us to say that pilgrimages entered into their religious system, though we may not unreasonably infer so from the size and wealth of several temples, notably those of Ishtar, from the Assyrian custom of imposing their own deities upon conquered nations, and from the example of one great religious assembly from all the provinces of the Babylonian empire, recorded in Daniel iii. There may, perhaps, be indirect proof of Babylonian pilgrimages in what Cyrus states in his cylinder-inscription, namely, that Nabonidus had offended the gods by transporting their images to Babylon, and thus, as it were, making them perform pilgrimage.

Persians. The ancient Zend creed of the Medes and Persians, having no temples for worship, had no pilgrimages; but in its later Mithraic form, the initiation of neophytes by the Magians into the mysteries, through a painful course of purgation (curiously resembling one prevalent in Ireland far within the present century), in a cavern or grotto at Babylon, necessitated a pilgrimage thither on the part of those who desired to become experts; and Lucian has left some account of its rules in his *Menippus*.[1]

Phœnician. Amongst the Phœnicians there are clear traces of at least two great pilgrimages in honor of Ashtoreth, one to Aphaca (probably the Aphek of Scripture), celebrated for a yearly miracle of a ball of fire appearing on the mountain summit, and thence falling into the sea. The obscene rites for which this temple was infamous led to its destruction by Constantine the Great (Euseb., *Vit. Const.*, iii. 56). **Syrian.** The other great Ashtoreth pilgrimage was to Hierapolis in Syria, frequented by votaries from all the Semitic races except the Jews. Antioch was also a great centre of this cult, as also of that of Thammuz, but, strictly speaking, there is no proof of a Thammuz pilgrimage, nor of one in honor of Melkarth, though his worship was carried from Tyre, its chief seat, into all the Phœnician colonies, and the famous oracle of his temple at Gades drew crowds of inquirers annually. In Palestine proper, though the cults of Baal, Ashtoreth, Moloch, Dagon, and Beelzebub were widespread and persistent, and though the name Jericho probably, and Ashtaroth-Karnaim certainly, point to a seat of moon-worship, as Bethshemesh does to one of sun-worship, there is no direct evidence of organized pilgrimages to these places.

Greek. In ancient Hellas there were four classes of religious observance more or less cognate with pilgrimage, though not in any case identical therewith. First may be placed the consultation of oracles,—those of Apollo at Delphi, of Zeus at Dodona, of Trophonius at Lebadeia, and of Asclepius at Epidaurus (the last of which was resorted to also for the cure of disease) being the most famous and most frequented, while, outside Greece and its colonies, the oracle of the Libyan Ammon in the desert south of Cyrene was also in much esteem. Next come the four great national festivals and games, the Olympic, Pythian, Nemean, and Isthmian, attended by crowds from all Greek states, not only as attractive shows, but as religious ceremonies.[2] Thirdly may be named the more local or tribal festivals, such as the Panathenæa, the feast of the Charites at Orchomenus, that of Hera at Samos, of Aphrodite at Paphos, and of Artemis at Ephesus, which drew together many worshippers besides those who were especially bound to visit the shrines in question. But the closest parallel to the Christian theory of pilgrimage is found in the celebration of the Eleusinian mysteries (see MYSTERIES), the special likeness of which to pilgrimages of a later day lies in the notion of merit and spiritual benefit attached to initiation, to the belief that happiness in a future state of existence would be promoted, nay, insured, by admission to the ranks of the mystæ.

Roman. The Latin customs bear a certain superficial likeness to the Greek, in that local oracles, such as those of Faunus, of Albunea, of Fortuna, and of the Sibyls, were much frequented; there are traces of great tribal sanctuaries and gatherings, such as the worship of Jupiter Latiaris on the Alban Mount, of more narrowly restricted tribal cults, such as the Julian worship of Vejovis at Bovillæ and the Fabian sacrifice to Hercules on the Quirinal, and of at least two temples to which regular pilgrimages seem to have been made—those of Juno Sospita at Lanuvium, and of Vesta (perhaps of all the Penates also) at Lavinium. But, apart from racial and theosophic differences of belief, there was one factor at work in Italy which tended to bring about a wholly different character of popular religion from that which was evolved in Hellas—the overmastering centralization of Rome, and the practical identification of all solemn worship (apart from the rustic ceremonies in honor of minor and little-known deities) with the apotheosis of the Republic. Hence, after the chief seat of Roman worship was transferred from the Regia to the Capitol, pilgrimage proper disappeared, for the local gods of each newly absorbed city or state were added to the original triad of Roman gods, and to the other Sabine triad, moved from the Quirinal to the new sanctuary, and it becomes impossible to distinguish clearly between the purely political ceremonies performed in honor of gods viewed primarily as the tutelars of Rome, and voluntary resort to the great temple for the personal cult of any particular deity enshrined there. One relic of the older custom seems to have survived till later times, namely, the pilgrimage of Roman women barefoot to the temple of Vesta in the Forum on June 9 every year.

Teutonic and Slavonic. No pilgrimages seem to have been usual in the Teutonic and Slavonic religions, though both had special temples regarded as more sacred than the remainder, and in the case of the latter we know with tolerable accuracy that Kieff, Novgorod, Rethra in Mecklenburg, Karenz, Winneta or Julin (isle of Wollin), Stettin, and lastly Arkona in the isle of Rügen, succeeded one another as the chief seat of the worship of Perun, Lada, Bielbog, and other principal Slavic deities, and were necessarily attended by much larger bodies of worshippers than temples of less account, more thinly officered, and inferior in repute for the learning and prophetic powers of their priests.

Mexican. Directing our attention to an entirely different region of the world, we learn that in 1519, when Cortes entered Cholula, in Mexico, he found it a great resort of pilgrims to the huge temple of Quetzalcoatl, then of unknown antiquity, as founded by a race earlier than the Aztecs, and built upon a colossal mound, vying in dimensions with the largest pyramids of Egypt. And what is yet more curious, besides this principal shrine, there were subsidiary tribal temples in the city, restricted to the uses of the several allied or kindred nations, who desired to have their own sanctuary in the holy city, precisely as churches of different nationalities are found in Jerusalem and in Rome to-day. **Peruvian.** And similarly in Peru, the great Temple of the Sun at Cuzco, with its encircling girdle of chapels dedicated to minor deities, was visited by pilgrims from all parts of the empire; nay, it was even regarded as a misfortune to fail in accomplishing the journey.

Indian. India, however, is above all others the land of pilgrimages, for it has observed them during a longer unbroken period than any other country of which we possess sufficient records, and for frequency and multitude it would be difficult to find any parallel. The most celebrated of them are those to the temple of Jagan-nâth, at Puri in Orissa, Benares, Hurdwar, Ganga-Sagara, Gangotri, Jumnotri, Prayâga (Allahabad), Râmêswara, Gaya in Behar, and Ayodhya or Oudh. Apart from the motives, common to all pilgrims, of acquiring religious merit or expiating sins, these Indian shrines are frequented for the performance of *sraddha* ceremonies in honor of deceased ancestors or as votive acts for the recovery of the sick, or, again, to carry the ashes of deceased kindred to be scattered in the waters of some sacred or purifying river. Every great river in India, with some lakes, tanks, and springs, is regarded as permeated with the divine essence, and as capable of cleansing from all sin. Hence the favorite resorts are river sources and confluences, while Benares, as situated on the Ganges itself, is the holiest spot in Hindustan. The other most frequented shrines are usually associated with the cults of Krishna, Siva, and Râma. All these are exclusively connected with Brahman rites, for the entire extirpation of Buddhism from the Hindu peninsula has prevented any special sacredness from continuing to attach to the scenes of Gautama Buddha's life (though the Buddhists allege that the sanctity of Benares is due to its having been the residence of Buddha himself, and the scene of his earliest preachings); and it is in Ceylon only that two Indo-Buddhist pilgrimages survive,—that of Adam's Peak, and the yet more popular one to the temple of Kandy, where the *Dalada Malagawa*, or tooth of Buddha, is an object of special veneration. For northern Buddhism the chief shrines are Lhassa in Tibet, the seat of the Dalai Lama, and Urga in northern Mongolia, the seat of the Tesho-Lama or Bogdo-Lama.[1] Before the Brahman revolution, which drove Buddhism out of India, pilgrimages to the chief scenes of Gautama Buddha's life were common; and notably Kapilavastu, his birthplace, Benares, where he began his mission, and Kasinagara, where he died, were much frequented, especially by Chinese converts. The narratives of some of these, Fa Hian, Hwai-Seng, and Sung-yun, and Hwen-T'sang, the most noteworthy of them all (see vol. xii. p. 434), who came to visit the holy places and to collect the sacred books, are still extant.

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[1] This is probably the source of the Moslem legend of Harût and Marût, the fallen angels chained in a cavern at Babylon, who will teach magic to such as consult them in a prescribed manner.

[2] The Panhellenic festival at Ægina is omitted, as a mere factitious device of the emperor Hadrian, when classical paganism was dying, and not a real Greek custom.

Chinese.

In China pilgrimages are made to several of the more sacred spots both by Buddhists and Confucianists. Wutai-shan, in Shan-si, is the chief resort of Buddhist pilgrims, and Tai-shan, the mountain sacred to Confucius, that of Confucianists (Williamson, *Journeys in North China*).

Japanese.

In Japan both the older Shintô nature-worship and the newer Buddhist creed have their several sanctuaries and pilgrimages. The principal Shintô pilgrimages are those to Isé in the department of Watarai, and to the sacred mountain Fuji. There are two temples at Isé, ranking in sanctity first of all Shintô shrines, and the special seat of the worship of Ten-shôkô-daigin, the Sun-Goddess, from whom the Mikado is held to descend. Two great festivals are held yearly at Isé, in the sixth and twelfth months, and are known as *O-barai no matsuri*, "great purification feast," being held to effect the purifying of the whole nation from the sins of the previous half year. Tickets inscribed with the names of the gods of Isé, and especially that of the Sun-Goddess, are issued at the temples and their agencies (being formerly sold by hawkers corresponding to the pardoners of mediæval Europe), and are carefully preserved in the domestic shrine of Japanese houses, being supposed to avert all peril for six months, but requiring renewal at the end of that period. The pilgrims to Isé number many thousands yearly, and are known as they return by bundles of charms wrapped in oiled paper, and hanging from the neck by a string. The pilgrimage to Fuji takes place in summer, and the pilgrims go clad in white, and carrying bells. They ascend the mountain so as to reach the summit before sunrise, when they turn to the east, clap their hands, and chant a hymn to the Sun-Goddess. There are also many local Shintô pilgrimages of less note. Buddhism in Japan is broken up into several sects, having each of them their own pilgrimages; but the most frequented are those of the god Fudo at Narita and the sacred mountain of Oyama, each some thirty miles distant from Tokio. These both belong to the Shingou sect, the earliest introduced into Japan. The Hokke or Nichiren sect make pilgrimages to the monastery of Ikegami, near Tokio, and to that at Mount Minobu, about 100 miles to the west, between which two shrines the relics of the founder are divided. Ninety miles North of Tokio are the shrines of Mount Nikko, also a great Buddhist pilgrimage, where the shoguns are buried, and where the founder of the Tokugawa dynasty is worshipped under the name of Gongen.

So much will suffice to have said concerning the various heathen pilgrimages, and we may now consider those of the Hebrew religion and its two derivatives, Islam and Christianity.

Jewish.

The legislation of the Pentateuch is precise in making resort to one central shrine a positive and fundamental precept, binding on the whole nation, obviously with the double object of cementing national unity and of guarding against the erection of local sanctuaries, which were liable to be diverted to idolatrous cults (see PENTATEUCH). Under the judges and the kings we find many traces of pilgrimage, not only to the sanctuary of the ark at Shiloh, and afterwards to Jerusalem, but to local high places, such as Ophrah, Mizpeh, Dan, Bethel, and Beersheba. In truth, it is not till the post-exilic period that the supremacy of one national sanctuary is assured (though a pilgrimage even after the destruction of the temple is recorded in Jeremiah xli. 5, showing that the mere site was held sacred), for the local devotion of the high places resisted all the efforts of the reforming party under Hezekiah and Josiah even in the kingdom of Judah itself. Since the final overthrow of the Jewish polity by Titus and Hadrian, no effort has been made either to establish a centre of sacrificial worship anywhere outside Palestine (as in the curious episode of the temple of Heliopolis in Egypt), or to revive it in Jerusalem itself, where, even now, the synagogues and colleges of the Sephardim and Ashkenazim are entirely separate and independent organizations, and show no tendency to coalesce into the nucleus of a national system. Hence, as the political and religious motives for the pilgrimage to Jerusalem have both dropped into abeyance, the custom itself is no longer regarded as binding, and, though it is not obsolete, inasmuch as a visit to the Holy City is considered a meritorious act, yet it has now, like the pilgrimage to Hebron, more of an emotional and historical character than a ceremonial one, so that it is not in the strict sense a pilgrimage any longer.

Mohammedan.

Although the Mohammedan pilgrimages are much later in chronological order than the Christian ones, it will be more convenient to consider them briefly first. They consist, then, of two main classes, which may be distinguished conveniently by Latin theological terms, as those of "obligation" and those of "devotion." There is properly only one Moslem pilgrimage of obligation, that to Mecca, which still often draws an annual contingent of from 70,000 to 80,000 pilgrims (see MECCA). It is in truth a pagan survival which proved too powerful for extirpation by Mohammed. The Kaaba had been constituted the national sanctuary of Arabia about 100 B.C., and contained, besides the famous Black Stone, some three hundred and sixty idols of various Bedouin tribes, united in one pantheon, exactly as with the

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[1] [According to A. H. Keane's *Asia* (London, 1882), p. 581, the Tesho-Lamaship has its seat at Teshu-lumbo, a place near Shigatse in Tibet. The incarnation at Urga in Mongolia is a third and distinct one, called the Khutuktu.—AM. ED.]

Capitol of Rome; and, though it was possible to sweep the idols out of the Kaaba, it was not so easy to deconsecrate the spot, but far more convenient to give it a new sanction.

The Mohammedan pilgrimages of devotion are very numerous, and are chiefly connected with the saint-worship which has overlaid and obscured the original strict monotheism of Islam. Chief amongst the sacred shrines of this second class stands the tomb of Mohammed at MEDINA (*q.v.*), but, holy as it is considered, and meritorious as a visit to it is accounted, it is in no sense binding on a Moslem's conscience, and only about one-third of the Meccan pilgrims proceed thither. Other sanctuaries abound in all Mohammedan countries, of which a few, like Abraham's tomb at Hebron, are honored by all Mohammedan sects, while others are peculiar to the Sunnites and Shiites respectively, and others again, such as Kairwân in Tunis, and Wazan in Morocco, and still more the tombs and oratories of merely local saints or *welis*, found in almost every Moslem town or village, are restricted to a comparatively small body of votaries. The most famous, after the Pan-Islamic pilgrimages, are the great Shiite sanctuaries, of which there are three: Meshed in Khorásán, with the tomb and mosque of Imam Riza, said to attract almost as many yearly pilgrims as Mecca itself; Khoum in Irak Ajemi, where Fatima, wife of Imam Riza, is buried; and, yet more sacred than either, Kerbela in Mesopotamia, in the Turkish dominions, about 28 miles northwest of the ruins of Babylon, where is the tomb and mosque of Imam Hosein, grandson of Mohammed (see KERBELA and MOHAMMEDANISM). There is a passion-play performed there at the yearly commemoration, which draws enormous crowds from all parts of Persia and other Shiite regions, and the title hâjj attaches to all who make the journey. Some idea of the multiplicity of minor pilgrimages amongst Moslems may be gathered from the fact that in the city of Damascus alone there are one hundred and ninety-four places of resort by pilgrims, and fourteen more in the environs. A great reaction against the whole system, inclusive of the invocation of saints, took place under the Wahhabis in the last century, in the course of which countless *welis* or tombs of Moslem saints were destroyed, including even those of Hosein and Mohammed himself; but on the overthrow of the fanatics by Mohammed Ali, the customary practices were restored and have continued in full vigor ever since.

Christian.

Christian pilgrimages were at first limited to Jerusalem and its immediate neighborhood, including Bethlehem. It is probable enough that the local church of Jerusalem regarded the various scenes of the gospel history, and notably of the Passion and Resurrection, with special reverence, and would guide the steps of visitors to the most sacred localities while the city yet stood, and point out the sites, as nearly as possible, after the work of Titus had been completed by Hadrian, and a vast mound of earth, on whose summit rose a temple of Venus, had been raised over the Holy Sepulchre. But this is matter of conjecture rather than of knowledge. There is no actual proof of very early Christian pilgrimage to the holy places, though the belief was already current at the close of the 4th century that the custom had prevailed unbroken from apostolic times, as is distinctly asserted by Paula and Eustochium in their letter to Marcella (*Epist. Hieronym.*, xvii.), written in 386, wherein they state also that of which they are more trustworthy witnesses, that pilgrims then flocked from Armenia, Persia, India, Ethiopia, and even Gaul and Britain, to visit the cradle of Christianity. But in point of fact the earliest pilgrim of whose visit as a religious act we have definite proof is Alexander, a Cappadocian bishop, who came to Jerusalem in consequence of a dream (212), and was elected coadjutor to Narcissus, then bishop of the diocese (Euseb., *E. H.*, vi. 11). Origen, who was a friend of Alexander, is another early example, but his own words (*Comm. in Evang. Joann.*, vi. § 24) imply that he came rather in the modern spirit of devout scholarly inquiry than as a pilgrim in the strict sense. He paid a short visit in 216 and returned in 231, to settle down for a time at Cæsarea, where he opened a school of theology in 238. It is not till after the pilgrimage of the empress Helena (the first quite unquestionable event of the kind) about 326 or 328, that the fashion set in, accompanied with the desire to bring back some relic, either inherently sacred or at least hallowed by contact with certain venerated spots. That the temper of the time was not a very critical one is sufficiently proved by the casual mention by St. Chrysostom of a pilgrimage as commonly practiced to Arabia in order to see the dunghill on which Job sat, and that by visitors from the very ends of the earth (*Hom.* v. *de Statuis*).

But another kind of pilgrimage, destined to be more powerful than that to Jerusalem, began to be popular nearly at the same time, that to the tombs of distinguished martyrs or confessors. In the present day the passionate admiration of the Christians of the 3d, 4th, and 5th centuries for the martyrs as a class seems somewhat disproportioned to the part they actually played in the history of Christianity, which was more effectually propagated and maintained by the eminent teachers and divines of the ancient church. But the truth is that they supplied just the element of enthusiasm which was needed to sustain the courage and endurance of the humbler Christian laity under the stress of recurrent persecutions; and, when peace was finally secured under Constantine the Great, there were so many families which counted one or more martyrs amongst their kindred, and viewed such kinship as a patent of nobility, that everything favored the rapid development of pilgrimages to places in which so many had a direct personal, as well as a corporate religious, interest. So much did the notion begin to prevail that pilgrimage was almost a necessity of religion and that prayer could be heard more assuredly in particular places, that warnings against error of the kind were uttered by teachers whose own acts had helped to propagate the opinion in question. Thus, only a few years after the letter above cited, urging Marcella to migrate to Bethlehem, St. Jerome writes to Paulinus (393) pointing out that many of the most celebrated saints and ascetics had never visited the holy places, that heaven is just as open from Britain as from Jerusalem, and that the circumstances of life in Jerusalem itself were far from helpful to devotion. But his own abode at Bethlehem, the celebrity of the religious houses he founded and directed there, and the unlike tenor of other letters he wrote, entirely counteracted this advice. St. Chrysostom at one time speaks of the needlessness of pilgrimage (*Hom.* i. *in Philem.*; *Hom.* iii. and iv. *ad pop. Antioch.*), and at another expresses his own wish to see the relics of St. Paul at Rome (*Hom.* xxxii. *in Rom.* ii., iii.; *Hom.* viii. *in Eph.* ii.). So, too, St. Augustine contributed powerfully to promote pilgrimages to the shrines of saints by sending in 404 two clerical disputants to the shrine of St. Felix of Nola, in the hope that some miracle would be worked there to decide the matter, though no such signs had been granted at the grave of any African saint (*Ep.* lxxviii.). And in another place he attests the working of many miracles by the relics of the protomartyr St. Stephen in various African towns where portions of them had been shrined (*De Civ. Dei*, xxii. 8). Nevertheless, in yet a third place he appears to condemn this very temper as mere superstition, stating that while he knows many professing Christians who are worshippers of tombs and pictures, "the church condemns them and daily strives to correct them as evil children" (*De Mor. Eccl. Cath.*, xxxiv. 75, 76).

Here, too, example proved stronger than precept, and the only unqualified opposition to the popular tendency which issued from any quite unimpeachable source (for Vigilantius and Jovinian cannot be fairly cited) is the remarkable letter of St. Gregory of Nyssa to a friend, on the subject of pilgrimages to Jerusalem, the heads of which are as under: there is no divine precept for the usage; the moral dangers of the journey, from bad companions and from the quality of the inns, are great, especially to women, and above all to nuns; the immorality and irreligion of Jerusalem itself are gross and notorious. True, he had gone thither himself, but it was on public ecclesiastical business connected with the Arabian Church, and he had travelled in a public vehicle with a company of monks. He did not find his faith stimulated or improved in any way by a sight of the scenes of the gospel history, and he recommends others to stay at home, assuring them that no spiritual benefit is lost by so doing, and no spiritual gain acquired by visiting the most sacred places without inward amendment (*Epist.* ii.). The authenticity of this epistle has been challenged, but on no sufficient grounds.

What makes the devotion to the tombs of saints such a powerful factor in ecclesiastical history is that, after the Holy Sepulchre itself, no grave had such a hold on Christian imagination as that where the bodies of the two chief apostles, St. Peter and St. Paul, were held to rest in Rome. And consequently, as the division of the empire lessened the intercourse between East and West, as the decay of the old lines of communication made travelling more difficult, and as the advance of Mohammedanism in Syria and Palestine made it more dangerous also in that direction, Rome gradually supplanted Jerusalem to a great degree in the West as the goal of pilgrimage, and the enthusiasm of the visitors did much to consolidate the papal monarchy over Latin Christendom. So markedly did this new influence prevail that it has left its trace in more than one European language. The Low Latin *romerius*, *romipeta* for a pilgrim anywhither, *romeria*, *romipetagium* for the actual pilgrimage, the obsolete French *romieu*, *romipète*, *romivage*, the still current Spanish *romero*, *romeria*, and Portuguese *romeiro*, *romaria*, the Italian forename *Romeo*, and the English *romare* (*Piers Plowman*) attest the celebrity and popularity of this pilgrimage, into which soon entered such further ideas as the desirability of confessing sins to the pope personally and obtaining absolution from him, the reference of private cases to papal arbitration on the part of bishops and other ecclesiastical judges, and the injunction of the journey as in itself a penance, a notion prevalent in the Gallic churches as early as the close of the 5th century (Cæsar. Arelat., *Hom.* iii.). Nowhere was the pilgrimage to Rome more popular than in Saxon England, and amongst the crowds of penitents who made the journey were four kings, Ceadwalla, Ine, Coinred, and Offa, all of whom died in Rome, two of them as monks (Beda, *H. E.*, v. 7, 19). There were not wanting efforts to check the movement. Apart from the theological objections raised by Claudius of Turin, there is a letter extant from Boniface of Mainz, an Englishman born, to Cuthbert, archbishop of Canterbury, written about 743, begging him to get a canon enacted to forbid the pilgrimage to Rome, especially to nuns, on the ground of the moral perils of the road, stating that no city of France, Lombardy, or Italy was without Englishwomen leading depraved lives, whose virtue had fallen during pilgrimage. And the council of Chalons, in 813, enacted a canon to check pilgrimages both to Rome and to the shrine of St. Martin at Tours (then the most famous sanctuary in France), on the ground of serious abuses on the part of both clergy and laity; and the council of Seligenstadt made a like effort in 1022. But even the robber barons who looked on pilgrims as their natural prey could not arrest the movement (which was specially stimulated, as we learn from Radulphus Glaber, in 999 and 1000 by the belief that the end of the world was at hand), and the Roman pilgrimage reached its height in the Middle Ages through the institution of the Jubilee, or plenary indulgence to pilgrims, by Boniface VIII. in 1300, when 200,000 are said to have availed themselves of it, and smaller but still considerable numbers on its various repetitions at irregular intervals since. The pilgrimage to Jerusalem received fresh stimulus in the 9th century by the first occurrence of the alleged miracle of the heavenly fire on Easter Eve at the Holy Sepulchre, and continued to be frequented till checked by the fanaticism of the caliph Hakem-Biamr'illah about 1018, and more severely and permanently by the Seljukian Turks on their conquest of Syria, which occasioned those armed pilgrimages, the crusades, to whose history this branch of the subject thenceforward belongs. Meanwhile, a third class of sanctuaries had been steadily coming into notice and popularity, consisting neither of the seats of great historical events nor of the ascertained resting-places of eminent saints. These were the purely legendary shrines, the sites of some alleged vision, of the supernatural discovery of hidden relics, or of the presence of a wonder-working image or picture. One of the earliest and most famous of these was that of Compostella, where the relics of St. James the Great were said to be discovered in 816, and, after being again hidden for many centuries, to have been discovered afresh in 1884. This was one of those most frequented by English pilgrims, no fewer than 2460 licenses being granted for the journey in the one year 1434 (Rymer, *Fœd.* xi.).[1] Another, which became the Bethlehem of the West, as Rome had become its Jerusalem, was Loreto, where, ever since 1295, the Santa Casa, declared to be the home of the Holy Family, miraculously transported from Nazareth, has been frequented by pilgrims till very recent times, when its popularity has waned. Other famous shrines, some few of which even still attract yearly crowds of pilgrims, are Einsiedeln in Switzerland; Assisi, Oropa, Varese and Vicovaro in Italy; Monserrat and Guadalupe in Spain; Mariazell in Austria; Oetting and Eberhardsclausen in Germany; Walsingham, Becket's shrine at Canterbury, Peterborough, St. Davids, and Holywell in England and Wales; St. Andrews in Scotland; Chartres, Notre Dame de Liesse, Notre Dame de Rocamadour, and Notre Dame des Victoires, with Ste. Anne d'Auray in Britanny, in France; and Hal in Belgium. Devotion to these shrines was encouraged and developed by copious indulgences annexed to them; but this system in the long run became adverse to pilgrimages, because exactly the same privileges were annexed at a later time to acts much more easy of performance. Thus, the wearers of the cord of St. Francis, every time of reciting certain brief prayers, acquire all the indulgences attached to the holy places of Palestine, Rome, Assisi, and so forth, and have naturally little inducement to perform toilsome and costly journeys thither.

There is a further small class of pilgrimages, differing from all others in being neither permanent nor yearly, but periodical at various long intervals. They are usually connected with the exposition of the principal relic or relics in some important church, an event which rarely occurs. Such are the pilgrimages of Cologne, to the shrine of the Three Kings, and that of Treves, where the alleged seamless coat of Christ has been displayed for popular devotion, and has been visited by vast crowds of pilgrims.

Pilgrims in the Middle Ages were known by a peculiar garb and various badges, the hood and cape, the staff and scrip and water-bottle, and the low-crowned hat, turned up in front, and fastened with strings, being common to all, while the palm specially marked a pilgrim from the Holy Land; a shell, one from Compostella; a bottle or bell, one from Canterbury, and so forth. They had many privileges and advantages. They were exempt from toll, their persons were inviolable, and any injury done to them incurred the penalty of excommunication; they were entitled to shelter, fire, and water in all convents on their road, and the needier ones to food in addition; and there were resting-stations erected for them on all the great lines of travel, sustained sometimes by voluntary offerings, and sometimes by public imposts; while in Rome, above all, institutions for their reception and relief were established early, and are still in active operation.[1] Nevertheless they declined in repute, not only by reason of the feigned devotees who joined them for purposes of vagrancy and mendicancy, and even from worse motives, but because many notorious criminals were customarily sent on pilgrimage as a punishment, with no care to isolate them from their innocent companions. The general charge of moral deterioration as a result of pilgrimage, which recurs from the fourth century onwards, is specifically brought by Langland in respect of truthfulness:

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[1] This concourse of English pilgrims was soon looked on in France as politically dangerous, so that in the 14th century, when Pedro the Cruel was dethroned by Henry of Trastamara, the latter was compelled by his allies to refuse entrance into Spain to all pilgrims who had not license of transit from the king of France. This kind of jealousy lasted very long, for there are edicts of Louis XIV. and XV. forbidding foreign pilgrimage to French subjects without the written permission of their bishop, and the counter-signature of a state official, under pain of the galleys for life. They bear date 1671, 1686, and 1738.

> "Pilgrims and palmeres plighten hem togidere,
> For to seken seint Jame and seintes at Rome.
> They wenten forth in hire wey, with many wise tales,
> And hadden leve to lyen all hire lif after."
> —(*Vision of Piers Plowman*, pass. i. line 82).

Hence pilgrimages were attacked with the weapons of ridicule, and the most celebrated satires upon them are the chapter in *Reineke Fuchs*, describing Reynard's adventures as a pilgrim, and the yet wittier squib of Erasmus, *Peregrinatio religionis ergo*, in which he gives a sarcastic account of the pilgrimage to Walsingham, which had much to do with destroying the prestige of not only that particular one, but most others also. The French Revolution all but completed the work of the Reformation in causing pilgrimages to decline seriously, where they were not entirely abolished, in the West, though they were still able to maintain their ground in retired and unchanging places such as Britanny, various places in central Italy, and in Ireland, where the severely penitential pilgrimages of Lough Finn, Lough Dearg, and Croagh Patrick are not yet obsolete. There was a remarkable recrudescence of the spirit of pilgrimage under the pontificate of Pius IX., notably to the new sanctuaries of La Salette and Lourdes in France, which reached its height about 1872–73, but has shown signs of subsiding again since.

In the Eastern Church, pilgrimages have not for many centuries formed so important a part of popular religion as in Latin Christendom, and the number of frequented shrines is very small. In the Greek Church properly so called, Mount Athos, with its numerous monasteries, where the great yearly gathering is on the feast of the Transfiguration, ranks next to the visit to the Jordan (Tozer, *Highlands of Turkey*, i. 103). After Mount Athos comes a shrine in the island of Tenos, where, in the cathedral church of the Panagia Evangelistria, is preserved an icon of the Madonna, alleged to be wonder-working, and said to have been discovered by means of a dream in 1824; the annual concourse of pilgrims twice a year, on the feasts of the Annunciation and the Assumption, is very great. Three alleged pictures of the Blessed Virgin by St. Luke—at Megaspelion, at Sumelas in the mountains behind Trebizond, and at Stiri in Mount Helicon—are also much visited. Etchmiadzin is the chief Armenian pilgrimage, besides which are those of Kaisariyeh and Mush (Tozer, *Turkish Armenia*, pp. 161, 271). And finally, the chief Russian pilgrimages are to the Petcherskoilavra at Kieff (said to be visited by 200,000 pilgrims yearly), the Solovetsk monastery near Archangel, and the Troitsa, close to Moscow, besides many more locally popular shrines. (R. F. L.)

PILLORY. This was a mode of punishment by public exposure of the offender on a platform or scaffold long used in most countries of Europe, originating probably with the Anglo-Saxons, one of whose methods of punishment as described by Strutt is nearly identical with the instrument which eventually became known as the pillory. The etymology is not quite clearly made out. It is most probably connected with *pillar*, Fr. *pilier*, M. H. German *Pfilaere*, but there are forms with an initial *s* (Prov. *espitlori*, Low Lat. *spilorium*) which this derivation does not explain. The more usual French term is not *pilori* but *le carcan*. The Germans have *Preller*. *Healsfang* or *halsfang* (Anglo-Saxon for a catching of the neck) was the old English name. The word was also sometimes applied to the pecuniary mulct paid in commutation of the punishment. No punishment has been inflicted in so many different ways as that of the pillory. Sometimes the machine was constructed so that several criminals might be pilloried at the same time, but it was commonly capable of holding only one. Douce (*Illustrations of Shakespeare*) gives six representations of distinct varieties of this instrument. In Griffiths (*Chron. of Newgate*) and in a learned and exhaustive account of the pillory by Jewitt (*Reliquary*, April, 1861), examples will also be found, and notably of the pillory for women, which differed in form from that in use for male offenders. It would appear that it had not always been customary to subject women to this form of punishment; for them the thew or the tumbrel, which latter was probably the same as the ducking or cucking stool often spoken of in the early English laws in conjunction with the pillory, was reserved. These varieties are all reducible, however, to the simplest form of the pillory as ordinarily known, which consisted of a wooden post and frame fixed on a platform raised several feet from the ground, behind which the culprit stood, his head and his hands being thrust through holes in the frame so as to be exposed in front of it. This frame in the more complicated forms of the instrument consisted of a perforated iron circle or carcan (hence the French name), which secured the heads and hands of several persons at the same time.

In the statutes of Edward I. it is enacted that every pillory or stretch-neck should be made of convenient strength so that execution might be done on offenders without peril of their bodies. It was customary to shave their heads wholly or partially and the beards of men, and to cut off the hair and even in extreme cases to shave the heads of female culprits. Some of the offences punished in England by the pillory will be found enumerated in the statute 51 Hen. III. c. 6 (1266), comprehending chiefly indictable offences not amounting to felony (commonly called misdemeanors), such as forestalling and regrating, using deceitful weights and measures, perjury or subornation of perjury, libel, seditious writings, etc. Later on, the punishment of the pillory was ordained for courtesans, common scolds, and brawlers and other like delinquents both male and female, and in the later years of its existence, notably during the 17th and 18th centuries, it was much resorted to as a punishment for political offenders, who on some occasions experienced the roughest treatment at the hands of the mob, ill-usage resulting in some instances on record even in death. The intention of setting a criminal in the pillory was that he should become infamous and known as such afterwards by the spectators. Examples have not been wanting, however, in which much sympathy has been both felt and expressed by the populace for the individual subjected to this punishment. The duration of the punishment was usually assigned at the discretion of the judge who passed the sentence, though sometimes it was fixed by law. The form of the judgment was that the defendant should "be set *in* and *upon* the pillory"; he was consequently said to stand *in* the pillory, not *at* it.

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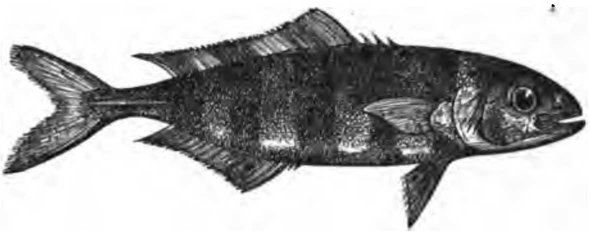
[1] For more details see Mr. Scudamore's articles, "Holy Places" and "Pilgrimages," in Smith's *Dictionary of Christian Antiquities*.

The pillory was abolished in Britain, so far as related to all offences save perjury and subornation, in 1816 (56 Geo. III. c. 138), and finally altogether by statute 7 Will. IV. and 1 Vict. c. 23 in 1837. In the former Act power had been reserved to the court to pass sentence of fine or imprisonment or both in lieu of the pillory. The punishment was done away with in France in 1832 upon the revision of the penal code, and has now indeed been withdrawn from most of the modern systems of penal law.

PILOT. The English Merchant Shipping Act of 1854 (17 & 18 Vict. c. 104) defines a pilot as being a person duly licensed by any pilotage authority to conduct ships to which he does not belong as one of the crew. Pilots are in fact taken on board to superintend the steering of the vessel, where the navigation is difficult and dangerous, in consequence of their special knowledge of particular waters; and it is to this class alone that the term now applies, whereas in early times the pilot was the steersman, or the individual who conducted the navigation of a ship across the ocean and out of sight of land. The word seems to be of Dutch origin, and to mean primarily a person who conducts a ship by the sounding line (*peillood*). Cowell (*Law Dict.*), describing *lodemanage*, speaks of it as the hire of a pilot for conducting a vessel from one place to another,—a *lodesman* (Ang. Sax. *lád-man*, a leader) being a pilot for harbor and river duty. During the period of his charge the whole responsibility of the safe conduct of the vessel devolves upon the pilot. Most systems of maritime law have made the employment of pilots compulsory, though this does not usually apply to ships of war. One effect of neglect or refusal on the part of the master of a ship to take a pilot is to discharge the insurers from their liability.[1] Excepting under extraordinary circumstances (such as where it is evident that he is acting rashly or is intoxicated, or is palpably incompetent) a master would not be justified in interfering with the pilot in his proper vocation. In England, societies or corporations have long been established for the appointment and control of pilots in particular localities; and of these the Trinity House, London, owing to the number of the pilots under its control, and the large extent of its jurisdiction, may be deemed the principal. The laws relating to pilotage were consolidated by 48 Geo. III. c. 104 (1808), which was amended by 6 Geo. IV. c. 125 (1825); further regulations were made by 16 & 17 Vict. c. 129 (1853), which incorporated the Cinque Ports with the Trinity House pilots; and all existing regulations on the subject were embodied in the Merchant Shipping Act 17 & 18 Vict. c. 104 (1854), already referred to, from which pilotage authorities within the United Kingdom derive their jurisdiction, and which regulates their powers, the licensing of pilots and their rights, privileges, liabilities, and remuneration (Maude and Pollock, *Law of Merchant Shipping*, 1861).

The laws of pilotage in the United States are regulated by the individual States according to the Acts of Congress.



Pilot-Fish.

PILOT-FISH (*Naucrates ductor*), a pelagic fish of the family of Horse-Mackerels, well known to sailors from its peculiar habit of keeping company with ships and large fishes, especially sharks. It occurs in all tropical and sub-tropical seas, and is common in the Mediterranean, but becomes scarcer in higher latitudes. In summer pilots will follow ships as far north as the south coast of England into port, where they are generally speedily caught. This habit was known to the ancients, who describe the *Pompilus* as a fish which points out the way to dubious or embarrassed sailors, and by its sudden disappearance indicates to them the vicinity of land; the ancient seamen of the Mediterranean regarded it therefore as a sacred fish. That the pilot follows sharks is an observation of much later date, which first appears in works of travel of the 17th century, the writers asserting that the shark never seizes the pilot-fish, and that the latter is of great use to its big companion in conducting it and showing it the way to its food. It is, however, extremely doubtful whether the pilot's connection with a shark serves a more special purpose than its temporary attachment to a ship. It accompanies both on account of the supply of food which it derives from them, picking up the crustaceans, cirripeds, or other marine animals swarming about the ship's bottom or parasitic on the shark, offal thrown overboard, or smaller pieces of flesh which are left unnoticed by the shark when it tears its prey. The pilot, therefore, stands to both in the relation of a so-called "commensal," like the *Echeneis* or sucking-fish, whose habits are in some respects identical with those of the pilot, and which is frequently found associated with it. All observers, however, agree that neither the pilot nor the sucker is ever attacked by the shark. The pilot attains to a length of about 12 inches. In the shape of its body it resembles a mackerel, but is rather shorter, especially in the head, and covered with small scales. A sharp keel runs along the middle of each side of the tail. The first dorsal fin consists of a few short spines not connected by a membrane; the second dorsal and the anal are composed of numerous rays. The teeth, which occupy the jaws, vomer, and palatine bones, are all small, in villiform bands. The coloration of the pilot renders it conspicuous at a distance; on a bluish ground-color from five to seven dark-blue or violet cross-bands traverse the body from the back to the belly. The pilot-fish spawns in the open sea, and its fry is constantly caught in the tow-net. But young pilot-fish differ considerably from the adult, having the spines of the first dorsal connected by a membrane, and some bones of the head armed with projecting spines. These little fishes were therefore long considered to be a distinct genus, *Nauclerus*.

PILPAY. See BIDPAI, vol. iii. p. 576.

PILSEN, the second town of Bohemia, lies at the confluence of the Radbusa and the Mies, 50 miles to the southwest of Prague. It consists of the town proper, which is regularly built and surrounded with promenades on the site of the old ramparts, and of three suburbs. The most prominent buildings are the Gothic church of St. Bartholomew, said to date from 1292; the Renaissance town-house, containing an interesting armory; the new real school; and the German and Bohemian theatres. The staple article of manufacture and commerce is beer, of which about 6,000,000 gallons are brewed here annually. Other industrial products are machinery, enamelled tinware, leather, alum, paper, earthenware, stoves, and spirits, while a tolerably brisk trade is carried on in wool, feathers, cattle, and horses. In the neighborhood are several coal-pits, iron-works, and glass-works, as well as large deposits of kaolin. The four annual fairs have lost much of their former importance. The population in 1880 was 38,883, consisting of Germans and Czechs in nearly equal proportions.

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[1] In a measure before parliament in 1884, but not passed, it was contemplated to wholly abolish compulsory pilotage, releasing owners or masters of ships not employing pilots from all pilotage dues or rates and from any penalty for not employing a pilot.

Pilsen first appears in history in 976, as the scene of a battle between Otho I. and Henry V., duke of Bavaria, and it became a town in 1272. During the Hussite wars it resisted several sieges, but it was taken by Mansfeld in 1618. Wallenstein fixed his headquarters at Pilsen in 1633–34; and it was the principal scene of the alleged conspiracy which cost him his life. The first printing press in Bohemia was set up at Pilsen in 1468.

PIMENTO, also called ALLSPICE (from a supposed combination of various flavors) and JAMAICA PEPPER, is the dried immature fruit of *Eugenia Pimenta* or *Pimenta officinalis*, an evergreen tree about 30 feet high belonging to the natural order *Myrtaceæ*. It is indigenous in the West India Islands, growing on limestone hills near the sea. The spice derives its name from *pimienta*, the Spanish word for pepper, which was given to it by the early explorers of the New World from its resemblance to peppercorns. The allspice of commerce is furnished wholly[1] by the island of Jamaica; and all attempts to cultivate the tree where it is not found growing spontaneously have hitherto failed. The so-called pimento walks or natural plantations from which the pimento is collected are formed by cutting down other growth upon land where the tree grows naturally, and thus allowing it to multiply freely. The berries are gathered in July and August, when of full size, but still unripe,—the small branches bearing fruit being broken off and dried in the sun and air for some days, when the stalks are removed and the berries are ready for packing. These owe their aromatic properties to an essential oil, of which they yield on distillation from 3 to 4½ per cent. This oil has a specific gravity of 1.037, deflects the ray of polarized light 2° to the left when examined in a column of 50 millimetres, and has substantially the same composition as oil of cloves, although differing in flavor. The berries also contain a tannin (giving a black color with ferric salts), starch, and a minute quantity of an alkaloid which, according to Dragendorff, has somewhat the odor of conia. The chief use of pimento is as a spice. The oil and distilled water are used to a limited extent in medicine to disguise the taste of nauseous drugs, and the oil is also used in perfuming soaps. The yield of some trees is said to reach as much as 150 ℔ of fresh or 112 ℔ of dried berries. The highest export reached of late years was 6,857,830 ℔ in 1870–71, valued at £28,574. In 1877–78 it was 6,195,109 ℔. About two-thirds of the produce goes to England, and one-third to the United States. The value in the London market is about 4d. to 6d. per ℔.

The fruit of an allied species, *Pimenta acris*, Wight, distinguished by the calyx being crowned with teeth, is sometimes met with in commerce. The bay rum so much used as a toilet article in the United States is a tincture flavored with the oil of the fruit and leaves of *P. acris*, which is commonly known as the bayberry tree.

PIN. A pin is a small spike, usually of metal, with a bulbed head, or some other arrangement for preventing the spike passing entirely through the cloth or other material it is used for fastening together. In one form or another pins are of the highest antiquity, and it may be assumed that their use is coeval with human dress of any kind, the earliest form doubtless being a natural thorn, such as is still often seen fastening the dresses of peasant women in upper Egypt. Pins of bronze, and bronze brooches in which the pin is the essential feature, are of common occurrence among the remains of the bronze age. Brooches and pins on which considerable artistic ingenuity was lavished were universally used among the civilized nations of antiquity (see BROOCH, vol. iv. p. 332). The ordinary domestic pin had become in the 15th century an article of sufficient importance in England to warrant legislative notice, as in 1483 the importation of pins was prohibited by statute. In 1540 Queen Catherine received pins from France, and again in 1543 an Act was passed providing that "no person shall put to sale any pinnes but only such as shall be double headed, and have the heads soldered fast to the shank of the pinnes, well smoothed, the shank well shapen, the points well and round filed, canted, and sharpened." At that time pins of good quality were made of brass; but a large proportion of those against which the legislative enactment was directed were made of iron wire blanched and passed as brass pins. To a large extent the supply of pins in England was received from France till about 1626, in which year the manufacture was introduced into Gloucestershire by John Tilsby. His business flourished so well that he soon gave employment to 1500 persons, and Stroud pins attained a high reputation. In 1636 the pinmakers of London formed a corporation, and the manufacture was subsequently established at Bristol and Birmingham, the latter town ultimately becoming the principal centre of the industry. So early as 1775 the attention of the enterprising colonists in Carolina was drawn to the manufacture by the offer of prizes for the first native-made pins and needles. At a later date several pin-making machines were invented in the United States. During the war of 1812, when the price of pins rose enormously, the manufacture was actually started, but the industry was not fairly successful till about the year 1836. Previous to this an American, Mr. Lemuel W. Wright of Massachusetts, had in 1824 secured in England a patent for a pin-making machine, which established the industry on its present basis.

The old form of pin, which has become obsolete only within the memory of middle-aged persons, consisted of a shank with a separate head of fine wire twisted round and secured to it. The formation and attachment of this head were the principal points to which inventive ingenuity was directed. The old method of heading involved numerous operations, which had to be expeditiously accomplished, and, notwithstanding the expertness of the workers, the result was frequently unsatisfactory. Fine wire for heads was first wound on a lathe round a spit the exact circumference of the pin shanks to be headed. In this way a long elastic spiral was produced which had next to be cut into heads, each consisting of two complete turns of the spiral. These heads were softened by annealing and made into a heap for the heading boy, whose duty was to thrust a number of shanks into the heap and let as many as might be fit themselves with heads. Such shanks as came out thus headed were passed to the header, who with a falling block and die arrangement compressed together shank and head of such a number as his die-block was fitted for. All the other operations of straightening the wire, cutting, pointing, etc., were separately performed, and these numerous details connected with the production of a common pin were seized on by Adam Smith as one of the most remarkable illustrations of the advantages of the division of labor.

The beautiful automatic machinery by which pins are now made of single pieces of wire is an invention of the present century. In 1817 a communication was made at the Patent office by Seth Hunt, describing a machine for making pins with "head, shaft, and point in one entire piece." By this machine a suitable length of wire was cut off and held in a die till a globular head was formed on one end by compression, and the other end was pointed by the revolution around it of a roughened steel wheel. This machine does not appear to have come into use; but in 1824 Wright patented the pin-making apparatus above referred to as the parent form of the machinery now employed. An extension for five years, from 1838, of Wright's patent, with certain additions and improvements, was secured by Henry Shuttleworth and Daniel Foote Tayler, and in the hands of Tayler's firm in Birmingham the development of the machine has principally taken place. In a pin-making machine as now used wire of suitable gauge running off a reel is drawn in and straightened by passing between straightening pins or studs set in a table. When a pin length has entered it is caught by lateral jaws, beyond which enough of the end projects to form a pin-head. Against this end a steel punch advances and compresses the metal by a die arrangement into the form of a head. The pin length is immediately cut off and the headed piece drops into a slit sufficiently wide to pass the wire through but retain the head. The pins are consequently suspended by the head while their projecting points are held against a revolving file-cut steel roller, along the face of which they are carried by gravitation till they fall out at the extremity well-pointed pins. The pins are next purified by boiling in weak beer; and, so cleaned, they are arranged in a copper pan in layers alternating with layers of grained tin. The contents of the pan are covered with water over which a quantity of argol (bitartrate of potash) is sprinkled, and after boiling for several hours the brass pins are coated with a thin deposit of tin, which gives them their silvery appearance. They are then washed in clean water and dried by revolving in a barrel, mixed with dry bran or fine sawdust, from which they are winnowed finished pins.

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[1] [Small shipments find their way into American markets from Mexico, of which country as well as of South America the plant is a native. See *Consular Reports*, Aug., 1884, p. 617.—AM. ED.]

A large proportion of the pins sold are stuck into paper by an automatic machine not less ingenious than the pin-making machine itself. Mourning pins are made of iron wire, finished by immersing in black japan and drying in a stove. A considerable variety of pins, including the ingeniously coiled, bent, and twisted nursery safety-pin, ladies' hair-pins, etc., are also made by automatic machinery. The sizes of ordinary pins range from the 3½-inch stout blanket pin down to the finest slender gilt pins used by entomologists, 4500 of which weigh about an ounce. A few years ago it was estimated that in the United Kingdom there were made daily 50,000,000 pins, of which 37,000,000 were produced in Birmingham, and the weight of brass and iron wire then annually consumed was stated at 1275½ tons, of which one-eighth part was iron wire. The annual value of the whole British trade was stated at £222,000. At the same time the consumption of wire in pin-making in the United States was estimated to be from 350 to 500 tons per annum, the value of the trade being £112,000. (J. PA.)

Descent.

PINDAR, the greatest lyric poet of ancient Greece whose work is represented by large remains, was born about 522 B.C., being thus some thirty-four years younger than Simonides of Ceos. His father's name was Daiphantus; his birthplace the village of Cynoscephalæ near Thebes in Bœotia. The traditions of his family, which claimed a proud descent, have left their impress on his poetry, and are not without importance for a correct estimate of his relation to his contemporaries. The clan of the Ægeidæ—tracing their line from the hero Ægeus—belonged to the "Cadmean" element of Thebes, *i.e.*, to the elder nobility, whose supposed date went back to the days of the founder Cadmus. A branch of the Theban Ægeidæ had been settled in Achæan times at Amyclæ in the valley of the Eurotas (Pind. *Isthm.* vi. 14), and after the Dorian conquest of the Peloponnesus had apparently been adopted by the Spartans into one of the three Dorian tribes. The Spartan Ægeidæ helped to colonize the island of Thera (*Pyth.* v. 68). Another branch of the race was settled at Cyrene in Africa; and Pindar tells how his Ægid clansmen at Thebes "showed honor" to Cyrene as often as they kept the festival of the Carneia (*Pyth.* v. 75). Pindar is to be conceived, then, as standing within the circle of those families for whom the heroic myths were domestic records. He had a personal link with the memories which everywhere were most cherished by Dorians, no less than with those which appealed to men of "Cadmean" or of Achæan stock. And the wide ramifications of the Ægeidæ throughout Hellas rendered it peculiarly fitting that a member of that illustrious clan should celebrate the glories of many cities in verse which was truly Panhellenic.

Life.

Pindar is said to have received his first lessons in flute-playing from one Scopelinus at Thebes, and afterwards to have studied at Athens under the musicians Apollodorus (or Agathocles) and Lasus of Hermione. In his youth, as the story went, he was defeated in a poetical contest by the Theban Corinna—who, in reference to his use of Theban mythology is said to have advised him "to sow with the hand, not with the sack." There is an extant fragment in which Corinna reproves another Theban poetess, Myrto, "for that she, a woman, contended with Pindar" (*ὅτι βανὰ φοῦσ' ἔβα Πινδάροιο ποτ' ἔριν*)—a sentiment, it may be remarked, which does not well accord with the story of Corinna's own victory. The facts that stand out from these meagre traditions are that Pindar was precocious and laborious. Preparatory labor of a somewhat severe and complex kind was, indeed, indispensable for the Greek lyric poet of that age. Lyric composition demanded studies not only in metre but in music, and in the adaptation of both to the intricate movements of the choral dance (*ὀρχηστική*). Several passages in Pindar's extant odes glance at the long technical development of Greek lyric poetry before his time, and at the various elements of art which the lyrist was required to temper into a harmonious whole (see, *e.g.*, *Ol.*, iii. 8, vi. 91, ix. 1, xiv. 15, xiii. 18; *Pyth.* xii. 23, etc.). The earliest ode which can be dated (*Pyth.* x.) belongs to the twentieth year of Pindar's age (502 B.C.); the latest (*Olymp.* v.) to the seventieth (452 B.C.). He visited the court of Hiero at Syracuse; Theron, the despot of Acragas, also entertained him; and his travels perhaps included Cyrene. Tradition notices the special closeness of his relations with Delphi: "He was greatly honored by all the Greeks, because he was so beloved of Apollo that he even received a share of the offerings; and at the sacrifices the priests would cry aloud that Pindar come in to the feast of the god."[1] He is said to have died at Argos, at the age of seventy-nine, in 443 B.C.

Repute in Greece.

Among the Greeks of his own and later times, Pindar was pre-eminently distinguished for his piety towards the gods (*εὐσεβέστατος*, *auct. vit.*). He tells us that, "near to the vestibule" of his house (*παρ' ἐμὸν πρόθυρον*, *Pyth.* iii. 77), choruses of maidens used to dance and sing by night in praise of the Mother of the Gods (Cybele) and Pan—deities peculiarly associated with the Phrygian music of the flute, in which other members of Pindar's family besides the poet himself are said to have excelled. A statue and shrine of Cybele, which he dedicated at Thebes, were the work of the Theban artists, Aristomedes and Socrates. He also dedicated at Thebes a statue to Hermes Agoraios, and another, by Calamis, to Zeus Ammon. The latter god claimed his especial veneration because Cyrene, one of the homes of his Ægid ancestry, stood "where Zeus Ammon hath his seat," *i. e.*, near the oasis and temple (*Διὸς ἐν Ἄμμωνος θεμέθλοις*, *Pyth.* iv. 16).

His house spared.

The author of one of the Greek lives of Pindar says that, "when Pausanias the king of the Lacedæmonians was burning Thebes, some one wrote on Pindar's house, 'Burn not the house of Pindar the poet;' and thus it alone escaped destruction." This incident, of which the occasion is not further defined, has been regarded as a later invention.[2] Better attested, at least, is the similar clemency of Alexander the Great, when he sacked Thebes one hundred and eight years after the traditional date of Pindar's death (335 B.C.). He spared only (1) the Cadmeia, or citadel, of Thebes (thenceforth to be occupied by a Macedonian garrison); (2) the temples and holy places; and (3) Pindar's house. While the inhabitants were sold into slavery, exception was made only of (1) priests and priestesses; (2) persons who had been connected by private *ξενία* with Philip or Alexander, or by public *ξενία* with the Macedonians; (3) Pindar's descendants. It is probable enough, as Dio Chrysostom suggests (ii. 33, 25), that Alexander was partly moved by personal gratitude to a poet who had celebrated his ancestor Alexander I. of Macedon. But he must have been also, or chiefly influenced by the sacredness which in the eyes of all Hellenes surrounded Pindar's memory, not only as that of a great national poet, but also as that of a man who had stood in a specially close relation to the gods, and, above all, to the Delphian Apollo.[3] Upwards of six

[1] Πινδάρου γένος, in ed. Ald.: *ἐτιμήθη δὲ σφόδρα ὑπὸ πάντων τῶν Ἑλλήνων διὰ τὸ ὑπὸ τοῦ Ἀπόλλωνος οὕτω φιλεῖσθαι ὡς καὶ μερίδα τῶν προσφερομένων τῷ θεῷ λαμβάνειν, καὶ τὸν ἱερέα βοᾶν ἐν ταῖς θυσίαις Πίνδαρον ἐπὶ τὸ δεῖπνον τοῦ θεοῦ.*

[2] Schaefer, *Demosthenes und seine Zeit*, iii. 119.

[3] It will be remarked that history requires us to modify the statement in Milton's famous lines:—

"The great Emathian conquerer bade spare
The house of Pindarus, when *temple* and tower
Went to the ground."

Indeed, the point of the incident depends much on the fact that the temples and Pindar's house were classed together for exemption.

hundred years after Pindar's death, the traveller Pausanias saw an iron chair which was preserved among the most precious treasures of the temple in the sanctuary at Delphi. It was the chair, he was told, "in which Pindar used to sit, whenever he came to Delphi, and to chant those of his songs which pertain to Apollo."

Pindar and Athens.

During the second half of Pindar's life, Athens was rising to that supremacy in literature and art which was to prove more lasting than her political primacy. Pindar did not live to see the Parthenon, or to witness the mature triumphs of Sophocles; but he knew the sculpture of Calamis, and he may have known the masterpieces of Æschylus. It is interesting to note the feeling of this great Theban poet, who stands midway between Homeric epos and Athenian drama, towards the Athens of which Thebes was so often the bitterest foe, but with which he himself had so large a measure of spiritual kinship. A few words remain from a dithyramb in which he paid a glowing tribute to those "sons of Athens" who "laid the shining foundations of freedom" (*παῖδες Ἀθαναίων ἐβάλοντο φαεννὰν κρηπῖδ' ἐλευθερίας*, fr. 77, Bergk, 4th ed.), while Athens itself is thus invoked: *ὦ ταὶ λιπαραὶ καὶ ἰοστέφανοι καὶ ἀοίδιμοι, Ἑλλάδος ἔρεισμα, κλειναὶ Ἀθᾶναι, δαιμόνιον πτολίεθρον.* Isocrates, writing in 353 B.C., states that the phrase, Ἑλλάδος ἔρεισμα, "stay of Hellas," so greatly gratified the Athenians that they conferred on Pindar the high distinction of *προξενία* (*i.e.*, appointed him honorary consul, as it were, for Athens at Thebes), besides presenting him with a large sum of money (*Antid.* § 166.). One of the letters of the pseudo-Æschines (*Ep.* iv.) gives an improbable turn to the story by saying that the Thebans had fined Pindar for his praise of Athens, and that the Athenians repaid him twice the sum.[1] The notice preserved by Isocrates—less than one hundred years after Pindar's death—is good warrant for the belief that Pindar had received some exceptional honors from Athens. Pausanias saw a statue of Pindar at Athens near the temple of Ares (i. 8, 4). Besides the fragment just mentioned, several passages in Pindar's extant odes bespeak his love for Athens. Its name is almost always joined by him with some epithet of praise or reverence. In alluding to the great battles of the Persian wars, while he gives the glory of Platæa to the Spartans, he assigns that of Salamis to the Athenians (*Pyth.* i. 75). In celebrating the Pythian victory of the Athenian Megacles, he begins thus:—"Fairest of preludes is the renown of Athens for the mighty race of the Alcmæonidæ. What home, or what house, could I call mine by a name that should sound more glorious for Hellas to hear?" Referring to the fact that an Æginetan victor in the games had been trained by an Athenian, he says—*χρὴ δ' ἀπ' Ἀθανᾶν τέκτον' ἀεθληταῖσιν ἔμμεν* (*Nem.* v. 49); "meet it is that a shaper of athletes should come from Athens"—where, recollecting how often Pindar compares the poet's efforts to the athlete's, we may well believe that he was thinking of his own early training at Athens under Lasus of Hermione.

Works.

Pindar's versatility as a lyric poet is one of the characteristics remarked by Horace (*Carm.* iv. 2), and is proved by the fragments, though the poems which have come down entire represent only one class of compositions—the *Epinicia*, or odes of victory, commemorating successes in the great games. The lyric types to which the fragments belong, though it cannot be assumed that the list is complete, are at least numerous and varied.

Fragments.

1. Ὕμνοι, *Hymns* to deities—as to Zeus Ammon, to Persephone, to Fortune. The fragmentary ὕμνος entitled Θηβαίοις seems to have celebrated the deities of Thebes. 2. Παιᾶνες, *Pæans*, expressing prayer or praise for the help of a protecting god, especially Apollo, Artemis, or Zeus. 3. Διθύραμβοι, *Dithyrambs*, odes of a lofty and impassioned strain, sung by choruses in honor of Dionysus (cp. Pind., *Ol.* xiii. 18, ταὶ Διωνύσου πόθεν ἐξέφανεν σὺν βοηλάτᾳ Χάριτες διθυράμβῳ,—where Pindar alludes to the choral form given to the dithyramb, *circ.* 600 B.C., by Arion,—βοηλάτης, "ox-driving," perhaps meaning "winning an ox as prize"). 4. Προσόδια, *Processional Songs*, choral chants for worshippers approaching a shrine. One was written by Pindar for the Delians, another for the Æginetans. 5. Παρθένια, *Choral Songs for Maidens*. The reference in Pind. *Pyth.* iii. 77 to maidens worshipping Cybele and Pan near the poet's house is illustrated by the fact that one of these Παρθένια invoked "Pan, lord of Arcadia, attendant of the Great Mother, watcher of her awful shrine" (fr. 95, Bergk). 6. Ὑπορχήματα, *Choral Dance Songs*, adapted to a lively movement, used from an early date in the cult of Apollo, and afterwards in that of other gods, especially Dionysus. To this class belongs one of the finest fragments (107), written for the Thebans in connection with propitiatory rites after an eclipse of the sun, probably that of April 30, 463 B.C. 7. Ἐγκώμια, *Songs of Praise* (for men, while ὕμνοι were for gods), to be sung by a κῶμος, or festal company. In strictness ἐγκώμιον was the genus of which ἐπινίκιον was a species; but the latter is more conveniently treated as a distinct kind. Pindar wrote encomia for Theron, despot of Acragas, and for Alexander I. (son of Amyntas), king of Macedon. 8. Σκόλια, *Festal Songs*. The usual sense of σκόλιον is a drinking-song, taken up by one guest after another at a banquet. But Pindar's σκόλια were choral and antistrophic. One was to be sung at Corinth by a chorus of the ἱερόδουλοι attached to the temple of Aphrodite Ourania, when a certain Xenophon offered sacrifice before going to compete at Olympia. Another brilliant fragment, for Theoxenus of Tenedos, has an erotic character. 9. Θρῆνοι, *Dirges*, to be sung with choral dance and the music of the flute, either at the burial of the dead or in commemorative rituals. Some of the most beautiful fragments belong to this class (129-133). One of the smaller fragments (137)—in memory of an Athenian who had been initiated into the Eleusinian mysteries (*ἰδὼν κεῖνα*)—has been conjecturally referred to the Θρῆνος which Pindar is said to have written (schol. *Pyth.* vii. 18) for Hippocrates, the grandfather of Pericles. A number of small fragments, which cannot be certainly classified, are usually given as ἐξ ἀδήλων εἰδῶν, "of uncertain class." On comparing the above list with Horace, *Carm.* iv. 2, it will be seen that he alludes to No. 3 (*dithyrambos*); to Nos. 1, 2, and 7 (*seu deos regesve canit*); and to No. 9 (*flebili sponsæ juvenemve raptum Plorat*),—as well as to the extant *Epinicia* (*sive quos Elea domum reducit Palma cælestes*).

The extant odes.

The Epinicia.—The *ἐπινίκια* (sc. *μέλη*), or *ἐπινίκιοι* (sc. *ὕμνοι*), "Odes of Victory," form a collection of forty-four odes, traditionally divided into four books, answering to the four great festivals: (1) Ὀλυμπιονῖκαι (*sc.* *ὕμνοι*): fourteen odes for winners of the wild olive-wreath in the Olympian games held at Olympia in honor of Zeus once in four years; (2) Πυθιονῖκαι: twelve odes for winners of the laurel-wreath in the Pythian games held at Delphi in honor of Apollo, once in four years, the third of each Olympiad; (3) Νεμεονῖκαι: seven odes for winners of the pine-wreath in the Nemean games held at Nemea, in honor of Zeus, once in two years, the second and fourth of each Olympiad; and (4) Ἰσθμιονῖκαι: eleven odes for winners of the parsley wreath in the Isthmian games, held at the Isthmus of Corinth, in honor of Poseidon, once in two years, the first and third of each Olympiad. The Greek way of citing an ode is by the nomin. *plur.* followed by the numeral, *e.g.*, "the ninth Olympian" is Ὀλυμπιονῖκαι θ′. The chronological range of the collection (so far as ascertainable) is from 502 B.C. (*Pyth.* x.) to 452 B.C. (*Ol.* v.). With respect to the native places of the victors, the geographical distribution is as follows: for the mainland of Greece proper, 13 odes; for Ægina, 11; for Sicily, 15; for the Epizephyrian Locrians (southern Italy), 2; for Cyrene (Africa), 3.

The general characteristics of the odes may be briefly considered under the following heads: (1) language; (2) treatment of theme; (3) sentiment—religious, moral, and political; (4) relation to contemporary art.

Language.

1. The diction of Pindar is distinct in character from that of every other Greek poet, being almost everywhere marked by the greatest imagi-

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[1] Compare Jebb, *Attic Orators*, vol. ii. p. 148.

native boldness. Thus (*a*) metaphor is used even for the expression of common ideas, or the translation of familiar phrases, as when a cloak is called *εὐδιανὸν φάρμακον αὐρᾶν* (*Ol.* ix. 104), "a warm remedy for winds." (*b*) Images for the highest excellence are drawn from the furthest limits of travel or navigation, or from the fairest of natural objects; as when the superlative hospitality of a man who kept open house all the year round is described by saying, "far as to Phasis was his voyage in summer days, and in winter to the shores of Nile" (*Isthm.* ii. 42); or when Olympia, the "crown" (*κορυφά*) or flower (*ἄωτος*) of festivals, is said to be excellent as water, bright as gold, brilliant as the noonday sun (*Ol.* i. *ad init.*). This trait might be called *the Pindaric imagery of the superlative.* (*c*) Poetical inversion of ordinary phrase is frequent; as, instead of, "he struck fear into the beasts," "he gave the beasts to fear" (*Pyth.* v. 56). (*d*) The efforts of the poet's genius are represented under an extraordinary number of similitudes, borrowed from javelin-throwing, chariot driving, leaping, rowing, sailing, ploughing, building, shooting with the bow, sharpening a knife on a whetstone, mixing wine in a bowl, and many more. (*e*) Homely images, from common life, are not rare; as from account-keeping, usury, sending merchandise over sea, the *σκυτάλη* or secret dispatch, etc. And we have such homely proverbs as, "he hath his foot in this shoe," *i.e.*, stands in this case (*Ol.* vi. 8). (*f*) The natural order of words in a sentence is often boldly deranged, while, on the other hand, the syntax is seldom difficult. (*g*) Words not found except in Pindar are numerous, many of these being compounds which (like *ἐναρίμβροτος*, *καταφυλλοροεῖν*, etc.) suited the dactylic metres in their Pindaric combinations. Horace was right in speaking of Pindar's "nova verba," though they were not confined to the "bold dithyrambs."

Treatment of theme.

2. The actual victory which gave occasion for the ode is seldom treated at length or in detail,—which, indeed, only exceptional incidents could justify. Pindar's method is to take some heroic myth, or group of myths, connected with the victor's city or family, and, after a brief prelude, to enter on this, returning at the close, as a rule, to the subject of the victor's merit or good fortune, and interspersing the whole with moral comment. Thus the fourth Pythian is for Arcesilas, king of Cyrene, which was said to have been founded by men of Thera, descendants of one of Jason's comrades. Using this link, Pindar introduces his splendid narrative of the Argonauts. Many odes, again, contain shorter mythical episodes,—as the birth of Iamus (*Ol.* vi.), or the vision of Bellerophon (*Ol.* xiii.),—which form small pictures of masterly finish and beauty. Particular notice is due to the skill with which Pindar often manages the return from a mythical digression to his immediate theme. It is bold and swift, yet is not felt as harshly abrupt—justifying his own phrase at one such turn, *καί τινα οἶμον ἴσαμι βραχύν* (*Pyth.* iv. 247). It has been thought that, in the parenthesis about the Amazons' shields (*quibus Mos unde deductus . . . quærere distuli*, *Carm.* iv. 4, 17), Horace was imitating a Pindaric transition; if so, he has illustrated his own observation as to the peril of imitating the Theban poet.

Sentiment of the odes —religious;

3. (*a*) The religious feeling of Pindar is strongly marked in the odes. "From the gods are all means of human excellence." He will not believe that the gods, when they dined with Tantalus, ate his son Pelops; rather Poseidon carried off the youth to Olympus. That is, his reason for rejecting a scandalous story about the gods is purely religious, as distinct from moral; it shocks his conception of the divine dignity. With regard to oracles, he inculcates precisely such a view as would have been most acceptable to the Delphic priesthood, viz., that the gods do illumine their prophets, but that human wit can foresee nothing which the gods do not choose to reveal. A mystical doctrine of the soul's destiny after death appears in some passages (as *Ol.* ii. 66 *sq.*). Pindar was familiar with the idea of metempsychosis (cp. *ib.* 83), but the attempt to trace Pythagoreanism in some phrases (*Pyth.* ii. 34, iii. 74) appears unsafe. The belief in a fully conscious existence for the soul in a future state, determined by the character of the earthly life, entered into the teaching of the Eleusinian and other mysteries. Comparing the fragment of the Θρῆνος (no. 137, Bergk), we may probably regard the mystic or esoteric element in Pindar's theology as due to such a source.

moral;

(*b*) The moral sentiment pervading Pindar's odes rests on a constant recognition of the limits imposed by the divine will on human effort, combined with strenuous exhortation that each man should strive to reach the limit allowed in his own case. Native temperament (*φυή*) is the grand source of all human excellence (*ἀρετή*), while such excellences as can be acquired by study (*διδακταὶ ἀρεταί*, *Ol.* ix. 100) are of relatively small scope—the sentiment, we may remark, of one whose thoughts were habitually conversant with the native qualities of a poet on the one hand and of an athlete on the other. The elements of *ὑγίεις ὄλβος*—"sane happiness," such as has least reason to dread the jealousy of the gods—are substance sufficing for daily wants and good repute (*εὐλογία*). He who has these should not "seek to be a god." "Wealth set with virtues"—(*πλοῦτος ἀρεταῖς δεδαιδαλμένος*), as gold with precious gems, is the most fortunate lot, *because* it affords the amplest opportunities for honorable activity. Pindar does not rise above the ethical standard of an age which said, "love thy friend and hate thy foe" (cp. *Pyth.* ii. 83; *Isthm.* iii. 65). But in one sense he has a moral elevation which is distinctively his own; he is the glowing prophet of generous emulation and of reverent self-control.

Political.

(*c*) The political sentiments of the Theban poet are suggested by *Pyth.* xi. 53: "In polities I find the middle state crowned with more enduring good; therefore praise I not the despot's portion; those virtues move my zeal which serve the folk." If in *Pyth.* ii. 86 a democracy is described as *ὁ λάβρος στρατός*, "the raging crowd," it is to be noted that the ode is for Hiero of Syracuse, and that the phrase clearly refers to the violence of those democratic revolutions which, in the early part of the 5th century B.C., more than once convulsed Sicilian cities. At Thebes, after the Persian wars, a "constitutional oligarchy" (*ὀλιγαρχία ἰσόνομος*, Thuc. iii. 62) had replaced the narrower and less temperate oligarchy of former days (*δυναστεία οὐ μετὰ νόμων*); and in this we may probably recognize the phase of Greek political life most congenial to Pindar. He speaks of a king's lot as unique in its opportunities (*Ol.* i. 113); he sketches the character of an ideal king (*Pyth.* iii. 71), but nothing in his poetry implies liking for the *τυραννίς* as a form of government. Towards the Greek princes of Sicily and Cyrene his tone is ever one of manly independence; he speaks as a Greek citizen whose lineage places him on a level with the proudest of the Dorian race, and whose office invests him with an almost sacred dignity. In regard to the politics of Hellas at large, Pindar makes us feel the new sense of leisure for quiet pursuits and civilizing arts which came after the Persian wars. He honors "Tranquillity, the friend of cities" (*Ἀσυχία φιλόπολις*, *Ol.* iv. 16). The epic poet sang of wars; Pindar celebrates the "rivalries of peace."

Relation to contemporary arts.

4. Pindar's genius was boldly original; at the same time he was an exquisite artist. "Mine be it to invent new strains, mine the skill to hold my course in the chariot of the Muses; and may courage go with me, and power of ample grasp" (*τόλμα δὲ καὶ ἀμφιλαφὴς δύναμις ἕσποιτο*, *Ol.* ix. 80). Here we see the exulting sense of inborn strength: in many other places we perceive the feeling of conscious art—as in the phrase *δαιδάλλειν*, so apt for his

method of inlaying an ode with mythical subjects, or when he compares the opening of a song to the front of a stately building (*Ol.* vi. 3). Pindar's sympathy with external nature was deeper and keener than is often discernible in the poetry of his age. It appears, for example, in his welcome of the season when "the chamber of the Hours is opened, and delicate plants perceive the fragrant spring" (fr. 75); in the passage where Jason invokes "the rushing strength of waves and winds, and the nights, and the paths of the deep" (*Pyth.* iv. 194); in the lines on the eclipse of the sun (fr. 107); and in the picture of the eruption, when Etna, "pillar of the sky, nurse of keen snow all the year," sends forth "pure springs of fire unapproachable" (*Pyth.* i. 20). The poet's feeling for color is often noticeable,—as in the beautiful story of the birth of Iamus—when Evadne lays aside her silver pitcher and her girdle of scarlet web; the babe is found, "its delicate body steeped in the golden and deep purple rays of pansies" (*Ol.* vi. 55).

Sculpture.

The spirit of art, in every form, is represented for Pindar by *χάρις*—"the source of all delights to mortals" (*Ol.* i. 30)—or by the personified Charites (Graces). The Charites were often represented as young maidens, decking themselves with early flowers—the rose, in particular, being sacred to them as well as to Aphrodite. In Pindar's mind, as in the old Greek conception from which the worship of the Charites sprang, the instinct of beautiful art was inseparable from the sense of natural beauty. The period from 500 to 460 B.C., to which most of Pindar's extant odes belong, marked a stage in the development of Greek sculpture. The schools of Argos, Sicyon, and Ægina were effecting a transition from archaic types to the art which was afterwards matured in the age of Phidias. Olympia forms the central link between Pindar's poetry and Greek sculpture. From about 560 B.C. onwards, sculpture had been applied to the commemoration of athletes, chiefly at Olympia. In a striking passage (*Nem.* v. *ad init.*) Pindar recognizes sculpture and poetry as sister arts employed in the commemoration of the athlete, and contrasts the merely local effect of the statue with the wide diffusion of the poem. "No sculptor I, to fashion images that shall stand idly on one pedestal for aye; no, go thou forth from Ægina, sweet song of mine, on every freighted ship, on each light bark." Many particular subjects were common to Pindar and contemporary sculpture. Thus (1) the sculptures on the east pediment of the temple at Ægina represented Heracles coming to seek the aid of Telamon against Troy—a theme brilliantly treated by Pindar in the fifth Isthmian; (2) Hiero's victory in the chariot-race was commemorated at Olympia by the joint work of the sculptors Onatas and Calamis; (3) the Gigantomachia, (4) the wedding of Heracles and Hebe, (5) the war of the Centaurs with the Lapithæ, and (6) a contest between Heracles and Apollo are instances of mythical material treated alike by the poet and by sculptors of his day. The contemporary improvements in town architecture, introducing spacious and well-paved streets, such as the *σκυρωτὴ ὁδός* at Cyrene (*Pyth.* v. 87), suggest his frequent comparison of the paths of song to broad and stately causeways (*πλατεῖαι πρόσοδοι—ἑκατόμπεδοι κέλευθοι*, *Nem.* vi. 47, v. 22). A song is likened to cunning work which blends gold, ivory, and coral (*Nem.* vii. 78). Pindar's feeling that poetry, though essentially a divine gift, has a technical side (*σοφία*), and that on this side it has had an historical development like that of other arts, is forcibly illustrated by his reference to the inventions (*σοφίσματα*) for which Corinth had early been famous. He instances (1) the development of the dithyramb, (2) certain improvements in the harnessing and driving of horses, and (3) the addition of the pediment to temples (*Ol.* xiii.).

Pindar's place in Greek literature.

In the development of Greek lyric poetry two periods are broadly distinguished. During the first, from about 600 to 500 B.C., lyric poetry is local or tribal—as Alcæus and Sappho write for Lesbians, Alcman and Stesichorus for Dorians. During the second period, which takes its rise in the sense of Hellenic unity created by the Persian wars, the lyric poet addresses all Greece. Pindar and Simonides are the great representatives of this second period, to which Bacchylides, the nephew of Simonides, also belongs. These, with a few minor poets, are classed by German writers as *die universalen Meliker*. The Greeks usually spoke, not of "lyric," but of "melic" poetry (*i.e.*, meant to be sung, and not, like the epic, recited); and "universal melic" is lyric poetry addressed to all Greece. But Pindar is more than the chief extant lyrist. Epic, lyric, and dramatic poetry succeeded each other in Greek literature by a natural development. Each of them was the spontaneous utterance of the age which brought it forth. In Pindar we can see that phase of the Greek mind which produced Homeric epos passing over into the phase which produced Athenian drama. His spirit is often thoroughly dramatic—witness such scenes as the interview between Jason and Pelias (*Pyth.* iv.), the meeting of Apollo and Chiron (*Pyth.* ix.), the episode of Castor and Polydeuces (*Nem.* x.), the entertainment of Heracles by Telamon (*Isthm.* v.). Epic narrative alone was no longer enough for the men who had known that great trilogy of national life, the Persian invasions; they longed to see the heroes moving and to hear them speaking. The poet of Olympia, accustomed to see beautiful forms in vivid action or vivid art, was well fitted to be the lyric interpreter of the new dramatic impulse. Pindar has more of the Homeric spirit than any Greek lyric poet known to us. On the other side, he has a genuine, if less evident, kinship with Æschylus and Sophocles. Pindar's work, like Olympia itself, illustrates the spiritual unity of Greek art.

Manuscripts and editions.

The fact that certain glosses and lacunæ are common to all our MSS. of Pindar make it probable that these MSS. are derived from a common archetype. Now the older scholia on Pindar, which appear to have been compiled mainly from the commentaries of Didymus (*circ.* 15 B.C.), sometimes presuppose a purer text than ours. But the compiler of these older scholia lived after Herodian (160 A.D.). The archetype of our MSS., then, cannot have been older than the end of the 2d century. Our MSS. fall into two general classes: (1) the older, representing a text which, though often corrupt, is comparatively free from interpolations; (2) the later, which exhibit the traces of a Byzantine recension, in other words, of lawless conjecture, down to the 14th or 15th century. To the first class belong Parisinus 7, breaking off in *Pyth.* v.; Ambrosianus 1, which has only *Ol.* i.–xii.; Mediceus 2; and Vaticanus 2,—the two last-named being of the highest value. The *editio princeps* is the Aldine, Venice, 1513. A modern study of Pindar may be almost said to have begun with Heyne's edition (1773). Hermann did much to advance Pindaric criticism. But Augustus Boeckh (1811–22), who was assisted in the commentary by L. Dissen, is justly regarded as the founder of a scientific treatment of the poet. The edition of Theodor Bergk (*Poet. Lyr.*) is marked by considerable boldness of conjecture, as that of Tycho Mommsen (1864) by a sometimes excessive adherence to MSS. A recension by W. Christ has been published in Teubner's series (1879). The edition of J. W. Donaldson (Cambridge, 1841) has many merits; but that of C. A. M. Fennell (Cambridge, 1879–83) is better adapted to the needs of English students. The translation into English prose by Ernest Myers (2d ed., 1883) is excellent. Pindar's metres have been analyzed by J. H. Schmidt in *Die Kunstformen der Griechischen Poesie* (Leipsic, 1868–72). For estimates of Pindar see the histories of Greek literature by G. Bernhardy, K. O. Müller, Nicolai, and É. Burnouf. (R. C. J.)

PINE (*Pinus*, Gr. *πίτυς*), a name given by the ancients to some of the resinous cone-bearing trees to which it is now applied, and, as limited by modern botanists, the designation of a large genus of true conifers (*Abietinæ*), differing from the firs in their hard woody cone-scales being thickened at the apex, and in their slender needle-shaped leaves growing from a membranous sheath, either in pairs or from three to five together,—each tuft representing an abortive branch, springing from the axil of a partially deciduous scale-leaf, the base of which remains closely adherent to the stem. The numerous male catkins are generally arranged in dense whorls around the bases of the young shoots; the anther-scales, surmounted by a crest-like appendage, shed their abundant pollen by longitudinal slits; the two ovules at the base of the inner side of each fertile cone-scale develop into a pair of winged seeds, which drop from the opening scales when mature—as in the allied genera.

The pines are widely distributed over the north temperate zone, in the southern portions chiefly confined to the mountains, along which, in Central America, a few are found within the tropic; in more northern regions they frequently form extensive forests, sometimes hardly mingled with other trees. Their soft, straight-grained, resinous, and often durable wood gives to many kinds a high economic value, and some are among the most esteemed of timber trees.

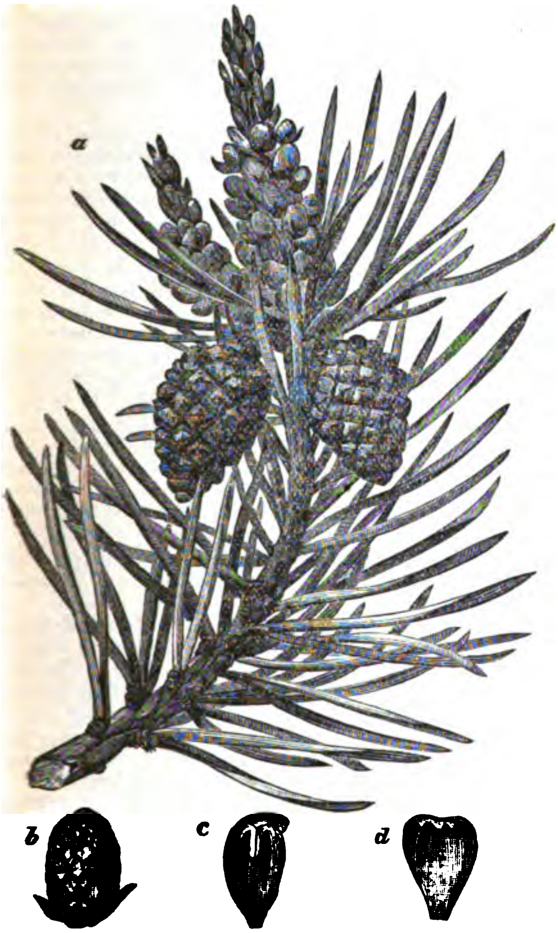

FIG. 1.—Scotch Fir (*Pinus sylvestris*). *a*, male flower and young cones; *b*, male catkin; *c*, *d*, outer and inner side of anther-scale.

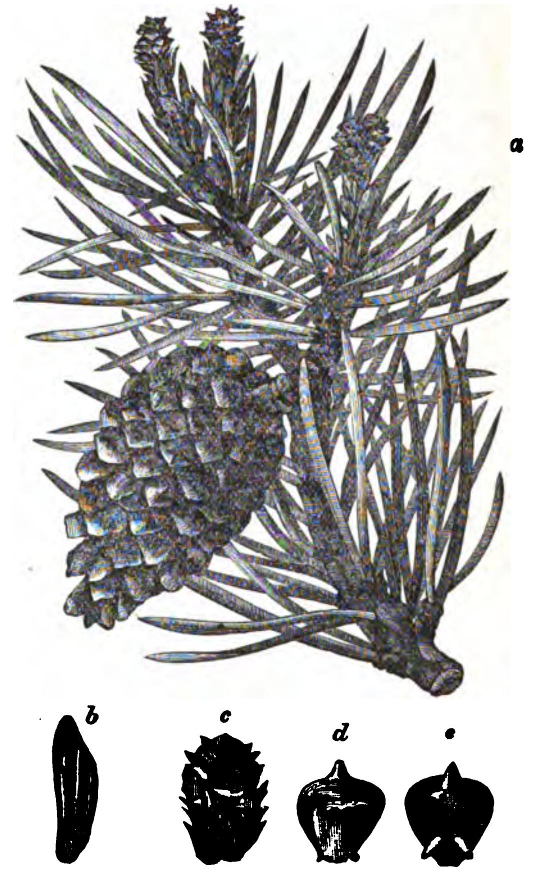

FIG. 2.—Scotch Fir (*Pinus sylvestris*). *a*, fertile flower and mature cone; *b*, winged seed; *c*, fertile catkin (or cone); *d*, scale and bract; *e*, inner side of scale.

Of the two-leaved species, *P. sylvestris*, the pine of northern Europe, may be taken as a type. When growing in perfection it is one of the finest of the group and perhaps the most picturesque of forest trees, attaining a height of from 70 to 120 feet; it is of conical growth when young, but in maturity acquires a spreading cedar or mushroom-like top, with a straight trunk of from 2 to 4 feet in diameter at the base, and gnarled twisted boughs, densely clothed at the extremities with glaucous green foliage, which contrasts strongly with the fiery red-brown bark. The leaves are rather short, curved, and often twisted; the male catkins, in dense cylindrical whorls, fill the air of the forest with their sulphur-like pollen in May or June, and fecundate the purple female flowers, which, at first sessile and erect, then become recurved on a lengthening stock; the ovate cones, about the length of the leaves, do not reach maturity until the autumn of the following year, and the seeds are seldom scattered until the third spring; the cone scales terminate in a pyramidal recurved point, well-marked in the green state and in some varieties in the mature cone, but in others scarcely projecting. *P. sylvestris* is found, in greater or less abundance, from the hills of Finmark and the plains of Bothnia to the mountains of Spain and even the higher forest-slopes of Etna, while in longitude its range extends from the shores of the North Sea to Kamchatka. Nowhere more abundant than in the Scandinavian peninsula, this tree is the true fir (*fur*, *fura*) of the old Norsemen, and still retains the name among their descendants in Britain, though botanically now classed as a pine. It grows vigorously in Lapland on the lower ground, and is found even at an elevation of 700 feet, while in south Norway it occurs up to 3000 feet, though the great forests from which "Norway pine" timber is chiefly derived are on the comparatively lower slopes of the southeastern dales; in the highest situations it dwindles to a mere bush. In Germany, both on the mountains and the sandy plains, woods of "kiefer" are frequent and widely spread, while vast forests in Russia and Poland are chiefly composed of this species; in many northern habitats it is associated with the spruce and birch. In Asia it abounds in

Siberia and on the mountains of Dahuria; on the European Alps it occurs at a height of 5600 feet, and on the Pyrenees it is found at still higher elevations; on the northern side of Etna it is said to grow at above 7000 feet. In Britain natural forests of Scotch fir of any extent are only now found in the Highlands, chiefly on the declivities of the Grampians, and most of the great woods have been much curtailed in recent times while the larger trees are generally felled as soon as they attain a timber size. In former ages the tree covered a large portion of the more northern part of the island, as well as of Ireland; the numerous trunks found everywhere in the mosses and peat-bogs of the northern counties of England attest its abundance there in prehistoric times; and in the remoter post-Glacial epoch its range was probably vastly more extended. The tree is not at present indigenous in southern Britain, but when planted in suitable ground multiplies rapidly by the wind-sown seeds; on many of the sandy moors and commons natural pine woods of large extent have been thus formed during the last fifty years. The Scotch fir is a very variable tree, and certain varieties have acquired a higher reputation for the qualities of their timber than others; among those most prized by foresters is the one called the Braemar pine, the remaining fragments of the great wood in the Braemar district being chiefly composed of this kind; it is mainly distinguished by its shorter and more glaucous leaves and ovoid cones with blunt recurved spines, and especially by the early horizontal growth of its ultimately drooping boughs; of all varieties this is the most picturesque. On the Continent the Hagenau pine of Westphalia is esteemed for the straightness and good quality of its timber. The heart-wood of the finer kinds of Scotch fir is of a deep brownish-red color, abounding in the resin to which its durability is probably due. For all indoor and most outdoor purposes it is as lasting as oak, and for ship planking is perhaps little inferior; from its lightness and elasticity it is well adapted for the construction of yachts and other small fast-sailing craft, and is said to be the best of all wood for masts and large spars; its weight varies from 30 to 40 ℔ the cubic foot. The sap-wood is more perishable, but is useful for fences, casks, and a variety of other purposes; soaking in lime-water renders it more lasting; great numbers of young pines are annually cut for railway sleepers, mining timber, and numerous agricultural applications; large quantities are consumed in forming the wood-pavement which in the great towns is rapidly superseding stone. The quality of the timber depends greatly on the soil and position in which the trees are grown; the dry slopes of granitic or gneissic mountains, or the deep well-drained sandy gravels of the lower country seem to answer equally well; but on clay or wet peat the tree rarely flourishes, and the timber is always indifferent; it is usually said that the wood is best in the cold climate of its more northern habitats, but the writer has seen a trunk (4 feet in diameter) grown on the sands of Surrey with heart-wood quite equal to any produced in Glenmore or Rothiemurchus. The rapidity of growth is still more variable; in Britain full maturity is attained in from seventy to one hundred and twenty years, but in Norway the trunk increases much more slowly; Schübeler states that a tree felled in the Alten district (about 70° lat.) measuring 2 feet 10 inches in diameter without the bark, showed four hundred circles of annual growth. In Norway the tree, growing in dense forests, is generally of but moderate girth, and probably this pine nowhere reaches a greater size than in the Scottish woods; a plank from Glenmore forest measured nearly 5½ feet across, and from 3 to 4½ feet is not an unusual diameter for a British pine tree.

Vast numbers of Scotch firs are raised in nurseries for artificial planting; the seed is sown in the spring, being just covered with earth, and the seedlings transplanted in the second year into rows for further culture, or taken direct from the seed-bed for final planting; sometimes the seed is sown where the trees are intended to grow. A plantation of Scotch fir requires frequent and careful thinning as the young trees increase in size; but pruning should be avoided as much as possible, excepting for the removal of dead wood. Plantations in England are generally ready for final cutting in from sixty to seventy years, and many are cleared at a much earlier stage of growth. *P. sylvestris* in Britain is liable to many insect depredations; the pine chafer, *Hylurgus piniperda*, is destructive in some places, the larva of this beetle feeding on the young succulent shoots, especially in young plantations; *Hylobius abietis*, the fir-weevil, eats away the bark and numerous lepidopterous larvæ devour the leaves; the pine saw-fly is also injurious in some seasons; the removal of all dead branches from the trees and from the ground beneath them is recommended, as most of these insects lay their eggs among the decaying bark and dead leaves. In England the pine is largely employed as a "nurse" for oak trees, its conical growth when young admirably adapting it for this purpose; its dense foliage renders it valuable as a shelter tree for protecting land from the wind; it stands the sea gales better than most conifers; but will not flourish on the shore like some other species. As fuel the wood of the Scotch fir is of value, but it makes too much black smoke to form an agreeable open fire; the small trunks and cuttings of plantations are employed by the lime-burner.

The pine is an important tree in the economy of the northern nations of Europe. In Scandinavia and Russia houses are chiefly constructed of its timber; and log-huts are made of the smaller trunks, and lined and roofed with the bark. The inner bark is twisted into ropes, and, like that of the spruce, is kiln dried, ground up, and mixed with meal in times of scarcity; in Kamchatka it is macerated in water, then pounded, and made into a kind of substitute for bread without any admixture of flour. In recent days the fibre of the leaves has been extracted in some quantity and applied to textile purposes under the name of *waldwolle*, both in Germany and Sweden. It is prepared by boiling the needles in a solution of soda to remove the resin, which process loosens the fibre and renders its separation easy; it has some resemblance to coarse wool, and is spun and woven into blankets and garments that are said to be warm and durable; it is also used for stuffing cushions; an essential oil, obtained by a previous distillation of the leaves, has medicinal virtues attributed to it by some German practitioners.

Large quantities of turpentine are extracted from this pine in Sweden and Russia by removing a strip of bark, terminating below in a deep notch cut in the wood, into which the turpentine runs, and from which it is scooped as it accumulates; but the product is not equal to that of the silver fir and other species. Tar is prepared largely from *P. sylvestris;* it is chiefly obtained from the roots, which, mingled with a few logs, are arranged in a conical or funnel-shaped hollow made on the steep side of a hill or bank; after filling up, the whole is covered with turf and fired at the top, when the tar exudes slowly and runs into an iron vessel placed below, from the spout of which it is conveyed into barrels. Most of the so-called Stockholm tar is thus prepared, chiefly in the province of Bothnia.

Closely allied to the Scotch pine, and perhaps to be regarded as a mere alpine form of that species, is the dwarf *P. Pumilio*, the "krummholz" or "knieholz" of the Germans,—a recumbent bush, generally only a few feet high, but with long zigzag stems, that root occasionally at the knee-like bends where they rest upon the ground. The foliage much resembles that of the Scotch fir, but is shorter, denser, and more rigid; the cones are smaller but similar in form. Abounding on the higher slopes of the Bavarian and Tyrolese Alps, it is a favorite shelter for the chamois; the hunters call it the "latschen," from its recumbent straggling habit. Krummholz oil, valued in Germany as an outward application in rheumatism and for bruises and sprains, is distilled from the young branches, and a fragrant white resin that exudes in some quantity from the buds is used for similar purposes and as a perfume; under the name of Hungarian balsam it is sold in the towns of Germany, being probably obtained from the Carpathians.

The Red Pine of Canada and New England (so called from the color of its bark), *P. resinosa*, is a tree of considerable size, sometimes attaining the dimensions of *P. sylvestris*. The somewhat glaucous leaves form dense tufts at the ends of the branches, and are 4 or 5 inches long; the ovate blunt cones are about half that length. The tree is of quick growth and the wood strong and resinous, but it is less durable than Scotch fir, though much employed in shipbuilding; according to Emerson, trunks exist in Maine 4 feet in diameter. A sandy soil seems to suit it best, and the quality of the wood probably much depends on its place of growth. Red pines abound in Nova Scotia and Newfoundland, and the tree is rather widely distributed over the northern parts of the continent; it rarely forms extensive woods, but grows chiefly in clumps among other trees, at least in its more southern habitats. Nearly allied is *P. Banksiana*, the Gray or Labrador Pine, sometimes called the Scrub Pine from its dwarfish habit; it is the most northerly representative of the genus in America, and is chiefly remarkable for its much recurved and twisted cones, about 2 inches long. The trunks are too small to be of great economic value, but the light wood is used by the natives for their canoes.

P. Laricio, the Corsican Pine, is one of the noblest trees of this group, growing to a height of 100 or even 150 feet, with a straight trunk and branches in regular whorls, forming in large trees a pyramidal head; the slender leaves, of a dark green tint, are from 4 to 7 inches long; the cones, either in pairs or several together, project horizontally, and are of a light brown color. This pine abounds in Corsica, and is found in more or less abundance in Spain, southern France, Greece, and many Mediterranean countries; it occurs on the higher mountains of Cyprus. The tree is of very rapid growth, but produces good timber, much used in southern dockyards and very durable, though less strong than that of *P. sylvestris;* the heart-wood is of a brownish tint. In southern France it has been planted with success on the drift sands of the Bay of Biscay, though it does not bear the full force of the sea-blast as well as the pinaster. In England it grows well in sheltered situations and well-drained soils.

The Black Pine, *P. Austriaca*, derives its name from the extreme depth of its foliage tints,—the sharp, rigid, rather long leaves of a dark green hue giving a sombre aspect to the tree. The light-colored, glossy, horizontal cones are generally in pairs, but sometimes three or four together. The tree is conical when young, but when old forms a spreading head; it often attains a large size. Southern Austria and the adjacent countries are the natural habitats of this pine; it seems to flourish best on rocky mountain sides, but in England grows well on sandy soils. The timber is valued in its native country, and is said to be durable and to stand exposure to the weather well; various resinous products are extracted from it. *P. pyrenaica* is a handsome species of pyramidal form, attaining a large size on the mountains of northern Spain. The leaves are long and of a light bright green; the cones are solitary, oblong, conical, and of a yellow tint. The timber is used in Spanish dockyards, but opinions vary as to its quality. In plantations its bright foliage, with the orange cones and young shoots, render it an ornamental tree, hardy in southern Britain. Near to the above are *P. Pallasiana* or *maritima*, and *P. halepensis*, Mediterranean forms chiefly valued for their resinous products; the former, planted on the loose sands of France, supplies much turpentine and resin.

P. Pinaster, the Cluster Pine or Pinaster, is an important species from its vigorous growth in the sand-drifts of the coast, for the purpose of binding which it has been grown more extensively and successfully than any other tree, especially on the dunes of the Bay of Biscay. Growing to a height of from 40 to 70 feet, the deeply-furrowed trunk occasionally reaches a diameter of 3 feet or more at the base, where, like most sand trees, it usually curves upward gradually, a form that enables the long tap-roots to withstand better the strain of the sea gale; when once established, the tree is rarely overthrown even on the loosest sand. The branches curve upwards like the stem, with their thick covering of long dark green leaves, giving a massive rounded outline to the tree; the ovate cones are from 4 to 6 inches long, of a light shining brown hue, with thick scales terminating in a pyramidal apex; they are arranged around the branches in the radiating clusters that give name to the tree. The pinaster grows naturally on sandy soils around the Mediterranean from Spain to the Levant. On the drift-sands of France, especially in the Gironde, forests have been formed mainly of this pine; the seeds, sown at first under proper shelter and protected by a thick growth of broom sown simultaneously, vegetate rapidly in the sea-sand, and the trees thus raised have, by their wind-drifted seed, covered much of the former desert of the Landes with an evergreen wood. These forests of pinaster, apart from the production of timber in a once treeless district, have a great economic value as a source of turpentine, which is largely obtained from the trees by a process analogous to that employed in its collection from *P. sylvestris;* the resin is yielded from May to the end of September, the cuts being renewed as the supply fails, until the tree is exhausted; the trunks are then felled and used in the manufacture of charcoal and lamp black; much tar and pitch is also obtained from these pinaster forests. In England the cluster-pine has been largely planted on sandy districts near the sea, and has become naturalized in Purbeck and other wild tracts in the southern counties, but the summer heat is too small to permit of its resinous products acquiring any value; the soft coarse wood, though perishable in the natural state, has been used for railway sleepers after saturation with creosote or preservative solutions. *P. bruttia*, the Calabrian Pine, a kindred form, is remarkable for its numerous densely clustered radiating cones; its wood is considered good in southern Italy.

P. Pinea is the Stone-Pine of Italy; its spreading rounded canopy of light green foliage, supported on a tall and often branchless trunk, forms a striking feature of the landscape in that country, as well as in some other Mediterranean lands. The beautiful reddish-brown shining cones, roundly ovate in shape, with pyramidal scale apices, have been prized from the ancient days of Rome for their edible nut-like seeds, which are still used as an article of food or dessert. They do not ripen until the fourth year, and are kept in the cone until required, as their abundant oil soon turns rancid. The tree has been naturalized in many warm countries, even in China; in England it seldom attains any large size, as the deficient summer heat prevents the wood from maturing; but trees occur occasionally in plantations 20 or 30 feet in height; the wood, though soft and deficient in the resin that gives durability to the timber of some species, is valued by the southern carpenter and cabinet-maker for its lightness, its fineness of grain, and the ease with which it is worked.

P. mitis, the Yellow Pine of the northern and middle States of America, is rather allied to the three-leaved section, but the leaves are mostly in pairs. It is a tree of large size, often attaining a height of 70 feet and upwards, though rarely more than 2 feet in diameter at the root; the lower branches spread horizontally, the upper, converging towards the trunk, give the tree somewhat the aspect of a spruce, hence it is called in some districts the "spruce pine." The leaves are long, slender, and of a bluish-green hue; the pendant cones are about 1½ inches long, with a slender point to each scale. The yellow pine is one of the most important timber trees of the genus; the heart-wood being very durable is largely employed in shipbuilding and for house timber, being nearly equal to that of *P. sylvestris;* large quantities are exported to Britain under the name of "New York yellow pine"; the sap-wood is perishable.

The three-leaved group includes several of the most valuable trees of America; among them is *P. rigida*, the Pitch-Pine of the northern States, a tree of from 40 to 50 feet in height with rugged trunk, occasionally 3 feet in diameter; the short dark-green leaves are in thick tufts, contrasting with the pale yellowish, usually clustered cones, the scales of which are furnished with small curved spines. The wood is very hard and abounds with resin, but on swampy land is of inferior quality and of little value except for fuel, for which the pitch-pine is highly prized; on drier ground the grain is fine from the numerous knots. Large quantities of tar and pitch are obtained from this species. The tree is one of the few that will flourish in salt-marshes.

P. australis is the "Georgia Pitch-Pine," or Yellow Pine of the southern States; it abounds on the sandy soils that cover so much of Georgia, the Carolinas, and Florida, and on those dry lands attains its highest perfection, though occasionally abundant on moist ground, whence it is sometimes called *P. palustris*. The most marked feature of the tree is its long tufted foliage,—the leaves of a bright green tint, springing from long white sheaths, being often a foot in length. The tall columnar trunk furnishes the most valued pine timber of the States; close-grained and resinous, it is very durable and polishes well; it is largely employed in American ship-yards, and immense quantities are exported, especially to Britain and the West India Islands. This tree yields an abundant supply of tar and turpentine of good quality, which products are collected and manufactured in the "pine barrens" on a large scale.

P. Tæda, the "Loblolly Pine" of the backwoodsman, a tall tree with straight trunk and spreading top, covers great tracts of the "pine-barrens" of the southern States, but also frequently spreads over deserted arable lands that have been impoverished by long and bad farming; hence the woodsmen call it the "old-field" pine, while, from the fragrance of its abundant resin, it is also known as the frankincense pine. It is a fine species 80 or 90 feet high, having sometimes a girth of 6 or 8 feet, with a broad spreading head; the leaves are rather long and of a light green tint, the cones generally in pairs, the scales terminating in a sharp incurved prickle. The timber of this pine is indifferent, but the forests of it are of importance from the quantity of turpentine they yield; the trees also furnish much firewood of good quality.

P. ponderosa, a pine of western America, belonging to this section, is a fine timber tree deserving of notice from the extreme density of its wood, which barely floats in water; it abounds in some parts of the western range of the Rocky Mountains. The leaves are very long and twisted, the small oval cones armed with recurved prickles; the tree is said to be of rapid growth.[1] In Oregon and California several large pines of this group are found. *P. Coulteri* or *macrocarpa*, is remarkable for its enormous cones (sometimes a foot long, 6 inches in diameter, and weighing more than 4 ℔); the scales end in long hooked points curving upwards; the leaves are long, rigid, and glaucous in hue. Nearly related to this is *P. Sabiniana*, the Nut-Pine of California, the cones of which are of nearly equal size, also with hooked scales; the large nut-like seeds are eaten by the Indians; the tree is one of the largest of the section, sometimes attaining a height of 120 feet and upwards, while trunks have been found, it is said, 10 or 12 feet in diameter.[2] *P. longifolia*, a Nepal species, is remarkable for the great length of its lax slender leaves, of a grass-green tint; the cones have the points of the scales recurved. It is known in India as the "Cheer-Pine"; the wood is good, resinous, and moderately durable; the tree is common on the foot-hills of the Himalayas. *P. Gerardiana*, another Nepal species, is a large tree with a conical head, growing on the more elevated parts of the mountain range; it furnishes edible seeds. The leaves, short and glaucous, like those of the Scotch fir, have deciduous sheaths; the cones have recurved scale points like those of the cheer-pine. *P. canariensis*, which forms forests on the mountains of Grand Canary and Teneriffe, growing at an elevation of 6000 feet, also belongs to this group. The leaves are long, lax, and of a bright green tint; the cone-scales are without spines; the trunk attains a large size, and yields good and durable timber. The beautiful Monterey-Pine, *P. insignis*, distinguished by the brilliant color of its foliage, has the leaves in tufts of three or four; the lower cone-scales have recurved points. This fine pine has been planted in the southwestern parts of England, but is scarcely hardy.

The pines with five leaves in each tuft have generally deciduous sheaths. The most important economic species is the well-known White Pine, *P. Strobus*, from its large growth and abundance, as well as the soft even grain of its white wood, one of the most valuable of American trees. The tree abounds from Canada to Georgia, and is also found in British Columbia, but in the eastern States has been so long sought for by the lumberer that most of the old trees have long disappeared, and large white pine timber is now only found in quantity in the Canadian Dominion.[3] Formerly Maine and Vermont were celebrated for the size of their pines, but few of these great trees now exist in New England; one that stood near the banks of the Merrimack in New Hampshire is said to have had a trunk nearly 8 feet in diameter, and Michaux measured a stump 6 feet across. On a deep rich soil *P. Strobus* attains a height of 150 or even 200 feet, and trunks without a branch are sometimes found 80 or 90 feet long; in the earlier stages of growth it has a pyramidal form, in open glades the lower boughs often touching the ground, but in old age it acquires a wide almost cedar-like top. The light bluish-green foliage is somewhat lax, very dense in young trees; the cones are long and rather curved, with thin smooth scales a little thickened at the apex, and generally more or less covered with exuding white resin; they are about 5 or 6 inches in length and 1½ to 2 inches broad; the male catkins are of a bluish tint; the cones ripen in the autumn of the second year. The wood of the white pine is durable for indoor use, especially when protected by paint, but when exposed to moist air it rapidly decays, and it is very liable to dry rot; it is said to be best when grown on sandy soils. Immense quantities are still exported, especially from Canada, its smooth easily-worked grain rendering it a favorite wood for the house-carpenter and joiner; it weighs about 28 ℔ per cubic foot. In England, where it is generally known as the "Weymouth Pine," it succeeds well on deep light soils when well-drained; trees have attained occasionally a height of 100 feet and upwards in British plantations; but it is apt to be infested with American blight (*Eriosoma*). In northern Germany it also grows well; a tree at Berlin measured upwards of 3 metres in circumference, the age being one hundred and fifty years. The climate of Scotland appears less suitable for it, probably from the want of summer heat, and it can hardly be recommended for British planting otherwise than for ornamental purposes.

Nearly approaching this is *P. excelsa*, the Bhotan Pine, which differs chiefly in its longer cones and drooping glaucous foliage. It is found in Kumaon and Bhotan and on some of the Nepal ranges, but does not grow in the moist climate of the Sikkim Himalayas; it is found at a height of 6000 to 7000 feet, and attains large dimensions; the wood is highly resinous, and is said to be durable; great quantities of a white clear turpentine exude from the branches when injured. The Bhotan pine is quite hardy in southern England, and has been largely planted of late as an ornamental tree.

P. Lambertiana, the Giant Pine or Sugar-Pine of California, is the largest of the genus, rising to the height of 200 feet, with a trunk 20 to 30 feet in girth, and, it is said, occasionally attaining much larger dimensions. The head is of a pyramidal form, the lower branches drooping like those of a Norway spruce; its foliage is of a light bright green color. The pendant cones are very large, sometimes 18 inches long and 4 inches in diameter, with large nut-like seeds, which, pounded and baked, are eaten by the Indians. The tree abounds in some sandy districts, but more generally occurs singly or in small groups dispersed through the woods, attaining its greatest dimensions in light soils. The wood is soft and nearly white, but contains much resin, which when fire has run through the forest exudes, and having in this half-burnt condition a sweetish taste, has given the common name to the tree; the wood seems to be formed slowly; from its smooth grain it is valued for indoor carpentry; the saccharine burnt resin is used as a laxative in California.

P. Cembra is the Stone-Pine of Siberia and Central Europe. It abounds on the Alps, the Carpathians, and the Siberian ranges, in Switzerland being found at an altitude of 6800 feet in some localities. It is a straight-growing tree, with gray bark and whorls of horizontal branches, growing often from the ground, giving a cylindro-conical outline; the leaves are short, rigid, and glaucous; the cones, oblong and rather pointing upwards, grow only near the top of the tree, and ripen in the second autumn; the seeds are oily like those of *P. Pinea*, and are eaten both on the Alps and by the inhabitants of Siberia; a fine oil is expressed from them which is used both for food and in lamps, but, like that of the Italian pine, it soon turns rancid. The growth of *P. Cembra* is slow, but the wood is of remarkably even grain, and is employed by the Swiss wood-carvers in preference to any other. The *Cembra* is the "zirbel" or "zirbel-kiefer" of the Germans, and is known locally in Switzerland as the "aroile," "aloies," and "arve."

P. occidentalis, a five-leaved pine with pale green foliage and small ovate cones, is found on the high mountains of St. Domingo. Many members of the group occur on the Mexican isthmus, one of which *P. cembroides*, produces edible seeds. *P. Ayacahuite*, a large tree growing on the mountains of Guatemala, with glaucous foliage like *P. Strobus*, yields a valuable resin. *P. filifolia*, and *P. macrophylla*, likewise natives of Central America, are remarkable for the extreme length of their leaves; the former is said to attain a large size. (C. P. J.)

PINE-APPLE. The pine-apple so-called consists in reality of the inflorescence of the plant, the originally separate flowers of which, together with the bracts supporting them, become fleshy and consolidated into one mass. The swelling and fusion of the tissues take place after the process of fertilization, and it may be that the richly perfumed succulent mass is an aid in the distribution of seed by affording food to certain animals. In the highly developed cultivated pines, however, it frequently happens that the seeds do not ripen properly. The pine, *Ananassa sativa*, is a member of the Bromeliad family, supposed to be of tropical American origin, and has been found wild in Mexico, Central America, Guiana, and Brazil, but is now widely dispersed in all tropical and semitropical countries.

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[1] [Specific gravity 0.4715. See C. S. Sargent's Report on Forests of North America in vol. ix. of U. S. Tenth Census, 1884.—AM. ED.]

[2] [Height from 80 to 100 feet and diameter from 2 to 4 feet. See Sargent's Report, *ut supra*.—AM. ED.]

[3] [The White Pine of British Columbia is the *P. Monticola*. *P. Strobus* reaches to greatest development between lat. 47° N. and a line running south of Pennsylvania, Central Michigan and Minnesota. See Sargent, *ut supra*.—AM. ED.]

Evelyn in his *Diary* mentions tasting a pine-apple from Barbados at the table of Charles II., and this is we believe the first mention of the fruit in English literature. A picture, of which a copy may be seen at the rooms of the Royal Horticultural Society of London, represents the royal gardener, Mr. Rose, presenting on bended knee the first pine-apple grown in Britain, and it is surmised that this may have been grown from the "suckers" of the fruit above alluded to by Evelyn, though it is generally considered that the pine was not cultivated in England till 1712. In spite of the great improvements in the quality of pines, and the great progress that has been brought about in the rapidity and facility of production, pine-growing is still attended with considerable expense, and much expenditure of time and labor. At the same time great attention has been given to pine culture in the West India Islands, the Azores, etc., and very large quantities of fruit of fine quality are imported into Britain at relatively low prices. But for pines of the highest flavor in the winter and spring seasons Englishmen must still look to their own gardens. See HORTICULTURE.

PINEL, PHILIPPE (1745–1826), a distinguished French physician, was born at the chateau of Rascas, Saint-André, in the department of Tarn, France, on April 20, 1745. He studied at Lavaur and afterwards at the university of Toulouse, where he took his doctor's degree in 1773. From Montpellier where he taught mathematics and at the same time carried on his medical studies, he removed in 1778 to Paris, engaging there chiefly in literary work connected with his profession. His first publication was a French translation of Cullen's *Nosology* (1785); it was followed by an edition of the works of Baglivi (1788), and in 1791 he published a *Traité medico-philosophique de l'aliénation mentale*. In 1792 he became head physician of the Bicêtre, and two years afterwards he received the corresponding appointment at the Salpêtrière, where he began to deliver a course of clinical lectures; these formed the basis of his *Nosographie philosophique* (1798; 6th ed. 1818), which was further developed in *La Médecine clinique* (1802). Pinel was made a member of the Institute in 1803, and soon afterwards was appointed professor of pathology in the École de Médecine. Neither as a lecturer nor as an author, however, did he achieve great success, and his enduring fame rests entirely upon the fact that by his courageous action he was among the first to introduce the humane treatment of the insane, removing with his own hands the bonds of patients who had been chained to the wall for years. See vol. xiii. p. 116. He died at Paris on October 26, 1826.

PINEROLO, a city of Italy, in the province of Turin (Piedmont), is built in a straggling manner on a hill-side just above the junction of the valleys of the Chisone and the Lemina, at a height of 1237 feet above the sea, 23½ miles by rail southwest of Turin. It is the terminus of the branch railway from Turin by Sangone or Nichellino, and has steam tramways running up to Perosa (12 miles) and south to Saluzzo. Till 1696 it was strongly fortified with a citadel on Santa Brigida, a castle on St. Maurizio, and city walls constructed by Thomas I. of Savoy. It has a cathedral (St. Donatus), a bishop's palace, a large seminary, a theatre (1842), a hospital (1546), a public library, a cavalry college, a school of music, and a Waldensian chapel and schools. Cotton, silk, wool, and hemp are among the local manufactures. The population of the city was 11,362 in 1871 and 12,003 in 1881 (commune 16,730 and 17,492).

Pinerolo was bestowed on the bishops of Turin by Otho III. in 996; but in 1078 the countess Adelaide made it over to the Benedictine abbey of Santa Maria, in whose possession it remained till 1159. Thomas I. of Savoy captured the castle in 1188, and in 1246 the commune formally recognized the supremacy of Savoy. Passing in 1295 into the hands of Philip, son of Thomas III., Pinerolo became his residence and capital, a distinction which it retained under Amadeus VIII. of Savoy, even after the extinction of the separate house of Piedmont in 1418. Francis I. of France obtained possession of the town in his descent into Italy, and tried to secure the allegiance of the people by relieving the woollen trade from taxation; but Emmanuel Philibert received it back from Henry III. in 1574. A second occupation by the French occurred under Cardinal Richelieu: the French language was imposed on the people, great fortifications were constructed, and the fortress was used as a state prison for such men as Fouquet, De Caumont, and the Man with the Iron Mask. Victor Amadeus bombarded the place in 1693, and ultimately compelled Louis XIV. to relinquish his hold on it: but before the withdrawal of the French troops the defences were demolished and the military importance of Pinerolo brought to a close. In 1748 the town was made a bishop's see. Michele Buniva, pensioned by Victor Emanuel I. as the introducer of vaccination into Piedmont, was a native of Pinerolo and has a statue in the Piazza del Palazzo. De Grossi and Massi are among the local historians.

PINK. As usually applied this word corresponds to a genus of *Caryophyllaceæ*, the *Dianthus* of botanists. It is characterized by the presence of opposite simple leaves proceeding from thickened nodes, a cymose inflorescence, a tubular calyx surrounded by a number of overlapping bracts, a showy corolla of five free long-stalked petals, ten stamens proceeding, together with the petals, from a short stalk supporting the ovary, which latter has two styles and ripens into an oblong pod which splits by two valves. The species are herbaceous or perennial, of low stature, often with very showy flowers. They are natives chiefly of southern Europe and the Mediterranean region, a few being found in temperate Asia and south Africa. One species only is native to America, and that only in the northwest. Four species are wild in Britain, with two others which are more or less naturalized. These two are the more interesting as being the originals of the pinks and of the carnations and picotees of English gardens. Garden Pinks are derivatives from *Dianthus plumarius*, a native of central Europe, with leaves rough at the edges, and with rose-colored or purplish flowers. The use of "pink" to denote a color is derived from the name of the plant. The Carnation and Picotee are modifications of *Dianthus Caryophyllus*, the Clove Pink, a species with smooth edges to the leaf. This is a native of Europe, growing on rocks in the south, but in the north usually found on old walls. Its occurrence in England on some of the old Norman castles, as at Rochester, is supposed by Canon Ellacombe to indicate its introduction by the Normans; in any case the plant grows in similar situations in Normandy. The original species has "self"-colored flowers, that is, flowers of one hue, generally some shade of pink, but the variations in gardens are infinite. The carnation includes those flowers which are streaked or striped lengthwise—the picotees are those in which the petals have a narrow band of color along the edge, the remainder of the petal being free from stripes or blotches. These by the old writers were called "gillyflowers" (see vol. x. p. 536). The Sweet William of gardens is a product from *Dianthus barbatus*; the Indian Pink comes from *D. sinensis*, of which *D. Heddewigii* is a variety; the Alpine Pink, *D. alpinus*, is a very lovely plant for the rockery; and there are many hybrid and other varieties met with in gardens, for an account of which reference must be made to treatises on horticulture.

PINKERTON, JOHN (1758–1826), archæologist, numismatist, historian, geographer and miscellaneous writer in prose and verse, was born at Edinburgh, February 17, 1758. After a brief education at Lanark he was articled as a law clerk in Edinburgh, his earliest work, printed during his clerkship, being an *Elegy on Craigmillar Castle* (1776). In 1780 he removed to London to devote himself to literary work, publishing, in 1781, a volume of *Rimes* of no great merit, and a professed collection of *Scottish Tragic Ballads*. These were followed in 1782 by *Two Dithyrambic Odes on Enthusiasm and Laughter*, and by a series of *Tales in Verse*. Under the title of *Select Scottish Ballads* he reissued in 1783 his tragic ballads, with a supplement comprising *Ballads of the Comic Kind*,—a collection which obtained for him the not wholly appropriate title of "the second Chatterton." An *Essay on Medals* in 1784 won him a considerable reputation, which was in some respects unpleasantly maintained by his bold but eccentric *Letters on Literature*, published in 1785, under the pseudonym of Robert Heron—a temporary adoption of his mother's surname. In the following year he edited the *Ancient Scottish Poems from the MS. Collections of Sir Richard Maitland of Lethington*,—a genuine reproduction, though his confession in the preface of forgery in the previous collections published by him brought groundless suspicion upon it. It was succeeded in 1787 by a compilation, under the new pseudonym of Bennet, entitled the *Treasury of Wit*, and by his first important historical work, the *Dissertation on the Origin and Progress of the Scythians or Goths*, to which Gibbon professed himself indebted. Turning his attention to hagiology, Pinkerton next collected and printed in 1789 certain *Vitæ Sanctorum Scotiæ*, and, a little later, published his *Enquiry into the History of Scotland preceding the Reign of Malcolm III.*, in which he hoped to settle the ancient history of his country on the solid footing of facts and authorities, and "leave nothing in the ink horn." In many quarters his attitude towards the Highlanders excited "violent disgust," but the *Enquiry* was twice reprinted, in 1794 and 1814, and is still of value for the documents embodied in it. His edition of Barbour's *Bruce* and a *Medallic History of England to the Revolution* appeared in 1790; a collection of *Scottish Poems reprinted from scarce Editions* in 1792; and a series of biographical sketches, the *Iconographia Scotica*, in the years 1795–97. In the last-mentioned year he published a *History of Scotland from the Accession of the House of Stuart to that of Mary*, containing valuable material, but almost entirely devoid of literary finish. A new biographical collection, the *Gallery of Eminent Persons of Scotland* (1799), was succeeded after a short interval by a *Modern Geography digested on a New Plan* (1802; enlarged, 1807). About this time he left London for Paris, where he chiefly resided until his death on May 10, 1826. His remaining publications were the *Recollections of Paris in the years* 1802-3-4-5 (1806); a very useful *General Collection of Voyages and Travels* (1808–1813); a *New Modern Atlas* (1809–15); and his *Petralogy* (1811). An unsuccessful tragedy by him was performed at Edinburgh in 1813.

Pinkerton possessed an exceedingly vigorous and acute mind, but very lacking in high constructive power; and, as he was less patient in the formation of opinion than in research, his best work is marred by imperfect judgments crudely and obstinately asserted. At the same time his writings take no mean rank in the advance towards a scientific treatment of history. Walpole, notes of whose conversations were published at his death by Pinkerton under the title of *Walpoliana*, regarded his understanding as "one of the strongest, most manly, and clearest he ever knew," and Gibbon not only praised his faculty of persistent application as herculean and heroic, but wished to secure his co-operation in a scheme for organizing the materials of early English history. The final verdict upon his work must be that of the earl of Buchan, who indorsed Pinkerton's statement that he was "a *homo umbratilis*, of a hypochondriac unsocial disposition," with the comment "*se ipse dixit:* it is his best apology; yet undoubtedly he has been a benefactor to literature."

PINSK, a district town of the government of Minsk, Russia, is situated in a marshy region at the confluence of the Strumeñ and Pina rivers, 172 miles to the southwest of Minsk. It has a lyceum, several primary schools, and a great number of Jewish schools. The town is almost entirely built of wood, and has a poor appearance. The population (13,000 in 1865) was in, 1884, 22,950, more than four-fifths of whom are Jews, who live almost exclusively on trade. This development of trade in a town situated at a distance from all railways (the nearest, that from Moscow to Warsaw, being 60 miles off) is due to the navigable river Pina, which connects it with the fertile regions on the Dnieper, and, by means of the Dnieper-and-Bug Canal, with Poland and Prussia, while the canal of Oginsky connects it with the basin of the Niemen. The merchandise brought from the Dnieper is unshipped at Pinsk, and sent west or northwest on smaller vessels.

Pinsk (Pinesk) is first mentioned in Russian annals in 1097 as a town belonging to Sviatopolk, prince of Kieff. In 1132 it formed part of the Minsk principality, and it often changed its rulers subsequently. After the Mongol invasion it became the chief town of a separate principality, and continued to be so until the end of the 13th century. In 1320 it was annexed to Lithuania; and in 1569, after the union of Lithuania with Poland, it was recognized as chief town of the province of Brest. During the rebellion of Bogdan Khmelnitzky (1640), as it had fallen into the hands of the Cossacks, the Poles took it by assault, destroying 14,000 persons and burning 5000 houses. Eight years later the town was burned again by the Russians. Charles XII. took it in 1706, and when compelled to quit burned the palace of Prince Wisznewecki, and the town with its suburbs. Pinsk was annexed to Russia in 1795.

PINTO, Fernão Mendes (1509 (?)–1583), a noted Portuguese adventurer, was born in 1509 or 1510 at Montemor-o-Velho, near Coimbra, and died near Lisbon, July 18, 1583. After spending some years in Lisbon and Setubal, and experiencing various adventures, he left his native country in 1537, in a fleet of five ships, committing himself to a career of adventure at sea, which lasted twenty-one years, in the course of which he was five times shipwrecked, thirteen times taken captive, and seventeen times sold as a slave. If Pinto's own narrative is colored in many passages by a wandering and fervid imagination, its substantial honesty is now generally admitted, in spite of Congreve's opprobrium in *Love for Love*,—"F. M. Pinto was but a type of thee, thou liar of the first magnitude." The fleet with which Pinto left Portugal anchored, after various adventures, at Socotra, and he himself was taken captive near the Straits of Babelmandeb, carried to Mocha, sold as a slave, and ransomed by the Portuguese governor of Ormuz. Returning to the Indies, he was again engaged in several expeditions, again enslaved, again ransomed, and again captured by pirates. In 1542 he was engaged in an expedition to Calempin, near Peking, to rifle the tombs of seventeen Chinese kings. Shipwrecked and captured on the Chinese coast, he was set to work in repairing the Great Wall, whence an inroad of Tartars transported him to the siege of Peking and next to Tartary. Hence we follow him to Cochin-China, Macao, and Japan. At Ningpo his report of Japan and its wealth caused the equipment of nine ships, eight of which foundered, Pinto's ship being driven to the Lew-chew Islands. After a variety of other adventures, Pinto returned a third time to Japan with Francis Xavier in 1548. In 1553, while at Goa on his return to Portugal with his rich fortune, he was induced to devote nearly all his wealth to the foundation of a seminary for propagating the faith in Japan. Returning to Lisbon in 1558, he spent a few years at court, but found the life very stale after his stirring adventures in the East.

The first extant account of his adventures is to be found in a collection of Jesuits' letters published in Italian at Venice in 1565. The full narrative, however, of his life is his own *Peregrinação*, which was first published in quarto at Lisbon in 1614 by Francisco de Herrera. In 1620 appeared a Spanish translation, and in 1628 at Paris a French translation by B. Figuier, followed by two other editions (1645 and 1830). There is also an English translation by H. Cogan (London, 1663 and 1692). See also Barbosa Machado, *Bibl. Lusitana*; Fr. da Sylva, *Dicionario bibliographico Portuguez*; Castelho, *Literaria Classica Portugueza*.

PINTURICCHIO (1454–1513), whose full name was **Bernardino di Betti**, the son of a citizen of Perugia, Benedetto or Betto di Biagio, was one of a very important group of painters who inherited the artistic traditions and developed the style of the older Perugian painters such as Bonfigli and Fiorenzo di Lorenzo. According to Vasari he was a pupil of Perugino; and so in one sense no doubt he was, but rather as a paid assistant than as an apprentice. The strong similarity both in design and methods of execution which runs through the works of this latter Perugian school, of which Perugino was the oldest member, is very striking; paintings by Perugino, Pinturicchio, Lo Spagna, and Raphael (in his first manner) may often be mistaken one for the other. In most cases, especially in the execution of large frescos, pupils and assistants had a large share in the work, either in enlarging the master's sketch to the full-sized cartoon, in transferring the cartoon to the wall, or in painting backgrounds, drapery, and other accessories. In this way the spirit and individuality of one man could impress itself indelibly on a numerous school of younger artists.

After assisting Perugino in the execution of his frescos in the Sistine Chapel, Pinturicchio was employed by various members of the Della Rovere family and others to decorate a whole series of chapels in the church of S. Maria del Popolo in Rome, where he appears to have worked from 1484, or earlier, to 1492 with little interruption. The earliest of these is an altarpiece of the Adoration of the Shepherds, in the first chapel (from the west) on the south, built by Cardinal Domenico della Rovere; a portrait of the cardinal is introduced as the foremost of the kneeling shepherds. In the lunettes under the vault Pinturicchio painted small scenes from the life of St. Jerome. The frescos which he painted in the next chapel, that built by Card. Innocenzo Cibo, were destroyed in 1700, when the chapel was rebuilt by Card. Alderano Cibo. The third chapel on the south is that of Giov. della Rovere, duke of Sora, nephew of Sixtus IV., and brother of Giuliano, who was afterwards Pope Julius II. This contains a fine altarpiece of the Madonna enthroned between Four Saints, and on the east side a very nobly composed fresco of the Assumption of the Virgin. The vault and its lunettes are richly decorated with small pictures of the life of the Virgin, surrounded by graceful arabesques; and the dado is covered with monochrome paintings of scenes from the lives of saints, medallions with prophets, and very graceful and powerfully drawn female figures in full length, in which the influence of Signorelli may be traced. In the fourth chapel Pinturicchio painted the Four Latin Doctors in the lunettes of the vault. Most of these frescos are considerably injured by damp, but happily have suffered little from restoration; the heads are painted with much minuteness of finish, and the whole of the pictures depend very largely for their effect on the final touchings *a secco*. The last paintings completed by Pinturicchio in this church were the frescos on the vault over the retro-choir, a very rich and well-designed piece of decorative work, with main lines arranged to suit their surroundings in a very skilful way. In the centre is an octagonal panel of the Coronation of the Virgin, and around it medallions of the Four Evangelists—the spaces between them being filled up by reclining figures of the Four Sibyls. On each pendentive is a figure of one of the Four Doctors enthroned under a niched canopy. The bands which separate these pictures have elaborate arabesques on a gold ground, and the whole is painted with broad and effective touches, very telling when seen (as is necessarily the case) from a considerable distance below. No finer specimen of the decoration of a simple quadripartite vault can anywhere be seen.

In 1492 Pinturicchio was summoned to Orvieto, where he painted two Prophets and two of the Doctors in the duomo. In the following year he returned to Rome, and was employed by Pope Alexander VI. (Borgia) to decorate a suite of six rooms in the Vatican, which Alexander had just built. These rooms, called after their founder the *Appartamenti Borgia*, now form part of the Vatican library, and five of them still retain the fine series of frescos with which they were so skilfully decorated by Pinturicchio. The upper part of the walls and vaults, not only covered with painting, but further enriched with delicate stucco work in relief, are a masterpiece of decorative design applied according to the truest principles of mural ornament,—a much better model for imitation in that respect than the more celebrated Stanze of Raphael immediately over the Borgia rooms. The main subjects are—(1) the Annunciation, the Nativity, the Magi, and the Resurrection; (2) Scenes from the lives of St. Catherine, St. Antony, and other saints; (3) allegorical figures of Music, Arithmetic, and the like; (4) four figures in half length, with rich arabesques; (5) figures of the planets, the occupations of the various months, and other subjects. The sixth room was repainted by Perino del Vaga.[1]

Though not without interruption, Pinturicchio assisted by his pupils, worked in these rooms from 1492 till 1498, when they were completed. His other chief frescos in Rome, still existing in a very genuine state, are those in the Cappella Bufalini at the south-west of St. Maria in Ara Cœli, probably executed from 1497 to 1500. These are well-designed compositions, noble in conception, and finished with much care and refinement. On the altar wall is a grand painting of St. Bernardino of Siena between two other saints, crowned by angels; in the upper part is a figure of Christ in a vesica-glory, surrounded by angel musicians; on the left wall is a large fresco of the miracles done by the corpse of St. Bernardino, very rich in color, and full of very carefully painted heads, some being portraits of members of the Bufalini family, for whom these frescos were executed. One group of three females, the central figure with a child at her breast, is of especial beauty, recalling the grace of Raphael's second manner. The composition of the main group round the saint's corpse appears to have been suggested by Giotto's painting of St. Francis on his bier in S. Croce at Florence. On the vault are four noble figures of the Evangelists, usually attributed to Luca Signorelli, but certainly, like the rest of the frescos in this chapel, by the hand of Pinturicchio. On the vault of the sacristy of S. Cecilia in Trastevere, Pinturicchio painted the Almighty surrounded by the Evangelists, a work which still exists in a fair state of preservation and unrestored. During a visit to Orvieto in 1496 Pinturicchio painted two more figures of the Latin Doctors in the choir of the duomo—now, like the rest of his works at Orvieto, almost destroyed. For these he received fifty gold ducats.

Among his panel pictures the following are the most important. An altarpiece for St. Maria de' Fossi at Perugia, painted in 1496–98, now moved to the picture gallery, is a Madonna enthroned among Saints, graceful and sweet in expression, and very minutely painted; the wings of the retable have standing figures of St. Augustine and St. Jerome; and the *predella* has paintings in miniature of the Annunciation and the Evangelists. Another fine altarpiece, similar in delicacy of detail, and probably painted about the same time, is that in the cathedral of San Severino—the Madonna enthroned looks down towards the kneeling donor. The angels at the sides in beauty of face and expression recall the manner of Lorenzo di Credi or Da Vinci. The Vatican picture gallery has the largest of

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[1] See Guattani, *Quadri nell' Appart. Borgia*, Rome, 1820.

Pinturicchio's panels—the Coronation of the Virgin, with the apostles and other saints below. Several well-executed portraits occur among the kneeling saints. The Virgin, who kneels at Christ's feet to receive her crown, is a figure of great tenderness and beauty, and the lower group is composed with great skill and grace in arrangement. Other important panel paintings by Pinturicchio exist in the cathedral of Spello, in the Siena gallery, at Florence, at Perugia, and in other collections.

In 1501 Pinturicchio painted several fine frescos in S. Maria Maggiore at Spello,—all very decorative, and full of elaborate architectural accessories. One of them, the Annunciation, is signed "Bernardinvs Pintvrichivs Pervsinvs." They are much injured by damp and clumsy restoration. The most striking of all Pinturicchio's frescos, both for brilliance of color and their wonderful state of preservation, are those in the cathedral library at Siena, a large room built in 1495 by Cardinal Francesco Piccolomini, afterwards Pius III. In 1502 the cardinal contracted with Pinturicchio to decorate the whole room with arabesques on the vault, and on the walls ten scenes from the life of Æneas Sylvius Piccolomini, Pius II., the uncle of Cardinal Francesco.

The contract, given in full by Milanesi (Vasari, iii. p. 519), is a very interesting one; it specially provides that the cartoons, their transference on to the walls, and all the heads, were to be by Pinturicchio's own hand, thus contradicting Vasari's assertion that the cartoons were the work of Raphael. In fact when closely examined the evidence which would give Raphael an important share in the execution of these fine paintings amounts to very little. The document provides for the price of these frescos, namely one thousand gold ducats, to be paid in various instalments. The work was begun early in 1503, but was interrupted for a while by the death of Pius III. His will, however, provided for the completion of the work by his executors, and the whole series were finished in 1507. The subjects are (1) the journey of the young Sylvius Piccolomini to the council of Basel, in the suite of Cardinal Capranica; (2) his reception by James I. of Scotland as envoy from the council of Basel; (3) his being crowned with the poet's laurel by Frederick III.; (4) his reception by Pope Eugenius IV. as ambassador from Frederick III.; (5) outside the wall of Siena he presents to Frederick III. his bride Leonora, infanta of Portugal; (6) he receives the cardinal's hat from Pope Calixtus III.; (7) he is borne in procession after his election as Pope Pius II.; (8) he presides at a council at Mantua; (9) he canonizes St. Catherine of Siena; (10) he arrives in Ancona to promote the crusade against the Turks. In addition to these there is, outside the library, over the door, the Coronation of Pius III.

Though this splendid series of paintings are laid in with true fresco-colors, there is but little *fresco buono* visible; almost the whole is painted over *a secco* with colors much more brilliant in tone than could be used on the wet stucco. This retouching, which was employed by all fresco painters, was used by Pinturricchio more than by most artists. In the lower part of the scene of St. Catherine's canonization he has introduced his own portrait, and standing by him is a youth who bears some resemblance to Raphael. The paintings are all finished with much care, but Pinturicchio has not kept to the flat and simply decorative treatment of his earlier manner; there is much more of aerial perspective and distance destroying the apparent solidity of the wall surface.

In 1508 Pinturicchio painted another panel of the Madonna enthroned among Saints for the church of the Minori Conventuali at Spello. It is now over the altar in the sacristy. On his return to Siena he painted a whole series of frescos on the walls of the Palazzo Petrucci, now all destroyed except one scene of the return of Ulysses to Penelope (or possibly Collatinus and Lucretia), which is now in the National Gallery of London, transferred to canvas. One of his last works, painted in 1513, the year of his death, is a very beautiful and highly finished panel with Christ bearing His Cross, now in the Palazzo Borromeo in Milan. Pinturicchio married Grania di Niccolò, and had by her two sons and four daughters; there is probably no truth in the story of his being starved by his wife during his last illness.

The frescos in the Cappella Bufalini were engraved in ten plates by Fran. Giangiacomo, and published by the Calcografia Camerale of Rome. The Siena library series were engraved by Faucci in the last century, and more recently by Lasinio. Neither set is remarkable for fidelity or spirit. The Siena frescos and those at Spello have been published in chromo-lithograph by the Arundel Society of London.

Pinturicchio's worth as a painter has been for the most part undervalued, partly owing to the very strong prejudice and dislike which tinges Vasari's biography of him. Even recent writers, such as Crowe and Cavalcaselle, have hardly done him justice. A fairer estimate of his position in the history of art is given by Vermiglioli, *Memorie di Pinturicchio*, Perugia, 1837; and in the valuable notes and appendix of Milanesi's edition of Vasari, iii. p. 493–531, Florence, 1878. See also Schmarsow, *Raphael und Pinturicchio in Siena*, Stuttgart, 1880, and *Pinturricchio in Rom*, Stuttgart, 1882, both well illustrated by photolithography. (J. H. M.)

PINZON, a family of wealthy Spanish navigators, of Palos de Moguer, in Andalusia, three members of which—Alonzo, Francesco, and Vicente, brothers—were associated with Columbus in his great discovery.

Martin Alonzo Pinzon, born about the middle of the 15th century, gave material assistance to Columbus in carrying out his project. In the expedition of 1492 Alonzo commanded the "Pinta," on board of which his brother Francesco was pilot; another brother, Vicente Yañez, had command of the "Nina." It was at Alonzo's persuasion that on October 7th the course of the expedition was changed to the southwest; the island of Guanahani or San Salvador, four days after, was sighted. On November 21, off the coast of Cuba, Alonzo separated himself from the expedition, and crowded sail to the westward, hoping to be the first to arrive at the land of gold of which they had heard the natives speak. After an absence of six weeks he rejoined Columbus, who accepted the excuses he gave for his absence. On the return journey Alonzo again separated from his leader, probably by design, and when Columbus arrived at Palos on March 15, 1493, he learned that Alonzo had already landed at Bayona in Galicia. If his object was to forestall Columbus and obtain the credit of being the discoverer of the New World his intentions were foiled; he was refused the audience which he craved of the sovereigns, and very shortly after died, it is supposed of chagrin. Even although it could be proved that Alonzo's intentions were dishonorable, we should remember that it was largely through his liberality that Columbus was enabled to carry out his immortal voyage.

Vicente Yañez Pinzon, who commanded the "Nina," also gave Columbus material help, and remained loyal to his leader throughout. In after years he made important discoveries on his own account. In 1499 he sailed with four caravels across the Atlantic to the southwest, and on January 20, 1500, he struck the South American continent at Cape S. Agostinho, its most easterly projection, three months before the Portuguese navigator Cabral reached Brazil, the discovery of which is generally attributed to him. Proceeding southwards a short distance, he then turned north, followed the coast to the northwest and went as far at least as what is now Costa Rica. After touching at Hayti, and losing two of his vessels among the Bahamas, Vicente returned to Palos in the end of September, 1500. Although concessions were made to him and he was created governor of the newly discovered lands by Ferdinand and Isabella, he does not seem to have ever taken possession. In 1508 we find Vicente sailing with Juan Diaz de Solis along the east coast of South America, in their attempt to find an opening towards the west that would conduct them to the Spice Islands. He did not get beyond the 40th degree of S. latitude, about the mouth of the Rio Negro, having passed the mouth of the La Plata without recognizing it. After 1523 all traces of Vicente are lost.

Navarrete, *Coleccion de Viajes*; Humboldt, *Geography of the New World*; Washington Irving's *Columbus* and *Companions* *of Columbus;* bibliography in Joaquin Caetana da Silva's *L'Oyapoç et L'Amazone;* Peschel, *Geschichte des Zeitalters der Entdeckungen.*

PIOMBO, SEBASTIANO DEL. See SEBASTIANO.

PIOTRKÓW, the chief town of a government of the same name in Russian Poland and formerly the seat of the high court of Poland, is situated on the railway from Warsaw to Vienna, 90 miles by rail to the southwest of the capital, 5 miles to the west of the river Pilica. Ten years ago it was a poor town of 17,000 inhabitants, but it has grown during the last few years, partly as the seat of the provincial administration and partly in consequence of the development of trade. In April, 1882, it had 23,050 inhabitants, including 3,000 military. Its manufactures are still insignificant; it has a few flour-mills, saw-mills, soap-works and breweries.

PIOZZI, HESTER LYNCH (1741-1821), the daughter of John Salisbury, of Bodville, Carnarvonshire, was born there, as it would appear from a protracted dispute between Croker and Macaulay, 27th January, 1741. After an education which extended considerably beyond that given to most ladies of her period—for she was acquainted with the learned languages as well as with French, Italian and Spanish—she was married in 1763 to Henry Thrale, a brewer of Southwark, whose house was at Streatham on the southeast corner of Tooting Beck Common. In this retreat she drew around her many of the most distinguished men of letters of the age. She was introduced to Johnson by Arthur Murphy in the year after her marriage and for nearly twenty years the sage remained on the closest intimacy with her. He travelled with them in Wales in 1774 and visited France in their company in 1775. Boswell's first visit to Streatham took place in October, 1769. Madame d'Arblay was first received there in August, 1778. In spite of this intercourse with the principal writers of the day troubles grew upon her in her married life. Her talents were not appreciated by her husband; he was always ill and frequently in pecuniary anxiety; and when children were born to her they often succumbed to sickness. After some years' illness Mr. Thrale died on April 4, 1781, and as the brewery in the borough sold for £135,000, the widow found herself amply provided for. At the time of Mr. Thrale's death Dr. Johnson was in declining health, and he soon began to think himself slighted, nor was his indignation abated at the announcement in the spring of 1783 of her engagement to Piozzi, an Italian musician. For a time the engagement was broken off, but it was quickly resumed, and on the 25th of July, 1784, they were married. The union provoked the resentment of her children and the undying denunciations of Dr. Johnson; but, when her husband was found to be a man of quiet and inoffensive manners and a careful guardian of his wife's resources, her children acquiesced in the marriage and most of her friends returned to her. Baretti, always her enemy, abused her, and Boswell ridiculed her, but her character has survived the insinuations of the one and the open malevolence of the other, as well as the satiric attacks of Peter Pindar. Piozzi died of gout at Brynbella, March, 1809, and from that time his widow's life was chiefly spent in the social circles of Bath and Clifton or in the retirement of Penzance. When long past seventy she took a fancy to William Augustus Conway, the actor, and the "love letters" which she wrote to him have been published with a catchpenny title. She died at Clifton, 2d May, 1821.

Mrs. Piozzi was bright and witty and possessed of manners which, if not refined, never failed to attract. Several of her literary publications have long since perished from want of vitality, but her little poem of "The Three Warnings" forms a part of most selections of English poetry. Her *Anecdotes of Dr. Johnson*, now a scarce book, are contained, "as she herself gave them to the world," in the concluding volume of Napier's *Johnson* (1884), and her notes to Wraxall's *Historical Memoirs* are reprinted in the 1884 edition of that work. The *Anecdotes* and the *Letters to and from Dr. Johnson* are inferior in interest only to the work of Boswell. Two editions of the *Autobiography* of Mrs. Piozzi, under the editorship of Abraham Hayward, have been issued, and the Rev. Edward Mangin published in 1833, under the disguise of "by a friend," a thin volume of *Piozziana.* Her features are reproduced in the lady's countenance in Hogarth's picture of the Lady's Last Stake.

PIPE (see MUSIC, vol. xvii. p. 84; and ORGAN, *ib.* p. 853). Strutt, in his *Sports and Pastimes of the People of England*, gives representations of the pipe and tabor as used in England in the 14th century to accompany a dancing dog, a cock on stilts, a horse rearing, etc. From the drawings we cannot ascertain the nature of the pipe represented. We may, however, suppose it to have been similar to the *galoubet* used in France, along with the tabor, from a very remote period. This galoubet is a small instrument of the flageolet kind. Its use for more than the last two centuries has been confined to Provence. It has only three finger-holes and is played with the left hand, whilst the right beats the tabor, which is attached to the performer. The compass of the galoubet is two octaves and a tone from D on the third line of the treble clef up to E *in altissimo*. Great skill is required to bring out all the sounds of its compass. Some of the players on this small and imperfect instrument are said to be so dexterous as to be able to perform upon it very difficult pieces of music composed for other instruments, such as the violin, etc. It is always accompanied by the tabor, which is a small drum of a cylindrical form and rather longer and narrower in its relative proportions than the common drum. In the last centuries several books of instruction were published at Paris by distinguished performers on the galoubet.

PIPE, TOBACCO. The smoking of tobacco in pipes is a custom which prevailed in America for a period of unknown duration previous to the discovery of that continent by Columbus. The most ancient pipes of which remains exist have been found in mounds or tumuli called pipe mounds, principally in the States of Ohio, Indiana, Illinois and Iowa. These mound pipes, which are carved in porphyry and other hard stones, are very uniform in type. The pipe cut out of a single piece of stone, consists of a slightly convex platform or base, generally from 3 to 4 inches in length, and about an inch broad, with the bowl on the centre. A fine hole is pierced from one end of the platform to the bottom of the bowl, the opposite end being obviously for holding in the hand while the pipe is being smoked. In the commonest forms the bowl is a simple cylinder or urn (Fig. 1), but in many cases remarkable artistic skill has been displayed in carving the bowls into miniature figures of birds, mammals, reptiles and human heads, often grotesque and fantastic, but always vigorously expressed (Fig. 2). These mound or platform pipes with carved human and animal forms are objects of the highest ethnographic interest and importance, being among the most characteristic remains of the ancient inhabitants of the Mississippi valley. The wide area over which they, as well as remains of baked clay pipes, are found throughout the American continent testifies to the universal prevalence of smoking in the pre-Columbian era. Many of the ancient clay

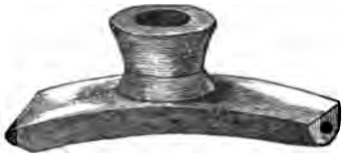

FIG. 1.—"Monitor" Pipe.

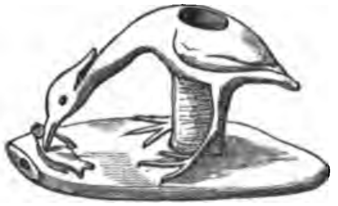

FIG. 2.—Heron Pipe.

pipes found in Mexico, etc., are elaborately moulded and ornamented, while others show considerable similarity to the early clay pipes of Europe. Among the North American Indian tribes the tobacco pipe occupies a position of peculiar symbolic significance in connection with the superstitious rites and usages of the race. The calumet, peace pipe, or medicine pipe is an object of the most profound veneration, entrusted to the care of a highly honored official, and produced and smoked with much ceremony only on occasions of great importance and solemnity. It is remarkable that, whilst the most ancient American pipes had no separate stem, it is the stem only of the medicine pipe which is the object of veneration among the Indians, the bowl used being a matter of indifference. The favorite material for Indian pipe bowls is the famous red pipe stone (catlinite), a fine grained easily-worked stone of a rich red color of the Côteau des Prairies, west of the Big Stone Lake in Dakota. The quarries were formerly neutral ground among the warring Indian tribes, many sacred traditions being associated with the locality and its product (see Longfellow's *Hiawatha*, i.). The Babeen Indians of the British-Columbian coast carve from a soft blue clay slate very elaborate and massive pipes with intricate pierced work and fantastic animal forms, the pipe tube being pierced from some protruding part of the sculpture.

There is considerable dispute as to whether pipes for smoking were at all known in Europe previous to the discovery of America. That tobacco-smoking was unknown is certain; but pipes of iron, bronze, and clay have been so frequently found associated with Roman remains and other antiquities as to lead many authorities to maintain that such pipes must have been anciently used for burning incense or for smoking aromatic herbs or hemp. Throughout Great Britain and Ireland small clay pipes are frequently dug up, in some instances associated with Roman relics. These are known amongst the people as elfin, fairy, or Celtic pipes, and in some districts supernatural agencies have been called in to account for their existence. The elfin pipes have commonly flat broad heels in place of the sharp spur now found on clay pipes, and on that flat space the mark or initials of the maker is occasionally found. There is no reason to believe that these pipes are older than the 17th century. The introduction of the tobacco pipe into Europe is generally ascribed to Ralph Lane, first governor of Virginia, who in 1586 brought an Indian pipe to Sir Walter Raleigh, and taught that courtier how to use the implement. The pipe makers of London became an incorporated body in 1619, and from England the other nations of Europe learned the art of making clay pipes. Baillard, in his *Discours du Tabac* (1668) says of the English—"Ces derniers ont inventé les pipes de terre cuite, qui ont cours aujourd'huy par tout le monde."

The habit of smoking with pipes spread with incredible rapidity; and among the various peoples the pipe assumed special characteristics, and its modifications became the medium of conveying social, political and personal allusions, in many cases with no little artistic skill and humor. The pipe also became the object of much inventive ingenuity, and it varied as greatly in material as in form—wood, horn, bone, ivory, stone, precious and other metals, amber, glass, porcelain, and above all clay being the materials employed in various forms. By degrees pipes of special form and material came to be associated with particular people, so that now we have the elongated painted porcelain bowls and pendulous stem of the German peasantry, the red clay bowl and long cherry wood stem of the Turk, and the very small metallic bowl and cane stem of the Japanese, etc. The most luxurious and elaborate form of pipe is the Persian *ḳalyún*, hookah, or water tobacco pipe. This consists of three pieces, the head or bowl, the water bottle or base, and the snake or long flexible tube ending in the mouthpiece. The tobacco, which must be previously prepared by steeping in water, is placed in the head and lighted with live charcoal, a wooden stem passes from its bottom down into the water which fills the base, and the tube is fitted to a stem which ends in the bottle above the water. Thus the smoke is cooled and washed before it reaches the smoker by passing through the water in the bottle, and by being drawn through the coil of tube frequently some yards in length. The bottles are in many cases made of carved and otherwise ornamented cocoa-nut shells, whence the apparatus is called *nárgíla*, from *nárgíl*, a cocoanut. Silver, gold, damascened steel, and precious stones are freely used in the making and decoration of these pipes for wealthy smokers.

Pipe Manufacture.—The regular pipe-making industries divide into many branches, of which the more important are the clay pipe, meerschaum (real and artificial), and wooden bowl trades. Clay pipes are made in prodigious numbers by hand labor with an iron mould and a steel wire for forming the tube of the stem. Pipe-moulding is a very simple operation in pottery, and the work is performed with astonishing celerity. A number of machines have been devised for automatic pipe-moulding; but the manual operations are so rapid and inexpensive that there is little margin for saving by the substitution of machinery. The pipes are very lightly fired so as to keep them soft and porous; and so cheaply made are they that the commoner kinds can be retailed at a profit for a farthing each. The principal centre of the clay pipe industry is at Broseley in Staffordshire, where the trade has been established since the early part of the 17th century. Meerschaum pipes (see MEERSCHAUM, vol. xv. p. 834) are the expensive luxury of the European smoker, and large sums of money are occasionally expended on the artistic treatment of the meerschaum bowl or on the adornment of its adjuncts. The common meerschaum is generally provided with a mouthpiece of amber, but modern ingenuity has succeeded in providing a remarkably clever imitation of both substances so that a large proportion of the so-called meerschaum pipes are factitious. .The headquarters of the meerschaum pipe industry is at Ruhla in Thuringia, and in connection with an official inquiry into the German tobacco trade in 1879 the average production of pipes and pipe adjuncts in that district for several years was ascertained. Of pipe bowls there were made yearly 540,000 genuine meerschaums; 5,400,000 artificial meerschaums; 4,800,000 wooden heads; 9,600,000 common porcelain bowls (the favorite of the German peasant); and 2,700,000 fine clay or lava bowls. Further the trade included 15,000,000 pipe stems or tubes of various materials; 19,200,000 adjuncts, such as flexible tubes, chains, tops, etc.; 144,000 pipe cases; 9,600,000 mouthpieces and cigar-holders of amber, horn, meerschaum, wood, etc.; and finally 15,000,000 complete pipes of various materials. The whole annual value of the industry is estimated at £1,000,000 [$4,860,000] sterling. The favorite wooden pipe generally known as a briar-wood or briar-root pipe is really made from the roots of the tree heath, *Erica arborea* (French, *bruyère*), principally obtained on the hills of the Maremma and taken thence to Leghorn. There the roots are shaped into blocks each suitable for a pipe, the cutting of the wood so as to avoid waste requiring considerable skill. These blocks are simmered in a vat for twelve hours, which gives them the much appreciated yellowish-brown hue of a good "briar-root." So prepared the blocks are exported for boring and finishing to St. Claude (Jura) in France and to Nuremberg, the two rival centres of the wooden pipe trade. (J. PA.)

PIPE-FISHES, small marine fishes, which with the Sea-horses form a distinct family, *Syngnathidæ*, of the

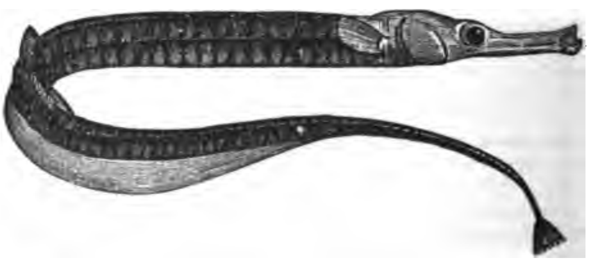

FIG. 1.—*Syngnathus acus*, male, with sub-caudal pouch.

order of Lophobranchiate Fishes (see ICHTHYOLOGY, vol. xii. p. 666). The name is derived from the peculiar form of their snout, which is produced into a more or less long tube, ending in a narrow and small mouth which opens upwards and is toothless. The body and tail are long and thin, snake-like, encased in hard integuments which are divided into regularly arranged segments. This dermal skeleton shows several longitudinal ridges, so that a vertical section through the body represents an angular figure, not round or oval as in the majority of other fishes. A dorsal fin is always present, and the principal (in some species, the only) organ of locomotion. The ventral fins are as constantly absent, and the other fins may or may not be developed. The gill-openings are extremely small, and placed near the upper posterior angle of the gill-cover. Pipe-fishes are abundant on such coasts of the tropical and temperate zones as offer by their vegetation shelter to these defenceless creatures. They are very bad swimmers, slowly moving through the water by means of the rapid undulatory movement of the dorsal fin. Their tail, even when provided with a caudal fin, is of no use in swimming, and not prehensile as in sea-horses. Specimens, therefore, are not rarely found at a great distance from land, having been resistlessly carried by currents into the open ocean; one species, *Syngnathus pelagicus*, has an extraordinarily wide range over the tropical seas, and is one of the common fishes inhabiting the vegetation of the Sargasso Sea. In pipe-fishes the male is provided with a pouch—in some species on the abdomen, in others on the lower side of the tail—in which the ova are lodged during their development. This marsupial pouch is formed by a fold of the skin developed from each side of the trunk or tail, the free margins of the fold being firmly united in the median line throughout the period during which the eggs are being hatched. When the young are hatched the folds separate, leaving a wide slit, by which the young gradually escape when quite able to take care of themselves. Nearly a hundred different species of pipe-fishes are known, of which *Siphonostoma typhle*, *Syngnathus acus* (the Great Pipe-fish, up to 18 inches in length), *Nerophis æquoreus* (Ocean Pipe-fish) *Nerophis ophidion* (Straight-nosed Pipe-fish), and *Nerophis lumbriciformis* (Little Pipe-fish) are British species. The last three are destitute of a caudal fin.

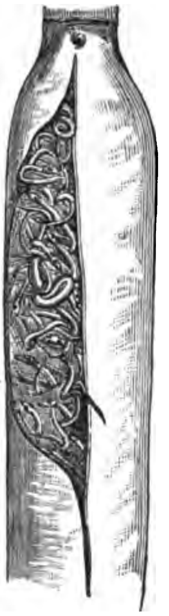

FIG. 2.—Sub-caudal pouch of *Syngnathus acus*, with the young ready to leave the pouch. One side of the membrane of the pouch is pushed aside to admit of a view of its interior. (Natural size.)

PIPIT, French *Pipit*, cognate with the Latin *Pipio* (see PIGEON, *supra*, p. 93), the name applied by ornithologists to a group of birds having a great resemblance both in habits and appearance to the LARKS (vol. xiv. p. 315), with which they were formerly confounded by systematists as they are at the present day in popular speech, but differing from them in several important characters, and, having been first separated to form the genus *Anthus*, which has since been much broken up, are now generally associated with the WAGTAILS (*q.v.*) in the Family *Motacillidæ*.[1] Pipits, of which over fifty species have been described, occur in almost all parts of the world, but in North America are represented by only two species—*Neocorys spraguii*, the Prairie-Lark of the northwestern plains, and *Anthus ludovicianus*, the American Titlark, which last is very nearly allied to the so-called Water-Pipit of Europe, *A. spipoletta*. To most English readers the best known species of Pipit is the Titlark or Meadow-Pipit, *A. pratensis*, a bird too common to need description, and abundant on pastures, moors, and uncultivated districts generally; but in some localities the Tree-Pipit, *A. trivialis*, or *A. arboreus* of some authors, takes its place, and where it does so it usually attracts attention by its loud song, which is not unlike that of a Canary-bird, but delivered (as appears to be the habit of all the Pipits) on the wing and during a short circuitous flight. Another species, the Rock-Lark, *A. obscurus*, scarcely ever leaves the sea-coast and is found almost all round the British Islands. The South African genus *Macronyx*, remarkable for the extreme length of its hind claw, is generally placed among the Pipits, but differs from all the rest in its brighter coloration, which has a curious resemblance to the American genus *Sturnella*, (see ICTERUS, vol. xii. p. 735), though the bird is certainly not allied thereto. (A. N.)

PIPPI, GIULIO (*c.* 1492–1546), the head of the Roman school of painting in succession to Raphael. This prolific painter, modeller, architect, and engineer is currently named GIULIO (or JULIO) ROMANO, from the place of his birth—Rome, in the Macello de' Corbi. His name in full was Giulio di Pietro di Filippo de' Giannuzzi,—Giannuzzi being the true family name, and Pippi (which has practically superseded Giannuzzi) being an abbreviation from the name of his grandfather Fillipo.

The date of Giulio's birth is a little uncertain. Vasari, who knew him personally, speaks of him as fifty-four years old at the date of his death, 1st November, 1546; thus he would have been born in 1492. Other accounts assign 1498 as the date of birth. This would make Giulio young indeed in the early and in such case most precocious states of his artistic career, and would show him as dying, after an infinity of hard work, at the comparatively early age of forty-eight.

Giulio must at all events have been quite youthful when he first became the pupil of Raphael, and at Raphael's death in 1520 he was at the utmost twenty-eight years of age. Raphael had loved him as a son, and had employed him in some leading works, especially in the Loggie of the Vatican; the series there popularly termed "Raphael's Bible" is done in large measure by Giulio,—as for instance the subjects of the Creation of Adam and Eve, Noah's Ark, and Moses in the Bulrushes. In the saloon of the "Incendio del Borgo," also, the figures of Benefactors of the Church (Charlemagne, etc.) are Giulio's handiwork. It would appear that in subjects of this kind Raphael simply furnished the design, and committed the execution of it to some assistant, such as Giulio,—taking heed, however, to bring it up, by final retouching, to his own standard of style and type. Giulio at a later date followed out exactly the same plan; so that in both instances inferiorities of method, in the general blocking-out and even in the details of the work, are not to be precisely charged upon the *caposcuola*. Amid the multitude of Raphael's pupils, Giulio was eminent in pursuing his style, and showed universal aptitude; he did, among other things, a large amount of architectural planning for his chief. Raphael bequeathed to Giulio, and to his fellow-pupil Gianfrancesco Penni ("Il Fattore"), his implements and works of art; and upon them it devolved to bring to completion the vast fresco-work of the "Hall of Constantine" in the Vatican—consisting, along with much minor matter, of the four large subjects, the Battle of Constantine, the Apparition of the Cross, the Baptism of Constantine, and the Donation of Rome to the Pope. The two former compositions were executed by Pippi, the two latter by Penni. The whole of this onerous undertaking was completed within a period of only three years—which is the more remarkable as, during some part of the interval since Raphael's decease, the Fleming, Adrian VI., had been pope, and his anti-æsthetic pontificate had left art and artists almost in a state of inanition. Clement VII. had now, however, succeeded to the popedom. By this time Giulio was regarded as the first painter in Rome; but his Roman career was fated to have no further sequel.

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[1] Pipits can always be distinguished from Larks by having the hind part of the "tarsus" undivided, while the Larks have it scutellated.

Towards the end of 1524 his friend the celebrated writer Baldassar Castiglione seconded with success the urgent request of the duke of Mantua, Federigo Gonzaga, that Giulio should migrate to that city, and enter the duke's service for the purpose of carrying out his projects in architecture and pictorial decoration. These projects were already considerable, and under Giulio's management they became far more extensive still. The duke treated his painter munificently as to house, table, horses, and whatever was in request; and soon a very cordial attachment sprang up between them. In Pippi's multifarious work in Mantua three principal undertakings should be noted. (1) In the Castello he painted the History of Troy, along with other subjects. (2) In the suburban ducal residence named the Palazzo del T (this designation being apparently derived from the form of the roads which led towards the edifice) he rapidly carried out a rebuilding on a vastly enlarged scale,—the materials being brick and terra-cotta, as there is no local stone,—and decorated the rooms with his most celebrated works in oil and fresco painting—the story of Psyche, Icarus, the Fall of the Titans, and the portraits of the ducal horses and hounds. The foreground figures of Titans are from 12 to 14 feet high; the room, even in its structural details, is made to subserve the general artistic purpose, and many of its architectural features are distorted accordingly. Greatly admired though these pre-eminent works have always been, and at most times even more than can now be fully ratified, they have suffered severely at the hands of restorers, and modern eyes see them only through a dull and deadening fog of renovation. The whole of the work on the Palazzo del T, which is of the Doric order of architecture, occupied about five years. (3) Pippi recast and almost rebuilt the cathedral of Mantua; erected his own mansion, replete with numerous antiques and other articles of vertu; reconstructed the street architecture to a very large extent, and made the city, sapped as it is by the shallows of the Mincio, comparatively healthy; and at Marmiruolo, some five miles distant from Mantua, he worked out other important buildings and paintings. He was in fact, for nearly a quarter of a century, a sort of Demiurgus of the arts of design in the Mantuan territory.

Giulio's activity was interrupted but not terminated by the death of Duke Federigo. The duke's brother, a cardinal who became regent, retained him in full employment. For a while he went to Bologna, and constructed the façade of the church of S. Petronio in that city. He was afterwards invited to succeed Antonio Sangallo as architect of St. Peter's in Rome,—a splendid appointment, which, notwithstanding the strenuous opposition of his wife and of the cardinal regent, he had almost resolved to accept, when a fever overtook him, and, acting upon a constitution somewhat enfeebled by worry and labor, carried him off on 1st November, 1546. He lies buried in the church of S. Barnaba in Mantua. At the time of his death Giulio enjoyed an annual income of more than 1000 ducats, accruing from the liberalities of his patrons. He left a widow, and a son and daughter. The son, named Raffaello, studied painting, but died before he could produce any work of importance; the daughter, Virginia, married Ercole Malatesta.

Wide and solid knowledge of design, combined with a promptitude of composition that was never at fault, formed the chief motive power and merit of Giulio Romano's art. Whatever was wanted, he produced it at once, throwing off, as Vasari says, a large design in an hour; and he may in that sense, though not equally so when an imaginative or ideal test is applied, be called a great inventor. It would be difficult to name any other artist who, working as an architect, and as the plastic and pictorial embellisher of his architecture, produced a total of work so fully and homogeneously his own; hence he has been named "the prince of decorators." He had great knowledge of the human frame, and represented it with force and truth, though sometimes with an excess of movement; he was also learned in other matters, especially in medals, and in the plans of ancient buildings. In design he was more strong and emphatic than graceful, and worked a great deal from his accumulated stores of knowledge, without consulting nature direct. As a general rule, his designs are finer and freer than his paintings, whether in fresco or in oil—his easel pictures being comparatively few, and some of them the reverse of decent; his coloring is marked by an excess of blackish and heavy tints.

Giulio Romano introduced the style of Raphael into Mantua, and established there a considerable school of art, which surpassed in development that of his predecessor Mantegna, and almost rivalled that of Rome. Very many engravings—more than three hundred are mentioned—were made contemporaneously from his works; and this not only in Italy, but in France and Flanders as well. His plan of entrusting principally to assistants the pictorial execution of his cartoons has already been referred to; Primaticcio was one of the leading coadjutors. Rinaldo Mantovano, a man of great ability who died young, was the chief executant of the Fall of the Giants; he also coöperated with Benedetto Pagni da Pescia in painting the remarkable series of horses and hounds, and the story of Psyche. Another pupil was Fermo Guisoni, who remained settled in Mantua. The oil pictures of Giulio Romano are not generally of high importance; two leading ones are the Martyrdom of Stephen, in the church of that saint in Genoa, and a Holy Family in the Dresden Gallery. Among his architectural works not already mentioned is the Villa Madama in Rome, with a fresco of Polyphemus, and boys and satyrs; the Ionic façade of this building may have been sketched out by Raphael.

Vasari gives a pleasing impression of the character of Giulio. He was very loving to his friends, genial, affable, well-bred, temperate in the pleasures of the table, but liking fine apparel and a handsome scale of living. He was good-looking, of middle height, with black curly hair and dark eyes, and an ample beard; his portrait, painted by himself, is in the Louvre. (W. M. R.)

PIPPIN, or **Pepin**, a name borne by several members of the Carlovingian family. (1) Pippin of Landen, or Pippin the Old, mayor of the palace, died 639. (2) His grandson, Pippin of Heristal, the father of Charles Martel, died 714. (3) Martel's son, Pippin the Short, king of the Franks, died 768. See, for these three, FRANCE, vol. ix. p. 468 *sq.* (4) Pippin, son of Charles the Great (776–810), was his father's deputy in Italy, and as such was anointed "king for Italy" by Pope Adrian I. in 781. (5) Pippin, second son of Louis the Pious, appointed king of Aquitaine by his father in 817, died in 838 after a reign spent in the family conflicts of the period. (6) The son of the last-named Pippin was called to the throne by the Aquitanians on his father's death, and maintained himself with varying fortunes against Charles the Bald, to whom Louis had given the vacant throne, till in 864 he was taken by treachery and soon died in confinement.

PIQUA, a city of Miami county, Ohio, U. S., is situated in a rich agricultural district on the Miami river, on the Miami and Erie Canal, and on the Pittsburgh, Cincinnati and St. Louis and the Cincinnati and Michigan railways, about 90 miles N. by E. of Cincinnati. Besides a large agricultural trade the city has woollen manufactures, iron foundries, and agricultural machine works. The population, 3277 in 1850, was 5967 in 1870 and 6131 in 1880.

PIQUET, a game at cards. The name, of uncertain etymology, is probably from *pique* (the spade suit). The Germans had formerly a *Schwerter* game, the packs used being like piquet packs. The *pique* of French cards corresponds to the *spade* (sword) of Italian and to the *espadas* of Spanish cards. Hence *piquet* may be the *sword game.*

It seems likely that piquet is a development of *ronfa*, a game mentioned by Berni in 1526; *la ronfle* (included in Rabelais's list, *circa* 1530) may be regarded as the same game. The point at piquet was anciently called *ronfle*.

The Spanish name of the game was *cientos* (*centum*, a hundred). Piquet was played in England under the name of *cent*, or *sant*, probably as early as 1550 (contemporaneously with the marriage of Mary to Philip of Spain). About the middle of the 17th century (shortly after the marriage of Charles I. to Maria Henrietta of France) the name cent was dropped in England, and the French equivalent, piquet, adopted.

Piquet is played by two persons, with a pack of thirty-two cards,—the sixes, fives, fours, threes, and twos being thrown out from a complete pack. Until recently the *partie* was the best of five games of a hundred up (a player not obtaining fifty losing a double game). But now the *partie* is generally determined in six hands, the player making the largest aggregate score being the winner. The number of points won is the difference between the two scores, with a hundred added for the game. If, however, the loser fails to make a hundred in six hands, the number of points won is the two scores added together, with a hundred for the game. Piquet played in this way is called *Rubicon Piquet*.

The dealer (see "Laws") deals twelve cards to his adversary and twelve to himself, by two at a time or by three at a time to each alternately. He then places the undealt cards, called the *stock*, face downwards on the table.

The players now look at their hands and *discard*, *i. e.*, put out, such cards as they deem advisable, and take in an equivalent number from the stock. The elder hand (non-dealer) may exchange five or any less number. He separates his discard from his hand, places it face downwards on the table, and takes from the top of the stock the number discarded. If he discards less than five, he must state how many he leaves. He is entitled to look at cards he leaves, replacing them face downwards on the top of the stock.

The younger hand may exchange three cards or any less number. If the elder hand leaves any cards, the younger may exchange as many as remain in the stock, discarding an equal number. He takes his cards from the top of the stock, including any left by the elder hand. If the younger hand leaves any cards, he announces the number left. He has the option of looking at cards he leaves. If he looks at them, he must show them to the elder hand, after the elder has named the suit he will first lead, or has led a card. If the younger hand elects not to look at the cards left the elder cannot see them. The younger hand must make his election before he plays to the card first led, or, if so required, after the dealer has named the suit he will first lead.

Each player may examine his own discard at any time during the hand; but he must keep it separate from his other cards.

The elder hand next *calls* his point, sequences, and quatorzes or trios, and, if *good*, scores for them.

The *point* must be called first or the right to call a point is lost. It is scored by the player who announces the suit of greatest strength, valued thus: ace, 11; court cards, 10 each; other cards, the number of pips on each. Thus, if the elder hand's best suit is ace, king, knave, nine, eight, he calls "five cards." If the younger hand has no suit of five cards, he says "good." The elder hand then says "in spades," or whatever the suit may be, or shows his point face upwards. If the younger hand has a suit of more than five cards, he says "not good." If the younger hand has also five cards, he says "equal" or "what do they make?" when the elder calls "forty eight" (or "making eight," short for forty-eight). The younger must not inquire what the point makes unless he has an equal number of cards. If the younger hand's five cards make less than forty-eight he says "good;" if exactly forty-eight, he says "equal;" if more than forty-eight, he says "not good."

The player whose point is good reckons one for each card of it; if the points are equal neither player scores for point.

Sequences are usually called next, the elder hand stating what his best sequence is, and the younger saying, "good," "equal," or "not good," as in the case of the point. Any three or more consecutive cards of the same suit held in hand constitute a sequence. The order of the cards is as follows:—ace (highest), king, queen, knave, ten, nine, eight, seven (lowest). A sequence of three cards is called a *tierce*; of four, a *quart*; of five, a *quint*; of six, a *sixième*; of seven, a *septième*; of eight, a *huitième*. A tierce of ace, king, queen is called a *tierce major*; a tierce of king, queen, knave is called *tierce to a king* (and so on for other intermediate sequences according to the card which heads them); a tierce of nine, eight, seven is called a *tierce minor*. Sequences of four or more cards follow the same nomenclature, *e. g.*, ace, king, queen, knave is a quart major; knave, ten, nine, eight is a quart to a knave; and so on.

A sequence of a greater number of cards is good against a sequence of a smaller number; thus, a quart minor is good against a tierce major. As between sequences containing the same number of cards, the one headed by the highest card is good; thus, a quart to a queen is good against a quart to a knave. Only identical sequences can be equal.

The elder hand announces, say, a quint major. If the younger has a sixième he says "not good;" if he has a quint major he says "equal;" if he has a lower sequence, or no sequence, he says "good." The player whose sequence is good reckons one for each card of it, and ten in addition for quints or higher sequences. Thus a tierce counts three; a quart, four; a quint, fifteen (5+10); a sixième, sixteen; and so on. If the elder hand's sequence is good, he names the suit, or shows it face upwards.

If the highest sequence (or the sequence first called) is good, all lower sequences can be reckoned, notwithstanding that the adversary has a sequence of intermediate value. For example, A has a quart to a queen (good), and a tierce minor. He calls and reckons seven, notwithstanding that B has a quart to a knave. B's quart counts nothing.

If the highest sequence is equal, neither player scores anything for sequence, even though one player may hold a second sequence of equal or inferior value.

Quatorzes are composed of four aces, four kings, four queens, four knaves, or four tens; *trios* of three of any of these. They are called and reckoned as before, except that here there can be no equality. A quatorze, if good, reckons fourteen; a trio, if good, reckons three. Any quatorze is good against a trio; if each player has a quatorze the highest is good; the same if each has a trio. As in the case of sequences, anything that is good enables the player to reckon all smaller quatorzes or trios in his hand. A quatorze or trio is called thus:—the elder hand says "four aces," "three queens," or as the case may be; the younger replies "good" or "not good," as before. When a player calls a trio of a denomination of which he might hold a quatorze, the adversary is entitled to be informed which card is not reckoned. Thus A, who might hold four kings, calls "three kings;" B says "good:" A says "I do not reckon the king of diamonds," or whichever king it may be that he has put out or suppresses.

When the elder hand has done calling he leads a card. Before playing to this card, the younger hand reckons all that he has good, stating of what cards his claims are composed, or showing the cards claimed for.

The next step is *playing* the hands. The elder hand leads any card he pleases; the younger plays to it. The younger hand must follow suit if able; otherwise he may play any card he thinks fit. The two cards thus played constitute a *trick*. The trick is won by the higher card of the suit led. It is not compulsory to win the trick if able to follow suit without. The winner of the trick leads to the next, and so on until the twelve cards in hand are played out.

During the play of the hands the leader counts one for each card led, whether it wins the trick or not. If the leader wins the trick, his adversary reckons nothing that trick; but if the second player wins the trick he also counts one; and so on. The winner of the last trick counts two instead of one.

The tricks are left face upwards on the table, in front of the player who wins them. They may be examined by either player at any time.

If each player wins six tricks the cards are *divided*, and there is no further score. If one player wins more than six tricks he wins *the cards*, and adds ten to his score. If one player wins every trick, he wins a *capot*, and scores forty for the cards, instead of ten.

During the play of the hand, a player is entitled to be informed as to any cards his adversary holds which he has reckoned as good, or has declared to be equal. A player may require his adversary to exhibit any such cards; but the usual practice is to reply to all necessary questions with regard to them, such as "how many of your point?" meaning how many in hand, "how many of your tierce?" and so on.

During the progress of the hand each player repeats aloud the amount of his score for the time being (see example). At the end of the hand the number scored is recorded on a ruled card. Each player has a card and writes down the scores of both himself and his opponent. At the end of the sixth hand, the totals are recorded, and the necessary subtraction or addition made. The scores are then compared. If there is any difference in the written scores, a player's score of his own hand is deemed to be the correct one.

Example.—A (elder hand) has dealt him ace, king, knave of spades; ace, queen, knave, eight of hearts; knave, eight, seven of clubs; and nine, eight of diamonds. He discards king of spades; eight, seven of clubs; and nine, eight of diamonds. He takes in nine, eight of spades; king of hearts; nine of clubs; and king of diamonds.

B (younger hand) has ten, seven of spades; ten, nine, seven of hearts; king, queen, ten of clubs; an ace, queen, knave, ten of diamonds. He discards seven of spades; and nine, seven of hearts. He takes in queen of spades; ace of clubs; and seven of diamonds.

The hand then proceeds thus. A (calls his point) "five cards." B (says) "equal," or "what do they make?"

A "forty-nine," or "making nine." B "good".

A (counting his point) "five" and (counting his sequence, which is good) "a quart major, nine. Three knaves?" B "not good."

A (leads ace of hearts and says) "ten." B "four tens, fourteen, and three queens, seventeen" (plays the ten of hearts).

A (leads the remaining hearts and says) "eleven, twelve, thirteen, fourteen." B (plays seven, ten, knave, queen of diamonds, and repeating his score, says) "seventeen."

A has now five tricks, and in order to win the cards should lead any card but a high spade. He leads king of diamonds, and says "fifteen." B (wins with ace and says) "eighteen," (and then leads the winning clubs, saying) "nineteen, twenty, twenty-one, twenty-two."

A (keeps ace, knave of clubs, and repeating his score says) "fifteen." B (leads queen of spades and says) "twenty-three."

A (wins with ace and says) "sixteen" (and leads knave saying) "eighteen" (and adding ten for the cards) "twenty-eight."

A then writes on his scoring card 28; 23. B writes on his 23; 28. The pack is collected, and the next hand commences.

Three scores (omitted in order to simplify the description of the game) have yet to be mentioned.

Carte Blanche.—If either player has neither king, queen, nor knave in the hand dealt him, he holds *carte blanche*, for which he scores ten. As soon as a player discovers he has a *carte blanche*, he must tell his adversary; this he usually does by saying "discard for *carte blanche*." The adverse discard is then made (as explained under discarding), after which the *carte blanche* is shown by dealing the cards quickly one on top of the other, face upwards on the table.

Pique.—If the elder hand scores, *in hand and play*, thirty or more, before the younger counts anything, he gains a *pique*, for which he adds thirty to his score. For example, A has a quint major, good for point and sequence, and three aces, also good. For these he counts twenty-three in hand. He next leads the quint major (twenty-eight), one of the aces and another card, making him thirty. He then adds thirty for the pique and calls his score "sixty."

Repique.—If a player scores, *in hand alone*, thirty or more, before his adversary reckons anything he gains a *repique*, for which he adds sixty to his score. Thus, point, quint, and quatorze, all good, make thirty-four. A player holding these adds sixty for the repique, and calls his score ninety-four."

The order in which the scores accrue is of importance. For the sake of convenience, the elder hand finishes his reckoning before the younger begins. The scores, however, whether made by the elder or younger hand are *recordable* in the following order:—(1) *carte blanche;* (2) point; (3) sequences; (4) quatorzes and trios; (5) points made in play; (6) the cards. This will often affect a pique or repique. Thus, a pique can only be made by the elder hand, as the one he reckons in play when he leads his first card counts before points subsequently made in play by the younger hand. The younger, therefore, cannot make thirty *in hand and play* before the elder scores one. But the one reckoned by the elder hand when he leads his first card does not prevent his being repiqued, because scores made *in hand* have precedence of points made *in play*. The elder leads his first card and counts for it before the younger reckons, simply as a convenient way of stating that he has nothing *in hand* which is good. Again, say A has a quint (good), a tierce, and a quatorze (good). He scores thirty-two in hand alone; but, if his point is not good, he does not gain a repique, because the younger hand's point is recordable in order before the sequences and quatorze. And again, say A has a *huitième* (good for twenty-six), and a tierce, and leads a card thus reaching thirty in hand and play. B has three tens. The trio reckoning in order before the point made in play by A saves a pique.

Carte blanche, taking precedence of all other scores, saves piques and repiques. It also counts towards piques and repiques. Thus, a player showing *carte blanche*, and having point and quint, both good, would repique his adversary.

A *capot* does not count towards a pique, as the *capot* is not made *in play*. It is added after the play of the hand is over.

A player who reckons nothing that hand as a penalty (see "Laws") is not piqued or repiqued if he holds any cards which, but for the penalty, would have reckoned before his adversary reached thirty.

Equalities do not prevent piques or repiques. A player who has an equal point or sequence scores nothing for it. Therefore if, notwithstanding the equality, a player makes thirty, in hand and play, or in hand, by scores which reckon in order before anything his adversary can count, he gains a pique or a repique.

Hints to Players.—On taking up your hand look for *carte blanche*.

Before discarding, ascertain what there is against you. Thus: if you have knave or ten of a suit, there is no quint against you in that suit.

When discarding, elder hand, your main object is to plan an attack. Younger hand, on the contrary, should guard his weak places and then see if he has a chance of attacking anywhere. Thus, the elder hand may freely unguard kings and queens, or discard whole suits of which he has indifferent cards only. The younger should do just the reverse, keeping guards to kings and queens, and should not leave himself blank of a weak suit, as his small cards may guard high ones taken in.

In most hands, and especially younger hand, it is essential to keep the whole of your best suit for point. Gaining the point makes an average difference of at least ten to the score; and, what is of more consequence, it save piques and repiques.

The cards are next in importance to the point. In discarding you should, when in doubt, take the best chance of dividing or winning the cards. Winning the cards instead of losing them makes a difference of about twenty-three points. Hence, especially elder hand, you should not necessarily keep the longest suit for point, if that suit is composed of low cards, and keeping it involves the discard of high cards from other suits.

As a rule, it is not advisable to leave any cards. The younger hand is at less disadvantage in leaving a card than the elder; for a card left by the elder can be taken by the younger; but a card left by the younger is only excluded from his hand. A card may generally be left when there is a chance of a great score if the cards in hand are not parted with, there being at the same time no pique or repique against you.

It is generally right to keep unbroken suits. Having made up your mind to discard from a given suit, you should throw the whole of it, except (*a*) winning cards; (*b*) guards to kings or queens, especially younger hand; or (*c*) cards which make up a quatorze or trio. It is better to keep cards in sequence than cards not in sequence. Trios should be kept if they can be retained without injury to the hand in other respects; but it is seldom advisable to put out a high card for the sake of keeping a trio of knaves or tens, especially if there is a quatorze against you.

The discard is further effected in the last hand of a *partie* by the state of the score. Thus, if you are a long way behind, and your only chance is a desperate discard, in order to keep cards which may possibly give you a pique or a repique, you may run considerable risk with that object. On the other hand, if you are well ahead, make a safe discard, *i. e.*, one which is likely to win the cards or to keep your adversary back.

When taking in after discarding, count that you leave the full number of cards for the younger hand, the penalty for taking in one of your adversary's cards being that you can reckon nothing that deal. The younger hand should also count that the proper number of cards are in the stock, before he takes in, as, if he mixes one of the elder's cards with his hand, he can reckon nothing that deal.

After taking in and before calling your hand, look through it and your discard to ascertain what remains against you. If there is anything against you which is not called, you will probably be able to judge from this some portion of the discard, and will so be assisted in playing the cards. But implicit reliance must not be placed on this. For experienced players not unfrequently omit to call some small score, such as a tierce, in order intentionally to mislead you. This manœuvre (called *sinking* a score) is especially resorted to when a player has a high card unguarded. In order to induce you to believe that it is guarded, he will put up with the loss of several points in calling, on the chance of recouping himself by afterwards saving or winning the cards in consequence of your misconceiving his discard.

If your adversary calls a point which is not good, you should at once note in which suit it is (or may be), in order to count the hand. If the younger hand admits a point to be good (as regards the number of cards that compose it), the elder should observe whether the younger could possibly have had equal or better in any suit. If so he has probably put out that suit. But it may be that the younger hand, if a good judge of the game, will admit the number of cards of a point to be good when he has an equal number. Thus:—A calls five cards, and B knows, from examining his hand and discard, that there is only one suit in which A can have five cards, and that they make fifty. B has five cards making forty-nine. B should promptly reply "good" although he has five cards himself; because he ought to know that A's five cards are better than his. By saying "equal," he unnecessarily exposes his hand.

In playing the cards, you must be guided a good deal by what your adversary has called, and, to some extent, by what he has not called. You will generally know several cards in the adverse hand, or will be able to mark some that have been put out. Sometimes you will know all the cards. Thus, if the younger hand fails to follow suit to your first lead in which you could only have five cards, it is evident he has put out three cards of that suit, and you know every card in his hand.

Failing direct indications, lead the point, unless you have a small point and there is a tenace in that suit against you.

When playing to the opponent's lead, keep guards to kings and queens. Having the choice between throwing a card you have declared and one you have not, prefer the former.

If you can make a pique, lead your winning cards one after the other, without considering how many of the remaining tricks you will lose. There is one exception to this:—in the sixth hand, if your losing the cards will enable the younger hand to save his rubicon, and your score is such that you can win the *partie* without the pique, you should forego the pique, when by not leading out your winning cards immediately you can divide or win the cards.

When you have five or six tricks and a winning card, lead the winning card, unless certain that your opponent has cards of that suit. By playing otherwise, you risk eleven points for the chance of gaining one for the last trick. This, of course, is liable to a similar exception as the previous case, viz., in the sixth hand with five tricks up, if you must win the cards or the last trick to win the *partie* or to save the rubicon.

In the sixth hand, if a player has scored less than a hundred, he should consider, before calling or playing, whether he can make his aggregate score up to a hundred or more. If he cannot, his object should be to reckon as little as he can, and to prevent his adversary from scoring, by making his point or sequence equal (if possible), and by endeavoring to divide the cards. If he is satisfied he cannot divide the cards, and there is no capot against him, he is at liberty to score two (one for a trick he wins, and one for a card he plays), and to throw his cards down, allowing the adversary to reckon thirteen in play.

On the other hand, a player who is ahead, and who sees his adversary cannot reach a hundred, should endeavor to prevent the declaration of equalities, and, if he cannot win the cards himself, should play to lose them.

During the calling and play of the hand, always keep in mind your adversary's score and satisfy yourself that he does not reckon too many. Mistakes occur, even among the most honorable players. If your adversary reckons too few, you are not bound to correct him.

Laws of Piquet.—1. A player may shuffle either pack, above the table. The dealer has the right to shuffle last. 2. A cut must consist of at least two cards. 3. Highest has choice of deal and cards. (Ace highest, seven lowest.) 4. If a card is exposed in cutting or before dealing, there must be a fresh cut. 5. The mode of distributing the cards (by twos or by threes) must not be altered during the *partie*. 6. The stock must be placed, in one packet, face downwards, between the players. 7. If the cards are dealt wrongly, the error may be rectified before either player has taken up his hand, or the adversary may demand a fresh deal. 8. If a card belonging to the elder hand or the stock is exposed when dealing, the adversary has the option of a fresh deal. If there is a faced card in the pack, there must be a fresh deal. 9. If, after the deal is completed, more than one card is found to have been dealt wrongly, or nine cards are found in the stock, there must be a fresh deal. The same if the wrong pack is dealt with, and the error is discovered before either player has taken up his cards; otherwise the packs remain changed. 10. If only one card has been dealt wrongly, the elder hand, after looking at his cards and before taking in a card, has the option of a fresh deal, and if there are only seven cards in the stock, he may alter his discard (see Laws 12 *sq.*). 11. The players deal alternately. If a player deals out of turn, and the error is discovered by either player before he takes up his cards, the deal is void, and the right dealer deals. If the error is discovered later, the elder hand must deal twice running with his own pack, unless that or the next deal is the last of the *partie*. 12. Each player is bound to discard at least one card (but see Laws 21, 22, and 23). 13. When taking in, the cards must be taken in order from the top of the stock. 14. After taking a card, a player cannot alter his discard; and if he then takes back any of his discard, he must play with more than twelve cards (see Law 30); if after taking a card he mixes any of his hand with his discard, he must play with less than twelve cards (see Law 29). 15. If either player, when taking in, exposes a card of the stock belonging to his adversary, he can reckon nothing that deal. 16. If either player mixes with his hand a card of the stock which belongs to his adversary, he can reckon nothing that deal; or the adversary may have a fresh deal. If he stands the deal he can only take in such of his cards as have not been mixed. 17. If a player discards more cards than he takes in, he must play with less than twelve cards (see Law 29). 18. If a player discards fewer cards than he takes in, he can reckon nothing that deal. 19. The adversary has the option of not enforcing the penalty of reckoning nothing that deal. 20. If the younger hand leaves any cards and mixes them with his discard, without showing them to the elder hand, the elder, after leading a card, is entitled to see the younger's discard. 21. If the elder hands elects to stand the deal when one card has been dealt wrongly, and he has thirteen cards, he must discard one card more than he takes in, and must discard at least two cards. If there are eight cards in the stock, the younger hand discards one less than he takes in, and if he only takes one card he need not discard any; if there are seven cards in the stock, and the elder hand discard six cards and takes five, the younger hand can only take two cards. 22. If the elder hand elects to stand the deal when he has eleven cards, and there are eight in the stock, he must discard one less than he takes in; if he only takes one card he need not discard any. The younger hand must discard one more than he takes in, and must discard at least two cards. 23. If the elder hand elects to stand the deal when he has twelve cards, and there are seven in the stock, he discards the same number as he takes in; the younger discards one more than he takes in, and must discard at least two cards. 24. When the elder hand's call is good against the cards, it is sufficient if he states the number of cards that compose it; if not he must say what it makes or to what card it is, or the value of the cards of which it consists. 25. The elder hand calling too little may correct his miscall before it has been replied to by the younger hand; and the younger hand, allowing a correct call to be good or equal, when he holds better, may correct his reply before the elder hand has made another call or, if there is no further call, before the elder hand has led a card. 26. If a player calls what he does not hold, he may correct his call before the younger hand has played to the first trick: and, if the younger hand has miscalled, the elder hand may take up his card and play differently. In the absence of correction, the offender can reckon nothing that deal, and the adversary, on discovery of the error, can reckon anything he has good, which is not barred by a correct call made in addition to the miscall. But there is no penalty for calling anything which a player could not possibly hold in his hand and discard taken together, nor for misnaming a suit, nor for misnaming the rank of a sequence, when one of the counting value named is held, provided the claim could not have been held in the hand and discard taken together; and, if a player voluntarily shows what he claims for, he is liable to no penalty for miscalling it. 27. A player who calls anything which is allowed to be good or equal must show the cards called at any time they are asked for during the play of the hand. 28. When the younger hand has played to the first trick, neither player can reckon anything omitted (but see Law 26). 29. A player is liable to no penalty for playing with less than twelve cards. His adversary counts as tricks all cards that cannot be played to. 30. If a player plays with more than twelve cards, he can reckon nothing that deal; but his cards, though not good to score, are good to bar his adversary. 31. A card led or played cannot be taken up (but see Law 26), but cards accidently dropped may be retaken. Also, if the leader leads several cards consecutively without waiting for them to be played to, and the adversary plays too many cards, he may retake the extra ones; and cards subsequently played in error must be taken up and played over again. Or, if a player leads out of turn, he may take up his card unless it has been played to. Or, if a player does not follow suit when able, the card played in error and all cards subsequently played must be taken up and played over again. Or, if a player misinforms his adversary when asked what cards he holds that have been allowed to be good or equal, the adversary may retake all the cards he has subsequently played, and may play differently. 32. Errors in counting the hand, if proved, may be rectified before the player in error has seen his next hand. 33. If both players score the same number in six deals, each deals once more, when the *partie* is concluded, even if there should be a second tie. 34. If the loser fails to score a hundred, he is rubiconed, whether the winner's score reaches a hundred or not. 35. The deal in which the discovery of an incorrect pack is made is void. All preceding deals stand good. 36. A bystander calling attention to any error or oversight, and thereby affecting the score, may be called upon to pay all stakes and bets of the player whose interest he has prejudicially affected.

See Edmond Hoyle, *A Short Treatise on the Game of Piquet* (1744); "Cavendish," *The Laws of Piquet and of Rubicon Piquet, adopted by the Portland Club, with a Treatise on the Game* (1882).

(H. J.)

PIRACY. Sir Edward Coke (*Instit.* iii. 113) describes a pirate (Latin *pirata*, from Greek πειρατής) as *hostis humani generis*, and as a rover and robber upon the sea. Piracy may be defined in law as an offence which consists in the commission of those acts of pillage and violence upon the high seas which on land would amount to felony. By the ancient common law of England piracy, if committed by a subject, was deemed to be a species of treason, being contrary to his natural allegiance, and by an alien to be felony; but since the Statute of Treasons, 25 Edw. III. c. 2 (1351–52), piracy has been held to be felony only. Formerly this offence was only cognizable by the Admiralty courts, whose proceedings were based upon the civil law, but by the statute 28 Hen. VIII. c. 15 (1536) a new jurisdiction proceeding according to the common law was set up which, modified and regulated by subsequent enactments, such as 39 Geo. III. c. 37 (1798–99), 4 & 5 Will. IV. c. 36 (1834), and 7 & 8 Vict. c. 2 (1844), continues to be the tribunal by which offenders of this description are tried.

Piracy, being a crime not against any particular state but against all mankind, may be punished in the competent court of any country where the offender may be found or into which he may be carried. But, whilst the law of nations gives to every one the right to pursue and exterminate pirates without any previous declaration of war (pirates holding no commission or delegated authority from any sovereign or state), it is not allowed to kill them without trial except in battle. Those who surrender or are taken prisoners must be brought before the proper tribunal and dealt with according to law.

The earliest of all sea-rovers were perhaps the Phœnicians. During the heroic age of Greece piracy was universally practiced. In the Homeric poems frequent mention is made of piracy, which indeed was held in honorable estimation,—the vocation of a pirate being recognized, so that a host, when he asked his guest what was the purpose of his voyage, would enumerate enrichment by indiscriminate maritime plunder as among those projects which might naturally enter into his contemplation. So late as the time of Solon the Phoceans, on account of the sterility of their soil, were forced to roam the seas as pirates. That legislator tolerated whilst he regulated the association of sea-rovers which he found established by inveterate usage. The prevalence of the piratical spirit in Greece in the early ages may perhaps be explained by the number of small independent states into which the country was divided, and the violent animosity subsisting among them. In this way predatory habits were diffused and kept alive. As a more regular system of government grew up, and a few states such as Athens and Corinth had become naval powers, piracy was made a capital offence. It was, however, never entirely put down. Cilicia was at all times the great stronghold of the pirates of antiquity, and in consequence of the decline of the maritime forces which had kept them in check they increased so much in numbers and audacity as to insult the majesty of Rome itself, so that it became necessary to send Pompey against them with a large fleet and army and more extensive powers than had ever previously been conferred on any Roman general. The Etruscans were notorious sea-rovers who infested the Mediterranean; and Polybius relates that the Romans imposed upon the Carthaginians as a condition of peace the stipulation that they should not sail beyond Cape Faro, either for the purposes of trade or piracy.

Hallam (*Middle Ages*, iii. 336) says that in the 13th and 14th centuries a rich vessel was never secure from attack, and neither restitution nor punishment of the criminals was to be obtained from Governments. Hugh Despenser seized a Genoese vessel valued at 14,300 marks, for which no restitution was ever made. The famous Hanseatic League was formed in the middle of the 13th century in northern Germany chiefly for the purpose of protecting the ships of the confederated cities from the attacks of the pirates by which the Baltic was then infested.

A graphic account of piracy as it existed at the end of the 16th century in European waters, especially on the English, French, and Dutch coasts will be found in Motley *Hist. United Netherlands* (vols. iii. and iv.). The nuisance was not abated in Europe until the feudal system had been subverted and the ascendency of the law finally secured. In more modern times some of the smaller West India Islands became a great resort of pirates, from which, however, they have for many years been driven; for continued acts of piracy the city of Algiers was successfully bombarded by the British fleet under Lord Exmouth as lately as August, 1816; and pirates are still not unfrequently met with in the Indian and Chinese seas, but piracy in its original form is no longer in vogue. The BUCCANEERS (*q.v.*) were cruel piratical adventurers of a later date who commenced their depredations on the Spaniards soon after they had taken possession of the American continent and the West Indies, although there was a time when the spirit of buccaneering approached in some degree to the spirit of chivalry in point of adventure. Scaliger observes in a strain of doubtful compliment, "Nulli melius piraticam exercent quam Angli." The first levy of ship money in England in 1635 was to defray the expense of chastising these pirates. The buccaneering confederacy was broken up through the peace of Ryswick in 1697.

At a very early period of English history the law provided for the restitution of property taken by pirates, if found within the realm, whether belonging to strangers or Englishmen; but any foreigner suing for the recovery of his goods was required to prove that at the time of the capture his own sovereign and the sovereign of the captor were in mutual amity, for it was held that piracy could not be committed by the subjects of states at war with each other. In England the crown is, generally speaking, entitled to all *bona piratorum;* but if any person can establish a title to the goods the claim of the crown thereto ceases. By 13 & 14 Vict. c. 26 (1850), ships and effects captured from pirates are to be restored on the payment of one-eighth of their value (by way of salvage), which is to be distributed among the recaptors.

Cowel (*Law Dict.*, 1727) states that in former times the word pirate was used in a better sense than that of a sea-robber, being attributed to persons to whose care the mole or pier of a haven was entrusted, and, quoting the learned Spelman, he adds, sometimes to a sea soldier: "Robertus vero Comes (Normaniæ) attemptavit venire in Angliam cum magno exercitu, sed a piratis Regis qui curam maris a Rege (Willielmo) susceperant repulsus est" (*Glossarium*, 1687, p. 460). (J. C. W.)

PIRÆUS. See ATHENS.

PIRANESI, GIOVANNI BATTISTA, an eminent Italian engraver of ancient architectural subjects, was born in the former half of the 18th century, and studied his art at Rome. The great remains of that city kindled his enthusiasm and demanded portrayal. His hand faithfully imitated the actual remains of a fabric; his invention, catching the design of the original architect, supplied the parts that were wanting; his skill introduced groups of vases, altars, tombs; and his broad and scientific distribution of light and shade completed the picture, and threw a striking effect over the whole. One engraving after another was executed with much brilliancy; and, as the work went on, the zeal of the artist only waxed stronger. In course of time it was found necessary to call in the aid of all his children and of several pupils. He did not, in fact, slacken in his exertions till his death in 1778. The plates of Piranesi, in which the severity of burin work is largely supplemented by the freer lines of the etching needle, were collected and preserved by his son and coadjutor Francesco. They were published, to the number of about 2000, in 29 vols. fol., Paris, 1835–37.

PIRMASENS, a small manufacturing town of the Bavarian palatinate, lies in a hilly district, nearly 40 miles west by south of Spires. The staple industry is the production of boots and shoes, which are exported to Austria, Russia, and even America; but musical instruments, stoneware, and other articles are also manufactured. The only noteworthy buildings are the town-house and the principal church, the latter containing a fine monument to Louis IX., landgrave of Hesse-Darmstadt. In 1880 the town contained 12,039 inhabitants, three-fourths of whom were Protestants.

Pirmasens owes its name to a St. Pirmin, who is said to have preached Christianity here in the 8th century. It originally belonged to the count of Hanau-Lichtenberg, but passed to Hesse-Darmstadt in 1736. In 1793 the Prussians gained a victory here over a body of French troops.

PIRNA, an ancient town of Saxony, lies on the left bank of the Elbe, on the margin of the "Saxon Switzerland," 11 miles above Dresden. It is on the whole a regularly built town, with promenades on the site of the former ramparts, but contains no notable edifices except the fine Gothic Hauptkirche (1502–46) and the townhouse. The chief source of its prosperity is formed by the excellent sandstone found on both banks of the Elbe above the town; but manufactures of cigars, chemicals, enamelled tinware, pottery, and leather are also carried on. Besides the export of the sandstone, it transacts a trade in grain, fruit, and timber, mainly by river. The population in 1880 was 11,680, almost all Protestants.

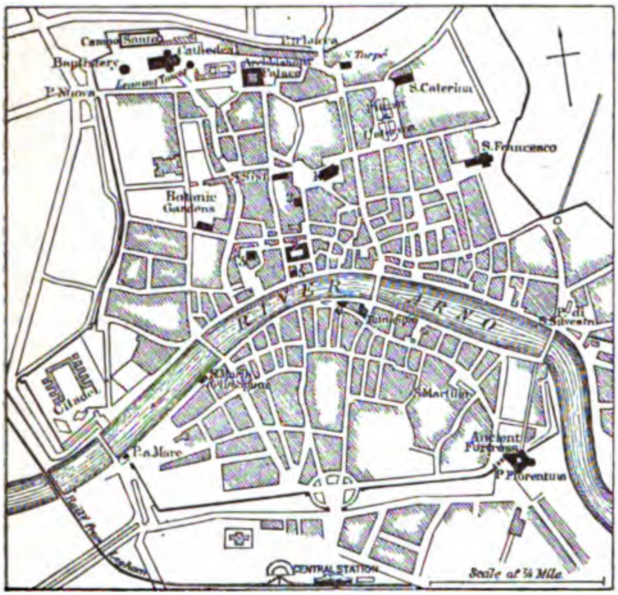
Pirna, originally a Slavonic settlement, long oscillated between Bohemia and Meissen (Saxony), but became permanently united with the latter in 1404. Having at a very early period received the privilege of holding fairs, it was at one time among the most flourishing of Saxon towns, but afterwards lost its importance through pestilence and the disasters of the Thirty Years' and Seven Years' Wars. On a rock above the town rises the fortress of Sonnenstein, now a lunatic asylum, erected in the 16th century on the site of an older castle, and once considered the most important fortress on the Elbe. It successfully withstood the Swedes in the Thirty Years' war, though the town was stormed, but was captured and dismantled by the Prussians in 1758. In 1813 it was occupied by the French, and held for several months.

PIRON, Alexis (1689–1773), the foremost epigrammatist of France, was born at Dijon on the 9th July, 1689. His father, Aimé Piron, was an apothecary, but was also a frequent writer of verse in Burgundian patois. Alexis began life as clerk and secretary to a banker, and then studied law without any success or much seriousness. As a young man he made himself notorious by the composition of a piece of licentious verse which might have brought him into serious difficulties but for the good nature of a high legal official, the president Bouhier. His sarcastic tongue made him unpopular in his neighborhood, and at last in 1719, when nearly thirty years old, he went to seek his fortune at Paris. His first experiences were not very encouraging, and he had to put up with the unpleasant and not very honorable position of literary adviser and corrector to the Chevalier de Belle Isle. An accident, however, brought him money and notoriety. The jealousy of the regular actors produced an edict restricting the Théâtre de la Foire, or licensed booths at fair times, to a single character on the stage. None of the ordinary writers for this theatre, not even Lesage, would attempt a monologue-drama for the purpose, and Piron obtained a footing as a dramatic author, much applause, and three hundred crowns, with a piece called *Arlequin Deucalion*. Thenceforward he was constantly employed for this theatre, and not seldom for the more dignified Comédie Française, but with the exception of the excellent verse comedy of *La Métromanie* no one of his comedies and none of his tragedies at all deserve mention. His real vocation was that of an epigram maker, and this, though it made him not a few enemies, recommended him to not a few patrons who supplied his necessities. His most intimate associates, however, during the middle period of his life were two ladies of talent though not of position, Mademoiselle Quinault, the actress, and her friend Mademoiselle Quenaudon or De Bar, companion to a lady of rank. She was slightly older than Piron and not beautiful, but after twenty years acquaintance he married her in 1741, lived happily enough with her for four years, and nursed her tenderly during an attack of madness which in other two years proved fatal. He long outlived her, dying on the 21st January, 1773, in his eighty-fourth year. The discredit of his early literary misdeed, and perhaps his indiscriminate habits of lampooning, prevented his election to the Academy, certain persons having induced the king to interpose his veto. But Piron was pensioned, and during the last half century of his life was never in any want. He was a complete literary free-lance, and lampooned Fréron and Desfontaines as sharply as he lampooned Voltaire and the *philosophe* coterie. Socially he was a rather loose liver, though probably, except on paper, not worse than most of his contemporaries. He was a member of the somewhat famous convivial society of the *Caveau*. But his true title to remembrance lies in his epigrams, one of which, the burlesque epitaph on himself but reflecting on the Academy (see vol. viii. p. 439), is known to almost everybody, while many others equal or surpass it in brilliancy. Grimm called him a "machine à saillies," and probably no man who ever lived possessed more of the peculiarly French faculty of sharply pointed verbal wit than he. It is noteworthy too that he was as ready with conversational retort as with his pen.

Piron published his own theatrical works in 1758, and after his death his friend and literary executor Rigollot de Juvigny published his *Œuvres Complètes*. During the last thirty years a good deal of unpublished work has been added by MM. Bonhomme, Lalanne, and others. But the epigrams, which take up but little room and have been frequently reissued in various selections, are alone of great importance.

PISA, which has always been one of the most important cities of central Italy, is situated on the banks of the Arno at a short distance from the sea, in the midst of a fertile plain backed by marble mountains wooded with pines and other forest trees. In the days of Strabo it was only two geographical miles from the sea-shore, but the continual increase of the delta at the mouth of the river has now trebled that distance. In the Middle Ages the Arno was still navigable for all ships of war then in use, and formed the safest of harbors.

The origin of Pisa is very ancient, and is involved in obscurity. The Romans believed it to date from the days of Troy, and also gave a legendary account of its foundation by colonists from Greece. Strabo mentions it as one of the bravest of the Etruscan cities. From Polybius we learn that in 225 B.C. it was already the friend of the Romans; and later it became their ally and was defended by them from the ferocious onslaughts of the Ligurian and Apuan tribes. Thus the Romans acquired great power over the city, and finally subjected it to their rule. In Cæsar's time according to some writers, in that of Augustus according to others, they established a military colony there. Nevertheless, excepting some inscriptions, sarcophagi, statues, and columns, very few remains of Roman buildings have been discovered in Pisa. Little is known of the history of Pisa during the barbarian invasions, but it is an ascertained fact that it was one of the first towns to regain its independence. Under the Byzantine dominion Pisa, like many other of the maritime cities of Italy, profited by the weakness of the Government at Constantinople to reassert its strength. And even during the first years of the harsh Lombard rule the need recognized by these oppressors of defending the Italian coast from the attacks of the Greeks was favorable to the development of the Pisan navy. Few particulars are extant concerning the real condition of the town; but we occasionally find Pisa mentioned, almost as though it were an independent city, at moments when Italy was overwhelmed by the greatest calamities. According to Amari's happy expression, "it was already independent by sea, while still enslaved on land." Its prosperity notably declined after the re-establishment of the Lombard rule and under the Franks. It again began to flourish under the marquises of Tuscany, who governed it in the name of the emperor.



1. Cavalieri di S. Stefano.
2. Academy of Fine Arts
3. Royal Theatre.
4. University.
5. Palazzo Laufreducci or Alla Giornata.
6. Post Office.

In 1003 we find records of a war between Pisa and Lucca, which, according to Muratori, was the first waged between Italian cities in the Middle Ages. But the military development and real importance of Pisa in the 11th century must be attributed to the continuous and desperate struggle it maintained against the tide of Saracenic invasion from Sicily. And, although the numerous legends and fables of the old chroniclers disguise the true history of this struggle, they serve to attest the importance of Pisa in those days. In 1004 the Saracens forced the gates and sacked a quarter of the town; and in 1011 they renewed the attack. But the Pisans repulsed them and assumed the offensive in Calabria, Sicily, and even in Africa. Still more memorable was the expedition afterwards undertaken by the united forces of Pisa and Genoa against Mogáhid, better known in the Italian chronicles as Mugeto. This Moslem chief had made himself master of Sardinia, and was driven thence by the allied fleets in 1015. Again invading the island, he was again attacked and defeated by the same adversaries, leaving a brother and son, or, as some authorities aver, a wife and son, prisoners in their hands. Sardinia continued to be governed by native magistrates, who were like petty sovereigns, but were now subject to the sway of Pisa. This was the primary cause of the jealousy of the Genoese, and of the wars afterwards made by them upon Pisa and carried on until its power was crushed. Meanwhile the Pisans flourished more and more, and continued hostilities against the Saracens. In 1062 their ships returned from Palermo laden with spoil. Thus it is not surprising that Pisa should already have had its own code of laws (*Consuetudini di Mare*), which in 1075 were approved by Gregory VII., and in 1081 confirmed by a patent from the emperor Henry IV., that supplies the first authentic notice of the existence of consuls in mediæval Italy.[1] The oldest of Pisan statutes still extant is the *Breve dei Consoli di Mare* of 1162.

In 1099 the Pisans joined in the second crusade, proved their valor at the capture of Jerusalem, and derived many commercial advantages from it; for within a short time they had banks, consuls, warehouses, and privileges of all kinds in every Eastern port. Thus, while the commune of Pisa was still under the rule of the marquises of Tuscany, all negotiations with it were carried on as with an independent state officially represented by the archbishop and consuls. The aristocrats were the dominant party, and filled the highest offices of the republic, which, in the 12th century, rose to great power, both on sea and land, by its wars with the Lucchese, Genoese, and Moslems. In 1110 Pisa made peace with Lucca after six years of continuous hostilities. And between 1114 and 1116 it achieved a still greater enterprise. The Pisan fleet of three hundred sail, commanded by the archbishop Pietro Moriconi, attacked the Balearic Isles, where as many as 20,000 Christians were said to be held captive by the Moslems, and returned loaded with spoil and with a multitude of Christian and Moslem prisoners. The former were set at liberty or ransomed, and among the latter was the last descendant of the reigning dynasty. The chief eunuch who had governed Majorca perished in the siege. Immediately afterwards the fourteen years' war with Genoa broke out. The two republics contested the dominion of the sea, and both claimed supreme power over the islands of Corsica and Sardinia. A papal edict awarding the supremacy of Corsica to the Pisan church proved sufficient cause for the war, which went on from 1118 to 1132. Then Innocent II. transferred the supremacy over part of Corsica to the Genoese church, and compensated Pisa by grants in Sardinia and elsewhere. Accordingly, to gratify the pope and the emperor Lothair II., the Pisans entered the Neapolitan territory to combat the Normans. They aided in the vigorous defence of the city of Naples, and twice attacked and pillaged Amalfi, in 1135 and 1137, with such effect that the town never regained its prosperity. It has been said that the copy of the Pandects then taken by the Pisans from Amalfi was the first known to them, but in fact they were already acquainted with those laws. The war with Genoa never came to a real end. Even after the retaking of Jerusalem by the Moslems (1187) the Pisans and Genoese again met in conflict in the East, and performed many deeds of valor. They were always ready to come to blows, and gave still more signal proofs of their enmity during the Sicilian war in behalf of the emperor Henry VI. From that moment it was plain that there could be no lasting peace between these rival powers until the one or the other should be crushed. The greatness and wealth of the Pisans at this period of their history is proved by the erection of the noble buildings by which their city is adorned. The foundations of the cathedral were laid in 1063, and its consecration took place in 1118; the baptistery was begun in 1152, and the campanile (the famous leaning tower) in 1174. And all three magnificent structures were mainly the work of Pisan artists, who gave new life to Italian architecture, as they afterwards renewed the art of sculpture.

It is asserted by some writers, especially by Tronci, that in the 12th century Pisa adopted a more democratic form of government. But in fact the chief authority was still vested in the nobles, who both in Pisa and in Sardinia, exercised almost sovereign power. They formed the real strength of the republic, and kept it faithful to the empire and the Ghibelline party. The Guelf and popular element which constituted the force and prosperity of Florence was hostile to Pisa, and led to its downfall. The independence of the former city was of much later origin, only dating from the death of Countess Matilda (1115,) but it rapidly rose to an ever-increasing power, and to inevitable rivalry with Pisa. Owing to the political and commercial interests binding Florence to the Roman court, the Guelf element naturally prevailed there, while the growth of its trade and commerce necessarily compelled that state to encroach on waters subject to Pisan rule. And, although Pisa had hitherto been able to oppose a glorious resistance to Genoa and Lucca, it was not so easy to continue the struggle when its enemies were backed by the arms and political wisdom of the Florentines, who were skilled in obtaining powerful allies. The chroniclers ascribe the first war with Florence, which broke out in 1222, to a most ridiculous motive. The ambassadors of the rival states in Rome are said to have quarrelled about a lapdog. This merely shows that there were already so many general and permanent reasons for war that no special cause was needed to provoke it. In 1228 the Pisans met and defeated the united forces of Florence and Lucca near Barga in the Garfagnana, and at the same time they dispatched fifty-two galleys to assist Frederick II. in his expedition to the East. Shortly after this they renewed hostilities with the Genoese on account of Sardinia. The judges who governed the island were always at strife, and, as some of them applied to Pisa and some to Genoa for assistance against one another, the Italian seas were once more stained with blood, and the war burst out again and again, down to 1259, when it terminated in the decisive victory of the Pisans and the consolidation of their supremacy in Sardinia. But meanwhile Florence had made alliance with Genoa, Lucca, and all the Guelf cities of Tuscany against its Ghibelline rival. The pope had excommunicated Frederick II. and all his adherents. And, as a crowning disaster, the death of Frederick in 1250 proved a mortal blow to the Italian Ghibelline cause. Nevertheless, the Pisans were undaunted. Summoning Siena, Pistoia, and the Florentine exiles to their aid, they boldly faced their foe, but were defeated in 1254. Soon after this date we find the old aristocratic government of Pisa replaced by a more popular form. Instead of the consuls there were now twelve elders (*anziani*); besides the podestà, there was a captain of the people; and there was a general council as well as a senate of forty members. The route of the Tuscan Guelfs on the field of Montaperto (1260) restored the fortunes of Pisa. But the battle of Benevento (1266), where Manfred fell, and the rout of Tagliacozzo (1268), sealing the ruin of the house of Hohenstauffen in Italy and the triumph of that of Anjou, were fatal to Pisa. For the republic had always sided with the empire and favored Conradin whose cruel end struck terror into the Ghibelline faction. The pope hurled an edict against the Pisans and tried to deprive them of Sardinia, while their merchants were driven from Sicily by the Angevins. The internal condition of the city was affected by these events. Owing to the increasing influence of the Guelf and popular side. to which the more ambitious nobles began to adhere for the furtherance of personal aims, the aristocratic Ghibelline party was rapidly losing ground. The first man to step to the front at this moment was Count Ugolino della Gherardesca of the powerful house of that name. He had become the virtual head of the republic, and, in order to preserve its independence and his own sway, inclined to the Guelfs and the popular party, in spite of the Ghibelline traditions of his race. He was supported by his kinsman Giovanni Visconti, judge of Gallura; but almost all the other great families vowed eternal hatred against him, and proclaimed him a traitor to his party, his country, and his kin. So in 1274 he and Visconti were driven into exile. Both then joined the Florentines, took part in the war against their native city, and laid waste its surrounding territories. In 1276 the Pisans were compelled to agree to very grievous terms—to exempt Florentine merchandise from all harbor dues, to yield certain strongholds to Lucca, and to permit the return of Count Ugolino, whose houses they had burnt, and whose lands they had confiscated. Thus the count again became a powerful leader in Pisa. Visconti, however, was dead.

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[1] It must be remembered that the Pisans and Florentines dated the beginning of the year *ab incarnatione, i.e.*, from the 25th March. But the Florentines dated it from the 25th following and the Pisans from the 25th March preceding the commencement of the common year. The new or common style was adopted throughout Tuscany in the year 1750.

This was the moment chosen by Genoa for a desperate and decisive struggle with her perpetual rival. For some years the hostile fleets continued to harass each other and engage in petty skirmishes, as if to measure their strength and prepare for a final effort. On the 6th August, 1284, the great battle of Meloria took place. Here seventy-two Pisan galleys engaged eighty-eight Genoese, and half the Pisan fleet was destroyed. The chroniclers speak of 5000 killed and 11,000 prisoners; and although these figures must be exaggerated, so great was the number of captives taken by the Genoese as to give rise to the saying, "To see Pisa you must now go to Genoa." This defeat crushed the power of Pisa. She had lost her dominion over the sea, and the Tuscan Guelfs again joined in attacking her by land. Count Ugolino had taken part in the battle of Meloria and was accused of treachery. At the height of his country's disasters, he sought to confirm his own power by making terms with the Florentines, by yielding certain castles to Lucca, and by neglecting to conclude negotiations with the Genoese for the release of the prisoners, lest these should all prove more or less hostile to himself. This excited a storm of opposition against him. The archbishop Ruggieri, having put himself at the head of the nobles, was elected podestà by the Lanfranchi, Sismondi and Gualandi, and a section of the popular party. The city was plunged into civil war. The great bell of the commune called together the adherents of the archbishop; the bell of the people summoned the partisans of the Count. After a day's fighting (1st July, 1288) the Count, his two sons, and his two nephews were captured in the Palazzo del Popolo (or town hall) and cast into a tower belonging to the Gualandi and known as the "Tower of the Seven Streets." Here they were all left to die of hunger. Their tragic end was afterwards immortalized in the *Divina Commedia*. The sympathies of Dante Alighieri, the Florentine patriot and foe of Rome, were naturally in favor of the victims of an aristocratic prelate, opposed to all reconciliation with Florence.

The Florentines were now allied with Lucca and Genoa, and a few of their vessels succeeded in forcing an entry into the Pisan port, blocked it with sunken boats, and seized its towers. Their own internal dissensions of 1293 put a stop to the campaign, but not before they had concluded an advantageous peace. They and all the members of the Guelf league were freed from all imposts in Pisa and its port. In addition to these privileges the Genoese also held Corsica and part of Sardinia; and throughout the island of Elba they were exempted from every tax. They likewise received a ransom of 160,000 lire for their Pisan prisoners. These were no longer numerous, many having succumbed to the hardships and sufferings of all kinds to which they had been exposed.

In 1312 the arrival of the emperor Henry VII. gladdened the hearts of the Pisans, but his sudden death in 1313 again overthrew their hopes. He was interred at Pisa, and Uguccione della Faggiuola remained as imperial lieutenant, was elected podestà and captain of the people, and thus became virtual lord of the city. As a Ghibelline chief of valor and renown, he was able to restore the military prestige of the

Pisans, who under his command captured Lucca and defeated the Florentines at Montecatini on the 29th August, 1315. So tyrannical, however, was his rule that in 1316 he was expelled by the popular fury. But Pisa's freedom was forever lost. He was succeeded by other lords or tyrants, of whom the most renowned was Castruccio Castracane, a political and military adventurer of much the same stamp as Uguccione himself. With the help of Louis the Bavarian, Castruccio became lord of Lucca and Pisa, and was victorious over the Florentines; but his premature death in 1328 again left the city a prey to the conflicts of opposing factions. New lords, or petty tyrants, rose to power in turn during this period of civil discord, but the military valor of the Pisans was not yet extinguished. By sea they were almost impotent—Corsica and Sardinia were lost to them for ever; but they were still formidable by land. In 1341 they besieged Lucca in order to prevent the entry of the Florentines, to whom the city had been sold for 250,000 florins[1] by the powerful Mastino della Scala. Aided by their Milanese, Mantuan, and Paduan allies, they gave battle to their rivals, put them to rout at Altopascio (2nd October), and then again excluded them from their port. Thereupon the Florentines obtained Porto Talamone from Siena and established a navy of their own. By this means they were enabled to capture the island of Giglio, and, attacking the Pisan harbor, carried off its chains, bore them in triumph to Florence, and suspended them in front of the baptistery, where they remained until 1848. Then, in pledge of the brotherhood of all Italian cities, they were given back to Pisa, and placed in the Campo Santo.

The war was now carried on by the free companies with varying fortune, but always more or less to the hurt of the Pisans. In 1369 Lucca was taken from them by the emperor Charles IV.; and afterwards Giovan Galeazzo Visconti, known as the Count of Virtù, determined to forward his ambitious designs upon the whole of Italy by wresting Pisa from the Gambacorti. For at this time the conflicts of the Raspanti faction, headed by the Gherardesca, with the Bergolini led by the Gambacorti, had left the latter family masters of the city. At Visconti's instigation Piero Gambacorti, the ruler of the moment, was treacherously assassinated by Jacopo d'Appiano, who succeeded him as tyrant of Pisa, and bequeathed the state to his son Gherardo. The latter, a man of inferior ability and daring, sold Pisa to the Count of Virtù, receiving in exchange 200,000 florins,[1] Piombino, and the islands of Elba, Pianosa, and Monte Cristo. Thus in 1399 Visconti took possession of Pisa, and left it to his natural son Gabriele Maria Visconti, who was afterwards expelled from its gates. But even during this century of disaster the Pisans continued to cherish the fine arts. In the year 1278 they had entrusted the erection of their fine Campo Santo to Niccola and Giovanni Pisano, by whom the architectural part of it was completed towards the end of the century. In the following year the first artists of Italy were engaged in its decoration, and Orcagna painted his celebrated frescos on its walls. Others were afterwards supplied by Benozzo Gazzoli and men of lesser note, and the labor of ornamentation was only discontinued in 1464.

Meanwhile, in 1406, the Florentines made another attack upon Pisa, besieging it simultaneously by sea and land. Owing to the starving condition of its defenders, and aided by the treachery of Giovanni Gambacorti, they entered the city in triumph on the 9th October, and sought to "crush every germ of rebellion and drive out its citizens by measures of the utmost harshness and cruelty." Such were the orders sent by the Ten of War to the representatives of the Florentine Government in Pisa, and such was then the established policy of every Italian state. Consequently for a long time there was a continual stream of emigration from Pisa. The Medici pursued a humaner course. In 1472 Lorenzo the Magnificent tried to restore the ancient renown of the Pisan university. To that end he filled it with celebrated scholars, and, leaving only a few chairs of letters and philosophy in Florence, compelled the Florentines to resort to Pisa for the prosecution of their studies. But nothing could now allay the inextinguishable hatred of the conquered people. When Charles VIII. made his descent into Italy in 1494, and came to Sarzana on his way to Tuscany, he was welcomed by the Pisans with the greatest demonstrations of joy. And, although that monarch was ostensibly the friend of Florence, they did not hesitate, even in his presence, to assert their own independence, and, casting the Florentine ensign, the Marzocco, into the Arno, made instant preparations for war. Between 1499 and 1505 they heroically withstood three sieges and repulsed three attacking armies. But their adversaries always returned to the assault, and, what was worse, yearly laid waste their territories and destroyed all their crops. Soderini, who was perpetual gonfalonier of Florence, and Machiavelli, the secretary of the Ten, urged on the war. In 1509 the latter encamped his forces on three sides of the distressed city, which at last, reduced to extremity by famine, was forced to surrender on the 8th June, 1509. Thenceforth the Florentines remained lords of Pisa. But now, mainly owing to the efforts of Soderini and Machiavelli, the conquerors showed great magnanimity. They brought with them large stores of provisions, which were freely distributed to all; they tried to succor the suffering populace in every way, and gave other assistance to the wealthier classes. Nevertheless, emigration continued even on a larger scale than in 1406, and the real history of Pisa may be said to have ended. In Naples, in Palermo, in all parts of Italy, Switzerland, and the south of France, we still find the names of Pisan families who quitted their beloved home at that time. The Florentines immediately built a new citadel, and this was a great bitterness to the Pisans. The Medici, however, remained well disposed towards the city. Leo X. was an active patron of the university, but it again declined after his death. The grand-duke Cosmo I., a genuine statesman, not only restored the university, but instituted the "Uffizio dei Fossi," or drainage office for the reclamation of marsh lands, and founded the knighthood of St. Stephen. This order played a noble part in the protection of Tuscan commerce, by fighting the Barbary pirates and establishing the prestige of the grand-ducal navy (see **Medici**). Under the succeeding Medici, Pisa's fortunes steadily declined. Ferdinand I. initiated a few public works there, and above all restored the cathedral, which had been partly destroyed by fire in 1595. These dreary times, however, are brightened by one glorious name—that of Galileo Galilei. A native of Pisa, he taught in its university; he made his first experiments in gravity from its bell tower, discovered, by observing the swing of the cathedral lamp, the law of the oscillation of the pendulum, and began there his stupendous reform of natural philosophy. But the sufferings inflicted on him by the Inquisition prove the depth of ignorance to which Tuscany and all Italy had then sunk.

As to Pisa, it is enough to mention that its population within the walls had been reduced in 1551 to 8574 souls, and that by 1745 it had only risen to the number of 12,406. Under the house of Lorraine, or more correctly during the reign of that enlightened reformer Pietro Leopoldo (1765–1790), Pisa shared in the general prosperity of Tuscany, and its population constantly increased. By 1840 it contained 21,670 souls, exclusive of the suburbs and outlying districts. At the present day Pisa is again one of the most flourishing cities of Tuscany. It counts 26,863 inhabitants within the walls, and including the suburbs a total of 44,518.[1] Its university is one of the best in Italy; it is an important railway centre; its commerce and manufactures are continually on the increase; its agriculture is rich and flourishing; and it is the chief city of a province numbering 283,563 inhabitants.

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[1] [A florin of that date was worth in England 3*s*. 4*d*. See Roger's *History of Agriculture and Prices*, 1866.—AM. ED.]

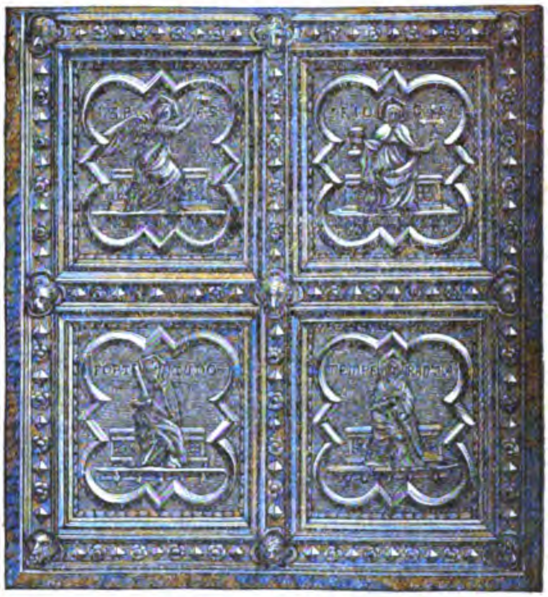
See P. Tronci, *Annali Pisani*, 2 vols., Pisa, 1868–1871; Roncioni, "Istorie Pisane," in the *Archivio Storico Italiano*, vol. vi. pt. 1; "Cronache Pisane," in the same *Archivio*, vol. vi. pt. 2; Repetti, *Dizionario Geografico Storico della Toscana*, s. v. "Pisa." (P. V.)

A few details regarding the principal buildings may be given by way of supplement to the foregoing article. The architects of the cathedral were Boschetto and Rinaldo, both Italians, probably Pisans. It is in plan a Latin cross, with an internal length of 311½ feet and a breadth of 252 feet. The nave, 109 feet high, has double vaulted aisles and the transepts single aisles; and at the intersection of nave and transepts there is a cupola. The basilica is still the predominant type, but the influence of the domed churches of Constantinople and the mosques of Palermo is also apparent. The pillars which support the nave are of marble from Elba and Giglio; those of the side aisles are the spoils of ancient Greek and Roman buildings brought by the Pisan galleys. Externally the finest part of the building is the west front, in which the note struck by the range of arches running round the base is repeated by four open arcades. Of the four doors three are by John of Bologna, who was greatly helped by Francavilla, Tacca, and others; that of the south side, of much older date, is generally supposed to be the work of Bonanno. Of the interior decorations it is enough to mention the altars of the nave, said to be after designs by Michelangelo, and the mosaics in the dome and the apse, which were among the latest designs of CIMABUE (*q. v.*). The baptistery was completed only in 1278, and marred in the 14th century by the introduction of Gothic details. The building is a circle 100 feet in diameter, and is covered with a cone-surmounted dome 190 feet high, on which stands a statue of St. Raniero. The lowest range of semicircular arches consists of twenty columns and the second of sixty; and above this is a row of eighteen windows in the same style separated by as many pilasters. In the interior, which is supported by four pilasters and eight columns, the most striking features are the octagonal font and the hexagonal pulpit, erected in 1260 by Niccola PISANO (*q. v.*). The campanile or "leaning tower of Pisa" is a round tower, the noblest, according to Freeman, of the southern Romanesque. Though the walls at the base are 13 feet thick, and at the top about half as much, they are constructed throughout of marble. The basement is surrounded by a range of semicircular arches supported by fifteen columns, and above this rise six arcades with thirty columns each. The eighth story, which contains the bells, is of much smaller diameter than the rest of the tower, and has only twelve columns. It is less to the beauty of its architecture, great though that is, than to the fact that, being 11 feet 2 inches (or if the cornice be included 13 feet 8 inches) out of the perpendicular, it strikes the imagination in a way peculiarly its own. The entire height is 183 feet, but the ascent is easy by a stair in the wall, and the visitor hardly perceives the inclination till he reaches the top and from the lower edge of the gallery looks "down" along the shaft receding to its base. There is no reason to suppose that the architects, Bonanno and William of Innsbrück, intended that the campanile should be built in this oblique position; it would appear to have assumed it while the work was still in progress. The Campo Santo, lying to the north of the cathedral, owes its origin to Archbishop Ubaldo (1188–1200), who made the spot peculiarly sacred by bringing fifty-three shiploads of earth from Mount Calvary. The building, erected in the Italian Gothic style between 1278 and 1283, by Giovanni Pisano, is of special interest chiefly for its famous frescos noticed above (see also ORCAGNA, vol. xvii. p. 838).

PISA, LEONARDO OF. See PISANUS.

PISANELLO. See PISANO, VITTORE.

PISANO, ANDREA. Andrea da Pontadera (*c.* 1270–1348),[2] generally known as Andrea Pisano, the chief pupil of GIOVANNI PISANO (*q. v.*), was born about 1270, and first learned the trade of a goldsmith, as did many other afterwards celebrated artists. This early training was of the greatest value to him in his works in bronze, to which the manipulation of the precious metals gave precision of design and refinement of execution. He became a pupil of Giovanni Pisano about 1300, and worked with him on the sculpture for S. Maria della Spina at Pisa and elsewhere. But it is at Florence that his chief works were executed, and the formation of his mature style was due rather to Giotto, than to his earlier master. Of the three world-famed bronze doors of the Florentine baptistery, the earliest one—that on the south side—was the work of Andrea; he spent many years on it; and it was finally set up in 1336.[3] This marvellous piece of bronze work, in many respects perhaps the finest the world has ever seen, has all the breadth of a sculptor's modelling, with the finish of a piece of gold jewelry. It consists of a number of small quatrefoil panels—the lower eight containing single figures of the Virtues (see the figure), and the rest scenes from the life of the Baptist. In design the panels owe much to Giotto: the composition of each is simple and harmonious, kept strictly within the due limits of the plastic art, no attempt at pictorial effects and varied planes being made,—in this very unlike the perhaps more magnificent but less truly artistic reliefs on the third door, that last executed by Ghiberti. Andrea Pisano, while living in Florence, also produced many important works of marble sculpture, all of which show strongly Giotto's influence. In some cases probably they were actually designed by that artist, as, for instance, the double band of beautiful panel reliefs which Andrea executed for the great campanile. The subjects of these are the Four Great Prophets, the Seven Virtues, the Seven Sacraments, the Seven Works of Mercy, and the Seven Planets. The duomo contains the chief of Andrea's other Florentine works in marble. In 1347 he was appointed architect to the duomo of Orvieto, which had already been designed and begun by Lorenzo Maitani. The exact date of his death is not known, but it must have been shortly before the year 1349.



Part of the first bronze door of the Baptistery at Florence, by Andrea Pisano.

Andrea Pisano had two sons, Nino and Tommaso,—both, especially the former, sculptors of considerable ability. Nino was very successful in his statues of the Madonna and Child, which are full of human feeling and soft loveli-

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[1] [*Almanach de Gotha* gives census of 1881 as follows: city, 37,704; Commune. 53,957.—AM. ED.].

[2] According to C. C. Perkins (see note on next page) Andrea died in 1345.—AM. ED.].

[3] The date on the door, 1330, refers to the completion of the wax model, not of the casting, which was at first unsuccessful, and had to be done over again by Andrea himself.

ness,—a perfect embodiment of the Catholic ideal of the Divine Mother. Andrea's chief pupil was Andrea di Cione, better known as ORCAGNA (*q.v.*). Balduccio di Pisa, another, and in one branch (that of sculpture) equally gifted pupil, executed the wonderful shrine of S. Eustorgio at Milan—a most magnificent mass of sculptured figures and reliefs.

PISANO, GIOVANNI (*c.* 1250–1330), son of NICCOLA PISANO (see below), born about 1250, was but little inferior to his father either as an architect or a sculptor. Together with Arnolfo del Cambio and other pupils, he developed and extended into other parts of Italy the renaissance of sculpture which in the main was due to the extraordinary talent of that distinguished artist. After he had spent the first part of his life at home as a pupil and fellow-worker of Niccola, the younger Pisano was summoned between 1270 and 1274 to Naples, where he worked for Charles of Anjou on the Castel Nuovo. One of his earliest independent performances was the Campo Santo at Pisa, finished about 1283; along with this he executed various pieces of sculpture over the main door and inside the cloister. The richest in design of all his works (finished about 1286) is in the cathedral of Arezzo,—a magnificent marble high altar and reredos, adorned both in front and at the back with countless figures and reliefs—mostly illustrative of the lives of St. Gregory and St. Donato, whose bones are enshrined there. The actual execution of this was probably wholly the work of his pupils.[1] In 1290 Giovanni was appointed architect or "capo maestro" of the new cathedral at Siena, in which office he succeeded Lorenzo Maitani, who went to Orvieto to build the less ambitious but equally magnificent duomo which had just been founded there. The design of the gorgeous façade of that duomo has been attributed to him, but it is more probable that he only carried out Maitani's design. According to Vasari, Giovanni and other pupils of Niccola also executed the bas-reliefs on the west front of Orvieto, but this assertion is unsupported by any documentary evidence. At Perugia, Giovanni built the church of S. Domenico in 1304, but little of the original structure remains. The north transept, however, still contains his beautiful tomb of Benedict XI., with a sleeping figure of the pope, guarded by angels who draw aside the curtain (see wood-cut). Above is a sculptured plinth supporting canopied figures of the Madonna and other saints. The whole composition is framed by a high cusped and gabled arch, on twisted columns, enriched with glass mosaic in the style of the Cosmati. The general design is like the earlier tomb of Cardinal de Braye at Orvieto, the work of Giovanni's fellow-pupil, Arnolfo del Cambio.

Part of the tomb of Benedict XI., by Giovanni Pisano.

One of Giovanni's most beautiful architectural works is the little chapel of S. Maria della Spina, on the banks of the Arno in Pisa; the actual execution of this gem-like chapel, and the sculpture with which it is adorned, was mostly the work of his pupils.[2] This exquisite little building has recently been pulled down and rebuilt, under the pretext of "restoration."

The influence of his father Niccola is seen strongly in all Giovanni's works, but especially in the pulpit of S. Andrea at Pistoia, executed about 1300. In design it resembles that in the Pisan baptistery; but the reliefs are less severely classical, and more full of vivid dramatic power and complicated motives. Another pulpit, designed on the same lines, was made by him for the nave of Pisa cathedral between 1310 and 1311. Only fragments of this now exist, but it is in course of restoration. The last part of Giovanni's life was spent at Prato, near Florence, where with many pupils he worked at the cathedral till his death about 1330.

PISANO, NICCOLA (*c.* 1206–1278), one of the chief sculptors and architects of mediæval Italy, was born about 1206. Though he called himself *Pisanus*, from Pisa, where most of his life was spent, he was not a Pisan by birth. There are two distinct accounts of his parentage, both derived mainly from existing documents. According to one of these he is said to have been the son of "Petrus, a notary of Siena"; but this statement is very doubtful, especially as the word "Siena" or "de Senis" appears to be a conjectural addition. Another document among the archives of the Sienese cathedral calls him son of "Petrus de Apulia." Crowe and Cavalcaselle, as well as the majority of modern writers, accept the latter statement, and believe that he not only was a native of the province of Apulia in southern Italy, but also that he gained there his early instruction in the arts of sculpture and architecture. Those on the other hand who with most of the older writers, prefer to accept the theory of Niccola's origin being Tuscan suppose that he was a native of a small town called Apulia near Lucca. As is the case with the biographies of so many of those artists who lived long before Vasari's own time, that author's account of Niccola is quite untrustworthy. There is no doubt that in the century preceding Niccola Pisano's birth Apulia, and the southern provinces generally, were more advanced in the plastic art than any part of northern Italy—witness especially the magnificent architecture and sculpture in the cathedrals of Salerno, Bari, Amalfi, Ravello, and many others, in which still exist bronze doors, marble pulpits, and other works of art of great merit, dating from the 11th and 12th centuries,—a period when northern Italy produced very little art-work of any real beauty. That the young Niccola Pisano saw and was influenced by these things cannot be denied, but Crowe and Cavalcaselle, in their eagerness to contradict the old traditions, go very much too far when they deny the story told by Vasari, of Niccola's admiration for and keen study of the remains of ancient Roman sculpture which were then beginning to be sought for and appreciated. In Niccola Pisano's works it is somewhat difficult to trace the direct influence of Apulian art, while in many of them, especially in the panel-reliefs of his Pisan pulpit (see figure), classical feeling is apparent in every fold of the drapery, in the modelling of the nude, and in the dignified reserve of the main lines of the composition.

For all that, Niccola was no dull copyist; though he emancipated himself from the stiffness and unreality of earlier sculpture, yet his admiration and knowledge of the physical beauty of the human form in no way detracted from the purity and religious spirit of his subjects. Though pagan in their beauty of modelling and grace of attitude, his Madonnas are as worshipful, and his saints as saintly, as those of any sculptor the world has ever seen. With true genius he opened out to the church a new field in which all the gifts of God, even purely physical ones, were made use of and adopted as types and symbols of inward purity and love—not repudiated and suppressed as snares of the evil one. Except through his works, but little is known of the history of Niccola's life. As early as 1221 he is said to have been summoned to Naples by Frederick II., to do work in the new Castle dell' Uovo. This fact supports the theory of his southern origin, though not perhaps very strongly, as, some years before, the Pisan Bonannus had been chosen by the Norman king as the sculptor to cast one of the bronze doors for Monreale cathedral, where it still exists. The earliest existing piece of sculpture which can be attributed to Niccola is a beautiful relief of the Deposition from the Cross, in the tympanum of the arch of a side door at San Martino at Lucca; it is remarkable for its graceful composition and delicate finish of execution. The date is about 1237. In 1260, as an incised inscription records, he finished the marble pulpit for the Pisan baptistery; this is on the whole the finest of his works.

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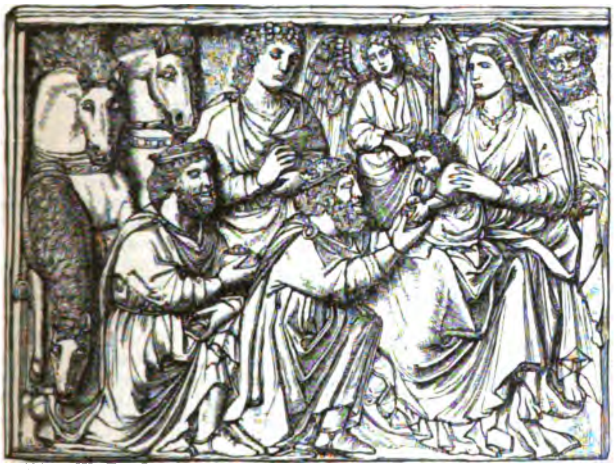
[1] [This altar was the work of another Giovanni of the 14th century. See C. C. Perkins, *Historical Handbook of Italian Sculpture*, N. Y., 1883, p. 31. Consult this work, pp. 27–34, for other particulars.—AM. ED.]

[2] See Schultz, *Denkmaler der Kunst in Unter-Italien*, vol. iii. p. 5.

It is a high octagon, on semicircular arches, with trefoil cusps, supported by nine marble columns, three of which rest on white marble lions. In design it presents that curious combination of Gothic forms with classical details which is one of the characteristics of the mediæval architecture of northern Italy; though much enriched with sculpture both in relief and in the round, the general lines of the design are not sacrificed to this, but the sculpture is kept subordinate to the whole. In this respect it is superior to the more magnificent pulpit at Siena, one of Niccola's later works, which suffers greatly from want of repose and purity of outline, owing to its being overloaded with reliefs and statuettes. Five of the sides of the main octagon have panels with subjects—the Nativity, the Adoration of the Magi, the Presentation in the Temple, the Crucifixion, and the Doom. These are all, especially the first three, works of the highest beauty, and a wonderful advance on anything of the sort that had been produced by Niccola's predecessors. The drapery is gracefully arranged in broad simple folds; the heads are full of the most noble dignity; and the sweet yet stately beauty of the Madonna could hardly be surpassed. The panel with the Adoration of the Magi is perhaps the one in which Niccola's study of the antique is most apparent (see figure). The veiled and diademed figure of the Virgin Mother, seated on a throne, recalls the Roman Juno; the head of Joseph behind her might be that of Vulcan; while the youthful beauty of an Apollo and the mature dignity of a Jupiter are suggested by the standing and kneeling figures of the Magi. Certain figures in others of the panels are no less deeply imbued with classical feeling.



The Adoration of the Magi, one of the panels in the pulpit of the Pisan Baptistery, by Niccola Pisano.

The next important work of Niccola in date is the Arca di San Domenico, in the church at Bologna consecrated to that saint, who died in 1221. Only the main part, the actual sarcophagus covered with sculptured reliefs of St. Dominic's life, is the work of Niccola and his pupils. The sculptured base and curved roof with its fanciful ornaments are later additions. This "Arca" was made when St. Dominic was canonized, and his bones translated; it was finished in 1267, not by Niccola himself, but by his pupils. The most magnificent, though not the most beautiful, of Niccola's works is the great pulpit in Siena cathedral (1268). It is much larger than that at Pisa, though somewhat similar in general design, being an octagon on cusped arches and columns. Its stairs, and a large landing at the top, with carved balusters and panels, rich with semi-classical foliage, are an addition of about 1500. The pulpit itself is much overloaded with sculpture, and each relief is far too crowded with figures. An attempt to gain magnificence of effect has destroyed the dignified simplicity for which the earlier pulpit is so remarkable.

Niccola's last great work of sculpture was the fountain in the piazza opposite the west end of the cathedral at Perugia. This is a series of basins rising one above another, each with sculptured bas-reliefs; it was begun in 1274, and completed, except the topmost basin, which is of bronze, by Niccola's son and pupil Giovanni.

Niccola Pisano was not only pre-eminent as a sculptor, but was also the greatest Italian architect of his century; he designed a number of very important buildings, though not all which are attributed to him by Vasari. Among those now existing, the chief are the main part of the cathedral at Pistoia, the church and convent of Sta Margherita at Cortona, and Sta Trinita at Florence. The church of Sant' Antonio at Padua has also been attributed to him, but without reason. Unfortunately his architectural works have in most cases been much altered and modernized. Niccola was also a skilled engineer, and was compelled by the Florentines to destroy the great tower, called the *Guardamorto*, which overshadowed the baptistery at Florence, and had for long been the scene of violent conflicts between the Guelfs and Ghibellines. He managed skilfully so that it should fall without injuring the baptistery. Niccola Pisano died at Pisa in the year 1278, leaving his son Giovanni a worthy successor to his great talents both as an architect and sculptor.

Though his importance as a reviver of the old traditions of beauty in art has been to some extent exaggerated by Vasari, yet it is probable that he, more than any other one man, was the means of starting that "new birth" of the plastic arts which, in the years following his death, was so fertile in countless works of the most unrivalled beauty. Both Niccola and his son had many pupils of great artistic power, and these carried the influence of the Pisani throughout Tuscany and northern Italy, so that the whole art of the succeeding generations may be said to have owed the greater part of its rapid development to this one family.

On the three preceding Pisani see Perkins, *Tuscan Sculptors*, vol. i., 1864; Cicognara, *Storia della Scultura*, 1823-24; Gaye, *Kunstblatt*, 1839; Rümohr, *Italienische Forschungen*, 1827-31; Milanesi, *Documenti dell' Arte* and *Vita di Niccola Pisano;* Vasari, Milanesi's ed., i. p. 293 and 481, 1882; Crowe and Cavalcaselle, *Painting in Italy*, 1864-66; Gruner, *Marmor-Bildwerke der Schule der Pisaner*, 1858; Leader Scott. *Early Italian Sculptors*, 1882; Symonds, *Renaissance in Italy; Fine Arts*, p. 100 *sq.*, 1877; Dohme, *Kunst und Kunstler Italiens*, Leispic, 1878; *Le tre porte del Battistero di Firenze*, 1821. (J. H. M.)

PISANO, VITTORE (*c.* 1380–1456), commonly called **PISANELLO**, the greatest of Italian medallists, was a native of San Vigilio sul Lago in the territory of Verona. Specimens of his work as a painter are still extant in Rome, Venice, Verona, and Pistoia, and entitle him to a place of some distinction in the history of that art. The National Gallery in London possesses a very fine specimen of Pisanello's work—a panel painted with miniature-like delicacy. For his pre-eminent position as a medallist, see NUMISMATICS, vol. xvii. p. 678. During the latter portion of his life he lived in Rome, where he enjoyed great repute.

PISANUS, LEONARDUS (Leonardo of Pisa), an Italian mathematician of the 13th century who has left the stamp of his name on a whole period in the history of the science. Of Leonardo's personal history few particulars are known. His father was called *Bonaccio*, most probably a nickname with the ironical meaning of "a good stupid fellow," while to Leonardo himself another nickname *Bigollone* (dunce, blockhead) seems to have been given. The father was secretary in one of the numerous factories erected on the southern and eastern coast of the Mediterranean by the warlike and enterprising merchants of Pisa. Where European and Arab merchants met was at that time the right place for learning arithmetic, and it was certainly with a view to this that the father had Leonardo sent to Bugia to continue his education. But Leonardo aimed at something higher than to make himself an accomplished clerk, and during his travels around the Mediterranean he obtained such erudition as would have gained him the name of a great scholar in much later times. In 1202 Leonardo Fibonacci (*i.e.*, son of Bonaccio) was again in Italy and published his great work *Liber Abaci*, which probably procured him access to the learned and refined court of the emperor Frederick II. Leonardo certainly was in relation with some persons belonging to that circle, when he published in 1220 another more extensive work *De Practica Geometriæ*, which he dedicated to the imperial astronomer Dominicus Hispanus. Some years afterwards (perhaps in 1228, as is related by an author on the authority of a manuscript only once seen by him) Leonardo dedicated to another courtier, the well known astrologer Michael Scott, the second edition of his *Liber Abaci*, which has come down to our times, and has been printed as well as Leonardo's other works by Prince Bald. Boncompagni (Rome, 1857–62, 2 vols.). The other works consist of the *Practica Geometriæ* and some most striking papers of the greatest scientific importance, amongst which the *Liber Quadratorum* may be specially signalized. It bears the notice that the author wrote it in 1225, and in the introduction Leonardo himself tells us the occasion of its being written. Dominicus had presented Leonardo to Frederick II.[1] The presentation was accompanied by a kind of mathematical performance, in which Leonardo solved several hard problems proposed to him by John of Palermo, an imperial notary, whose name is met with in several documents dated between 1221 and 1240. The methods which Leonardo made use of in solving those problems fill the *Liber Quadratorum*, the *Flos*, and a *Letter to Magister Theodore*. All these treatises seem to have been written nearly at the same period, and certainly before the publication of the second edition of the *Liber Abaci*, in which the *Liber Quadratorum* is expressly mentioned. We know nothing of Leonardo's fate after he issued that second edition, and we might compare him to a meteor flashing up suddenly on the black back-ground of the midnight sky, and vanishing as suddenly, were it not that his influence was too deep and lasting to allow of his being likened to a phenomenon passing quickly by.

To explain this influence and the whole importance of Leonardo's scientific work, we must rapidly sketch the state of mathematics about the year 1200. The Greeks, the most geometrical nation on the earth, had attained a high degree of scientific perfection, when they were obliged to yield to the political supremacy of Rome. From this time mathematics in Europe sunk lower and lower, till only some sorry fragments of the science were still preserved in the cell of the studious monk and behind the counting-board of the eager merchant. Geometry was nearly forgotten; arithmetic made use of the abacus with counters, or with the nine characters the origin of which is still a matter of controversy (see NUMERALS); the zero was still unknown. Among the Arabs it was quite otherwise. Greek mathematics found amongst them a second home, where the science was not only preserved but came to new strength, and was recruited from India, whence in particular came the symbol "zero" and its use, which alone renders possible numerical calculation in the modern sense of the word. Ancient astronomy as well as ancient mathematics reappeared in Europe, from the beginning of the 12th century onwards in an Arabian dress. Two men especially recognized the worth of these sciences and made it the task of their life to propagate them amongst their contemporaries,—the German monk Jordanus Nemorarius and the Italian merchant Leonardus Pisanus. Leonardo, as we have said, travelled all round the Mediterranean gathering knowledge of every kind. He studied the geometry of Euclid, the algebra of Mohammed ibn Musa Alchârizmi; he made himself acquainted with Indian methods; he found out by himself new theories. So runs his own account; and an exact comparison of Leonardo's works with older sources not only confirms the truth of his narrative, but shows also that he must have studied some other authors,—for instance, Alkarchi. In his *Practica Geometriæ* plain traces of the use of the Roman "agrimensores" are met with; in his *Liber Abaci* old Egyptian problems occur revealing their origin by the reappearance of the very numbers in which the problem is given, though one cannot guess through what channel they came to Leonardo's knowledge. Leonardo cannot now be regarded (as Cossali regarded him about 1800) as the inventor of that very great variety of truths for which he mentions no earlier source. But even were the predecessors to whom he is indebted more numerous than we are inclined to believe, were he the Columbus only of a territory the existence of which was unknown to his century, the historical importance of the man would be nearly the same. We must remember the general ignorance of his age, and then fancy the sudden appearance of a work like the *Liber Abaci*, which fills 459 printed pages. These pages set forth the most perfect methods of calculating with whole numbers and with fractions, practice, extraction of the square and cube roots, proportion, chain rule, finding of proportional parts, averages, progressions, even compound interest, just as in the completest mercantile arithmetics of our days. They teach further the solution of problems leading to equations of the first and second degree, to determinate and indeterminate equations, not by single and double position only, but by real algebra, proved by means of geometric constructions, and including the use of letters as symbols for known numbers, the unknown quantity being called *res* and its square *census*. We may well wonder, not that the impression caused by a work of such overwhelming character was so deep, but that it made any impression at all, and that the unprepared soil could receive the seed. The second work of Leonardo, his *Practica Geometriæ* (1220), is still more remarkable, since it requires readers already acquainted with Euclid's planimetry, who are able to follow rigorous demonstrations and feel the necessity for them. Among the contents of this book we simply mention a trigonometrical chapter, in which the words *sinus versus arcus* occur, the approximate extraction of cube roots shown more at large than in the *Liber Abaci*, and a very curious problem, which nobody would search for in a geometrical work, viz., to find a square number which remains a square number when 5 is added to it. This problem evidently suggested the first question put to our mathematician in presence of the emperor by John of Palermo, who, perhaps, was quite enough Leonardo's friend to set him such problems only as he had himself asked for. The problem was:—To find a square number remaining so after the addition as well as the subtraction of 5. Leonardo gave as solution the numbers $11\frac{97}{144}$, $16\frac{97}{144}$, and $6\frac{97}{144}$,—the squares of $3\frac{5}{12}$, $4\frac{1}{12}$, and $2\frac{7}{12}$; and the *Liber Quadratorum* gives the method of finding them, which we cannot discuss here. We observe, however, that the kind of problem was not new. Arabian authors already had found three square numbers of equal difference, but the difference itself had not been assigned in proposing the question. Leonardo's method, therefore, when the difference was a fixed condition of the problem, was necessarily very different from the Arabian, and, in all probability, was his own discovery.

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[1] The words "cum Magister Dominicus pedibus celsitudinis vestræ me Pisis duceret præsentandum" have always been taken to mean that Leonardo was presented to the emperor at Pisa, but the date of 1225 excludes this interpretation, as Frederick II. certainly never was in Pisa before July, 1226. The translation, therefore, ought to be—"when Magister Dominicus brought me *from* Pisa, etc.," the place where Leonardo met the emperor remaining unknown.

The *Flos* of Leonardo turns on the second question set by John of Palermo, which required the solution of the cubic equation $x^3+2x^2+10x=20$. Leonardo, making use of fractions of the sexagesimal scale, gives $x=1^{0}22^{\mathrm{i}}7^{\mathrm{ii}}42^{\mathrm{iii}}33^{\mathrm{iv}}4^{\mathrm{v}}40^{\mathrm{vi}}$, after having demonstrated, by a discussion founded on the 10th book of Euclid, that a solution by square roots is impossible. It is much to be deplored that Leonardo does not give the least intimation how he found his approximative value, outrunning by this result more than three centuries. Genocchi believes Leonardo to have been in possession of a certain method called *regula aurea* by Cardan in the 16th century, but this is a mere hypothesis without solid foundation. In the *Flos* equations with negative values of the unknown quantity are also to be met with, and Leonardo perfectly understands the meaning of these negative solutions. In the *Letter to Magister Theodore* indeterminate problems are chiefly worked, and Leonardo hints at his being able to solve by a general method any problem of this kind not exceeding the first degree. We have enumerated the main substance of what appear to be Leonardo's own discoveries, and the experienced reader will not hesitate to conclude that they prove him to have been one of the greatest algebraists of any time. As for the influence he exercised on posterity, it is enough to say that Luca Pacioli, about 1500, in his celebrated *Summa*, leans so exclusively to Leonardo's works (at that time known in manuscript only) that he frankly acknowledges his dependence on them, and states that wherever no other author is quoted all belongs to Leonardo Pisanus. (M. CA.)

PISCICULTURE. This art as at present pursued is not limited to those animals which are grouped by zoologists in the class of *Pisces*. "Fishery" is now understood to signify the exploitation of all products of the sea, lake, and river, the capture of whales, turtles, pearls, corals, and sponges, as well as of fish proper. The purpose of fish culture (or *aquiculture*, as it is in France more appropriately named) is to counteract by reparative and also by preventive measures the destructive effects of fishery.

The possibility of exterminating aquatic animals within the restricted limits of a lake or a river cannot be doubted; authorities are decidedly at variance, however, as to the extent of the influence of man upon the abundance of life in the open seas. Distinction must be made between the extermination of a species, even in a restricted locality, and the destruction of a fishery; the former is very unusual, and is seemingly impossible in the case of oceanic species, but the latter, especially for limited regions, is of almost yearly occurrence. Aquatic mammals, such as seals, may be entirely exterminated, especially when, like the fur seal, they forsake the water for a season and resort to the land for breeding purposes. The fur seals of the Pacific and Antarctic are now nearly gone, except in two groups of islands, the Pribylovs in Alaska and the Commander Islands in Siberia, where they enjoy Government protection, the islands being leased to the Alaska Commercial Company by whom only a stated number, all non-breeding males, may be killed each year, the permanence of the fishery being thus perfectly secured. Aquatic mammals also which never leave the water, like whales and sirenians, being conspicuous by reason of their size, and incapable of rapid multiplication, may, especially when they breed near the shore, suffer extermination. As examples may be cited the Arctic sea cow (*Rhytina stelleri*) and the Pacific gray whale (*Rhachianectes glaucus*), the former extinct, the latter having practically become so within the present century. The sperm whale is also rapidly disappearing. In the case of fixed animals like the oyster, the corals, and the sponges, again, the colonies or beds may be swept out of existence exactly as forests are hewn down. The native oyster beds of Europe are for the most part gone, and still more rapid has been the recent destruction of the oyster reefs in Pocomoke Sound, Maryland, a large estuary, formerly very productive—the result being due more directly to the choking up of the beds by the rubbish dragged over them by dredges, and the demolition of ledges suitable for the reception of young spat, than to the removal of all the adult oysters, which could, of course, never have been effected. The preservation of oyster beds is a matter of vital importance to the United States, for oyster-fishing, unsupported by oyster-culture, will soon destroy the employment of tens of thousands and a cheap and favorite food of tens of millions of the people. Something may undoubtedly be effected by laws which shall allow each bed to rest for a period of years after each season of fishing upon it. It is, however, the general belief that shell-fish beds must be cultivated as carefully as are garden beds, and that this can be done only by giving to individuals rights in submerged lands, similar to those which may be acquired upon shore. It is probable that the present unregulated methods will prevail until the dredging of the natural beds shall cease to be remunerative, and that the oyster industry will then pass from the improvident fishermen to the painstaking oyster-grower, with a corresponding increase in price and decrease in consumption. Such a change has already taken place in France and Holland, and to a large extent in England, but there appear to be almost unsurmountable difficulties in the way of protecting the property of oyster-culturists from depredations—difficulties apparently as formidable in England as in America.

Fishes in ponds, lakes, or streams are quickly exterminated unless the young be protected, the spawning season undisturbed, and wholesale methods of capture prohibited. Salmon and trout streams are preserved in all countries of northern Europe; and in Canada also, a large service of fishery wardens is maintained. In the United States there are in many of the older commonwealths excellent codes of laws for the preservation of fish and game which are enforced by anglers' clubs. A river may quickly be emptied of its anadromous visitors, salmon, shad, and alewives, by over-fishing in the spawning season, as well as by dams which cut off the fish from their spawning-grounds. Numerous rivers in Europe and America might be named in which this has occurred. In the same way, sea fishes approaching the coasts to spawn in the bays or upon the shoals may be embarrassed, and the numbers of each school decimated,—particularly if, as in the case of the herring, the eggs are adhesive and become entangled in nets. Sea fishes spawning in estuaries are affected much in the same manner as the salmon in rivers, though in a less degree, by wholesale capture in stationary nets. The shad and alewife fisheries of the United States are protected by an extensive code of laws, varying in the several States and in the different rivers of each State. The most satisfactory laws appear to be those which regulate the dates when fishery must commence and end, and prescribe at least one day in each week, usually Sunday, during which the ascent of the fish may not be interrupted. Migratory, semi-migratory, or wandering fishes, ranging singly or in schools over broad stretches of ocean, the mackerels, the tunnies, the sardines or pilchards, the menhaden, the blue-fish, the bonitoes, and the squeteague, stand apparently beyond the influence of human agency, especially since, so far as is known, they spawn at a distance from the coast, or since the adults, when about to spawn, cannot be reached by any kind of fishery apparatus. Their fecundity is almost beyond comprehension, and in many instances their eggs float free near the surface, and are quickly disseminated over broad areas. The conclusions gained by Prof. Baird, U. S. commissioner of fisheries, agree exactly with those of Prof. Huxley, that the number of any given kind of oceanic fish killed by man is perfectly insignificant when compared with the destruction effected by their natural enemies. Almost any body of water, be it a bay or sound, or be it the covering of a ledge or shoal at sea, may be over-fished to such a degree that fishing becomes unprofitable, especially if fishing be carried on in the spawning season.

In this manner, no doubt, have the coasts of England been robbed of the formerly abundant supplies of turbot and sole.

The character of the various destructive influences which man brings to bear upon the inhabitants of the water and their effects having thus been briefly noticed, the student of fish culture is confronted by the question, What can be done to neutralize these destructive tendencies? There are evidently three things to do:—(1) to preserve fish waters, especially those inland, as nearly as it may be possible in their normal condition; (2) to prohibit wasteful or immoderate fishing; and (3) to put into practice the art of fish breeding—(*a*) to aid in maintaining a natural supply, (*b*) to repair the effects of past improvidences, and (*c*) to increase the supply beyond its natural limits rapidly enough to meet the necessities of a constantly increasing population.

The preservation of normal conditions in inland waters is comparatively simple. A reasonable system of forestry and water-purification is all that is required; and this is needed not only by the fish in the streams but by the people living on the banks. It has been shown that a river which is too foul for fish to live in is not fit to flow near the habitations of man. Obstructions, such as dams, may, in most instances, be overcome by fish ladders. The salmon has profited much by those devices in Europe, and the immense dams in American rivers will doubtless be passable even for shad and alewives if the new system of fishway construction devised by Col. M'Donald, and now being applied on the Savannah, James, and Potomac, and other large rivers, fulfils its present promises of success.[1]

The protection of fish by law is what legislators have been trying to effect for many centuries, and the success of their efforts must be admitted to have been very slight indeed. Great Britain has at present two schools of fishery-economists,—the one headed by Prof. Huxley, opposed to legislation, save for the preservation of fish in inland waters; the other, of which Dr. Francis Day is the chief leader, advocating a strenuous legal regulation of sea fisheries also. Continental Europe is by tradition and belief committed to the last-named policy. In the United States, on the contrary, public opinion is generally antagonistic to fishery legislation; and Prof. Baird, the commissioner of fisheries, after carrying on for fourteen years, with the aid of a large staff of scientific specialists, investigations upon this very question, has not yet become satisfied that laws are necessary for the perpetuation of the sea fisheries, nor has he ever recommended to Congress the enactment of any kind of fishery laws.

Just here we meet the test problem in fish culture. Many of the most important commercial fisheries of the world, the cod fishery, the herring fishery, the sardine fishery, the shad and alewife fishery, the mullet fishery, the salmon fishery, the whitefish fishery, the smelt fishery, and many others, owe their existence to the fact that once a year these fishes gather together in closely swimming schools, to spawn in shallow water, on shoals, or in estuaries and rivers. There is a large school of *quasi* economists who clamor for the complete prohibition of fishing during spawning time. Their demand demonstrates their ignorance. Deer, game, birds, and other land animals may easily be protected in the breeding season, and so may trout and other fishes of strictly local habits. Not so the anadromous and pelagic fishes. If they are not caught in the spawning season, they cannot be caught at all.

The writer recently heard a prominent fish-culturist advocating before a committee of the United States Senate the view that shad should not be caught in the rivers because they come into the rivers to spawn. When asked what would become of the immense shad-fisheries if this were done, he ventured the remark that doubtless some ingenious person would invent a means of catching them at sea. The fallacy in the argument of these economists lies, in part, in supposing that it is more destructive to the progeny of a given fish to kill it when its eggs are nearly ripe than to kill the same fish eight or ten months earlier. We must not, however, ignore the counter argument. Such is the mortality among fish that only an infinitesimal percentage attains to maturity. Professor Möbius has shown that for every grown oyster upon the beds of Schleswig-Holstein 1,045,000 have died. Only a very small percentage, perhaps not greater than this, of the shad or the smelt ever comes upon the breeding grounds. Some consideration, then, ought to be shown to those individuals which have escaped from their enemies and have come up to deposit the precious burden of eggs. How much must they be protected? Here the fish-culturist comes in with the proposition that "it is cheaper to make fish so plentiful by artificial means that every fisherman may take all he can catch than to enforce a code of protection laws."

The salmon rivers of the Pacific slope of the United States, the shad rivers of the east, and the whitefish fisheries of the lakes are now so thoroughly under control by the fish-culturist that it is doubtful if any one will venture to contradict his assertion. The question is whether he can extend his domain to other species.

Fish culture in a restricted sense must sooner or later be resorted to in all densely populated countries, for, with the utmost protection, nature unaided can do but little to meet the natural demand for fish to eat. Pond-culture (*Teichwirthschaft*) has been practiced for many centuries, and the carp and the gold-fish have become domesticated like poultry and cattle. The culture of carp is an important industry in China and Germany, though perhaps not more so than it was in England three and four centuries ago; the remains of ancient fish-stews may be seen upon almost every large estate in England, and particularly in the vicinity of old monasteries. Strangely enough, not a single well-conducted carp-pond exists in England to-day to perpetuate the memory of the tens of thousands which were formerly sustained, and the carp, escaping from cultivation, have reverted to a feral state and are of little value. Until improved varieties of carp are introduced from Germany, carp-culture can never be made to succeed in England. Carp-culture is rapidly coming into favor in the United States; a number of young scale carp and leather carp were imported in 1877 for breeding purposes, and the fish commission has since distributed them to at least 30,000 ponds. Two railway cars especially built for the purpose are employed during the autumn months for delivering cargoes of carp, often making journeys of over three thousand miles, and special shipments have been made to Mexico and Brazil. The carp is not recommended as a substitute for the salmon, but is especially suited to regions remote from the sea where better flavored fish cannot be had in a fresh condition.

A kind of pond-culture appears to have been practiced by the ancient Egyptians, though in that country as in ancient Greece and Rome, the practice seems to have been similar to that now employed in the lagoons of the Adriatic and of Greece, and to have consisted in driving the young fish of the sea into artificial enclosures or vivaria, where they were kept until they were large enough to be used.

The discovery of the art of artificially fecundating the ova of fish must apparently be accredited to Stephen Ludwig Jacobi of Hohenhausen in Westphalia, who, as early as 1748, carried on successful experiments in breeding salmon and trout. The importance of this discovery was thoroughly appreciated at the time, and from 1763 to 1800 was a fruitful subject of discussion in England, France, and Germany. George III. of England in 1771 granted to Jacobi a life pension. It has been claimed by many French writers that the process of artificial fecundation was discovered as early as 1420 by Dom Pinchon, a monk in the Abbey of Reome, but this claim is but a feeble one, not having been advanced until 1854, and it is believed by many that the practice of the French monk was simply to collect and transplant the eggs which he had already found naturally fertilized. However interesting to the antiquarian, the proceedings of Dom Pinchon had no influence upon the progress of fish-culture. To Germany, beyond question, belongs the honor of discovering and carrying into practical usefulness the art of fish-culture. Upon the estate of Jacobi, by the discoverer and his sons, it was carried on as a branch of agriculture for fully eighty years—from 1741 to 1825—though it was nearly a hundred years before public opinion was ripe for a general acceptance of its usefulness, a period during which its practice was never abandoned by the Germans.

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[1] *Report* of United States Fish Commission for 1886.

Fish-culture in Britain was inaugurated in 1837 by Mr. John Shaw, gamekeeper to the duke of Buccleuch at Drumlanrig, who, in the course of ichthyological investigations, had occasion to fecundate the eggs of salmon and rear the young; and as regards France, an illiterate fisherman, Joseph Remy, living in the mountains of the Vosges, rediscovered, as it is claimed, or at any rate successfully practiced, in association with Antoine Gehin, the culture of trout in 1842. The originality and practical influence of Remy and Gehin's work appear to have been exaggerated by French writers. On the other hand the establishment in 1850 at Huningue (Hüningen) in Alsace by the French Government of the first fish-breeding station, or "piscifactory," as it was named by Professor Coste, is of great significance, since it marks the beginning of public fish-culture. The art discovered in Germany was practiced in Italy as early as 1791 by Baufalini, in France in 1820, in Bohemia in 1824, in Great Britain in 1837, in Switzerland in 1842, in Norway under Government patronage in 1850, in Finland in 1852, in the United States in 1853, in Belgium, Holland, and Russia in 1854, in Canada about 1863, in Austria in 1865, in Australasia by the introduction of English salmon, in 1862, and in Japan in 1877.

Artificial Propagation.—*Sponges* have been successfully multiplied by cuttings, like plants, in Austria and in Florida. *Oysters* have long been raised in artificial enclosures from spat naturally deposited upon artificial stools. The eggs of the American and Portuguese oysters have been artificially fecundated and the young hatched, and in July, 1883, Mr. John A. Ryder, embryologist of the U. S. Fish Commission, solved the most difficult problem in American oyster-culture by completing a mechanical device for preventing the escape of the newly hatched oysters while swimming about prior to fixation.[1] The English oyster, being hermaphrodite, or monœcious, cannot be artificially propagated from the egg like the diœcious American species.

The fertilization of the *fish egg* is the simplest of processes, consisting, as every one knows, in simply pressing the ripe ova from the female fish into a shallow receptacle and then squeezing out the milt of the male upon them. Formerly a great deal of water was placed in the pan; now the "dry method," with only a little, discovered by the Russian Vrasski in 1854, is preferred. The eggs having been fertilized, the most difficult part of the task remains, namely, the care of the eggs until they are hatched, and the care of the young until they are able to care for themselves.

The apparatus employed is various in principle, to correspond to the physical peculiarities of the eggs. Fish-culturists divide eggs into four classes, viz.:—(1) heavy eggs, non-adhesive, whose specific gravity is so great that they will not float, such as the eggs of the salmon and trout; (2) heavy adhesive eggs, such as those of the herring, smelt, and perch; (3) semi-buoyant eggs, like those of the shad and whitefish (*Coregonus*); and (4) buoyant eggs like those of the cod and mackerel.[*] (1) Heavy non-adhesive eggs are placed in thin layers either upon gravel, grilles of glass, or sheets of wire cloth, in receptacles through which a current of water is constantly passing. There are numerous forms of apparatus for eggs of this class, but the most effective are those in which a number of trays of wire cloth, sufficiently deep to carry single layers of eggs, are placed one upon the other in a box or jar into which the water enters from below, passing out at the top. (2) Heavy adhesive eggs are received upon bunches of twigs or frames of glass plates to which they adhere, and which are placed in receptacles through which water is passing. (3) Semi-buoyant eggs, or those whose specific gravity is but slightly greater than that of the water, require altogether different treatment. They are necessarily placed together in large numbers, and to prevent their settling upon the bottom of the receptacle it is necessary to introduce a gentle current from below. For many years these eggs could be hatched only in floating receptacles with wire cloth bottoms, placed at an angle to the current of the stream in which they were fixed, the motion of which was utilized to keep the eggs in suspension. Later an arrangement of plunging-buckets was invented, cylindrical receptacles with tops and bottoms of wire cloth, which were suspended in rows from beams worked up and down at the surface of the water by machinery. The eggs in the cylinders were thus kept constantly in motion. Finally the device now most in favor was perfected; this is a receptacle, conical, or at least with a constricted termination, placed with its apex downward, through which passes from below a strong current, keeping the eggs constantly suspended and in motion. This form of apparatus, of which the M'Donald and Clark hatching-jars are the most perfect development, may be worked in connection with any common hydrant.[2] (4) Floating eggs have been hatched only by means of rude contrivances for sustaining a lateral circular eddy of water in the receptacle.

The use of refrigerators, to retard the development of the eggs until such time as it is most convenient to take care of the fry, has been extensively introduced in the United States, and has been experimented upon in Germany.

The distinction between private and public fish-culture must be carefully observed. The maintenance of ponds for carp, trout, and other domesticated species is an industry to be classed with poultry-raising and bee-keeping, and its interest to the political economist is but slight. The proper function of public fish-culture is the stocking of the public waters with fish in which no individual can claim the right of property. This is being done in the rivers of the United States, with salmon, shad, and alewives, and in the lakes with whitefish. The use of steamships and steam machinery, the construction of refrigerating transportation cars, two of which, with a corps of trained experts, are constantly employed by the United States Fish Commission, moving fish and eggs from Maine to Texas, and from Maryland to California, and the maintenance of permanent hatching stations, seventeen in number, in different parts of the continent, are forms of activity only attainable by Government aid. Equally unattainable by private effort would be the enormous experiments in transplanting and acclimatizing fish in new waters,—such as the planting of Californian salmon in the rivers of the East, land-locked salmon and smelt in the lakes and rivers of the interior, and shad in California and the Mississippi valley, and the extensive acclimatization of German carp; the two last-named experiments carried out within a period of three years have met with successes beyond doubt, and are of the greatest importance to the country; the others have been more or less successful, though their results are not yet fully realized. It has been demonstrated, however, that the great river fisheries of the United States, which produced in 1880 48,000,000 ℔ of alewives, 18,000,000 ℔ of shad, 52,000,000 ℔ of salmon, besides bass, sturgeon, and smelt, and worth "at first hand" between 4,000,000 and 6,000,000 dollars, are entirely under the control of the fish-culturist to sustain or to destroy, and are capable of immense extension.

Having now attempted to define the field of modern fish-culture, and to show what it has already accomplished, it remains to be stated what appear to be its legitimate aims and limitations.

The aims of modern fish-culture, as understood by the present writer, are—(1) to arrive at a thorough knowledge of the life history from beginning to end of every species of economic value, the histories of the animals and plants upon which they feed or upon which their food is nourished, the histories of their enemies and friends, and the friends and foes of their enemies and friends, as well as the currents, temperatures, and other physical phenomena of the waters in relation to migration, reproduction, and growth; and (2) to apply this knowledge in such a practical manner that every form of fish shall be at least as thoroughly under control as are now the salmon, the shad, the alewife, the carp, and the whitefish. Its limitations are precisely those of scientific agriculture and animal rearing, since, although certain physical conditions may constantly intervene to thwart man's efforts in any given direction it is quite within the bounds of reasonable expectation to be able to understand what these are, and how their effects are produced. An important consideration concerning the limitations of fish-culture must always be kept in mind in weighing the arguments for and against its success, viz., that effort towards the acclimatization of fishes in new waters is not fish-culture, but is simply one of the necessary experiments upon which fish-culture may be based. The introduction of carp from Germany to the United States was not fish-culture; it was an experiment; the experiment has succeeded, and fish-culture is now one of its results. The introduction of California salmon to the Atlantic slope was an experiment; it has not succeeded; its failure has nothing to do with the success of fish-culture. If any one wants to see successful fish-culture in connection with this fish let him go to the Sacramento river. The introduction of shad to the Pacific coast was an experiment; it succeeded; shad culture can now be carried on without fear of failure by the Fish Commission of the Pacific States. An equally established success is whitefish culture in the Great Lakes. The experiments with cod and Spanish mackerel were not fish-culture, though it is hoped that they may yet lead up to it. And there is every reason to believe, from experiments in part completed, that the dominion of fish-culture may be extended in like manner to certain of the great sea fisheries, such as the cod, haddock, herring, mackerel, and Spanish mackerel fisheries.

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[1] *Bulletin*, United States Fish Commission, 1883.

[2] *Transactions*, American Fish Cultural Association, 1883.

Public fish-culture exists only in the United States and Canada. European fish-culturists have always operated with only small numbers of eggs. The hatchery of Sir James Maitland at Howieton, near Stirling, Scotland, may be specially mentioned in this connection, since it is undoubtedly the finest private fish-cultural establishment in the world. It is described in one of the Conference Papers of the International Fishery Exhibition.

The recent organization of the Scottish Fishery Board and the establishment of a society for the biological investigation of the coasts of Great Britain, are indications that England, having at last recognized the importance of protecting its extensive fishery industries, will at no distant time become a leader in matters of fishery economy.

Holland, Germany and Norway have hitherto been the only European nations manifesting intelligent enterprise in the consideration of fishery questions in general, although fair work has been done by Sweden and other countries in the treatment of limited special branches of this industry. In Germany the functions of the German Fishery Union (*Deutscher Fischerei-Verein*) and of the commission for the investigation of the German seas (*Ministerial-Kommission zur wissenschaftlichen Untersuchung der deutschen Meere zu Kiel*), taken together, represent practically the two divisions of the work of the United States Fish Commission—propagation and investigation. The latter body is composed of a commission of scientific men, whose head is appointed by the Government; it is carried on with Government funds, but is not in any way subjected to Government control, the central headquarters being at Kiel instead of Berlin. The Fischerei-Verein is also a private body, under the patronage of the emperor and with funds partly furnished by the Government and having also the general direction of the National Fish Cultural Society at Hüningen. This, also, is not a bureau of any Government department, but managed entirely by its own officers. It is the only European fisheries institution that has so far constituted a thoroughly successful experiment. The Netherlands Commission of Sea Fisheries (*Collegie voor de Zeevisscherijen*) is a body of fifteen men, chiefly workers in science, occupying a responsible position in the national economy, their function being "to advise Government in all subjects connected with the interest of the fisheries." During the twenty-five years of its existence, says its historian, "the commission has constantly been consulted by Government on the different measures that might be beneficial, or on the abolition of others that were detrimental, to the fisheries." The Society for the Development of Norwegian Fisheries (*Selskabet for de Norske Fiskeriers Fremme*) is an organization independent of the Government and electing its own officers, but receiving large grants from Government to carry on work precisely similar to that of the United States Commission. In 1882–83 these grants amounted to 49,000 kroner.

As an illustration of the interest manifested in fish-culture in the United States, it may be stated that from 1871 to 1883, $1,190,955 has been appropriated by Congress for the use of the United States Fish Commission, and that thirty-five of the State Governments have made special grants for fish-culture, in the aggregate equal to $1,101,000. To show the wholesale methods employed in this, a letter by Mr. Livingstone Stone, superintendent of one of the seventeen hatcheries supported by the United States Fish Commission, that on the M'Cloud river in California, may be quoted:

> "In the eleven years since the salmon-breeding station has been in operation 67,000,000 eggs have been taken, most of which have been distributed in the various States of the Union. Several millions, however, have been sent to foreign countries, including Germany, France, Great Britain, Denmark, Russia, Belgium, Holland, Canada, New Zealand, Australia and the Sandwich Islands. About 15,000,000 have been hatched at the station and the young fish placed in the M'Cloud and other tributaries of the Sacramento river. So great have been the benefits of this restocking of the Sacramento that the statistics of the salmon fisheries show that the annual salmon catch of the river has increased 5,000,000 pounds each year during the last few years."

Fifteen canneries now are fully supplied, whereas in 1872 the single establishment then on the river was obliged to close for lack of fish. In the two Government hatcheries at Alpena and Northville, Michigan, there have been produced in the winter of 1883–84 over 100,000,000 eggs of the whitefish, *Coregonus clupeiformis*, and the total number of young fish to be placed in the Great Lakes this year by these and the various State hatcheries will exceed 225,000,000. The fishermen of the Great Lakes admit that but for public fish-culture half of them would be obliged to abandon their calling. Instances of great improvement might be cited in connection with nearly every shad river in the United States. In the Potomac alone the annual yield has been brought up by the operations of fish-culture from 668,000 ℔ in 1877 to an average of more than 1,600,000 ℔ in recent years. In 1882 carp bred in the Fish Commission ponds in Washington were distributed in lots of 20 to 10,000 applicants throughout every State and Territory, at an average distance of more than 900 miles, the total mileage of the shipments being about 9,000,000 miles, and the actual distance traversed by the transportation car 34,000 miles. There still exists in Europe some skepticism as to the beneficial results of fish-culture. Such doubts do not exist on the other side of the Atlantic, if the continuance from year to year of liberal grants of public money may be considered to be a test of public confidence.

Perhaps the best general treatises upon the methods of artificial propagation practiced by pisciculturists are Herr Max Von Dem Borne's *Fischzucht*, Berlin, 1880, and from the philosophical standpoint, Dr. Francis Day's *Fish-Culture*, one of the handbooks of the International Fisheries Exhibition of 1883. The reports and bulletins of the United States Fish Commission, in twelve volumes, from 1873 to 1884, contain full descriptions of American methods and discussions of all foreign discoveries and movements. Two prominent London journals, the *Field* and *Land and Water*, contain authoritative articles upon the subject, and the museum of fisheries and fish-culture at South Kensington, enriched as it has been by the contributions of exhibitors at the Fisheries Exhibition of 1883, is an excellent exponent of the methods and implements in use in the past and at present. For a history of the subject see "Epochs in the History of Fish-Culture," by G. Brown Goode, in *Transactions* of the American Fish Cultural Association (10th meeting, 1881, pp. 34–58), and "The Status of the United States Fish Commission in 1884," by the same author, in part xii. of the *Report* of that commission; and for a discussion of modern methods and apparatus, as shown at the late Fisheries Exhibition, the essays by Mr. R. Edward Earll in the report of the United States Commissioner to the exhibition and in *Nature* (Oct. 4, 1883). (G. B. G.)

PISEK, a small town of Bohemia, 55 miles to the south of Prague, lies on the right bank of the Wottawa, which is here crossed by an interesting stone bridge of great antiquity. The town generally has a mediæval air, heightened by the preservation of part of the old walls and bastions. The most prominent buildings are the church of the Nativity, the town-house and the venerable chateau. The name of Pisek, which is the Czech for sand, is said to be derived from the gold-washing formerly carried on in the bed of the Wottawa. This source of profit, however, has been long extinct, and the inhabitants now support themselves by iron and brass founding, brewing and the manufacture of shoes and Turkish fezes. The population in 1880 was 10,545.

Pisek was one of the chief centres of the Hussites and it suffered very severely in the Thirty Years' War, when Maximilian of Bavaria put almost all the inhabitants to the sword. It was also occupied by the French in 1741. In spite of these reverses Pisek is now a very wealthy community, possessing large and valuable tracts of woodland.

PISIDIA, in ancient geography, was the name given to a country in the south of Asia Minor, immediately north of Pamphylia, by which it was separated from the Mediterranean, while it was bounded on the north by Phrygia, on the east by Isauria, Lycaonia and Cilicia and on the west and southwest by Lycia and a part of Phrygia (see vol. xv. Pl. II.). It was a rugged and mountainous district, comprising some of the loftiest portions of the great range of Mount Taurus, together with the offshoots of the same chain towards the central table land of Phrygia. Such a region was naturally occupied from a very early period by wild and lawless races of mountaineers, who were very imperfectly reduced to subjection by the powers that successively established their dominion in Asia Minor. The Pisidians are not mentioned by Herodotus, either among the nations that were subdued by Crœsus or among those that furnished contingents to the army of Xerxes, and the first mention of them in history occurs in the *Anabasis* of Xenophon, when they furnished a pretext to the younger Cyrus for levying the army with which he designed to subvert his brother's throne, while he pretended only to put down the Pisidians who were continually harassing the neighboring nations by their lawless forays (*Anab.* i. 1, 11; ii. 1, 4, etc.) They are afterwards mentioned by Ephorus among the inland nations of Asia Minor, and assume a more prominent part in the history of Alexander the Great, to whose march through their country they opposed a determined resistance. In Strabo's time they had passed tranquilly under the Roman dominion, though still governed by their own petty chiefs and retaining to a considerable extent their predatory habits.

The boundaries of Pisidia, like those of most of the inland provinces or regions of Asia Minor, were not clearly defined and appear to have fluctuated at different times. This was especially the case on the side of Lycia, where the upland district of Milyas was sometimes included in Pisidia, at other times assigned to Lycia. Some writers, indeed, considered the Pisidians as the same people with the Milyans, while others regarded them as descendants of the Solymi, but Strabo speaks of the language of the Pisidians as distinct from that of the Solymi, as well as from that of the Lydians. The whole of Pisidia is an elevated region of table-lands or upland valleys in the midst of the ranges of Mount Taurus which descends abruptly on the side of Pamphylia. It contains several small lakes, but the only one of any importance is that now called the Egerdin Göl, of which the ancient name has not been preserved. It is a fresh-water lake of about 30 miles in length, situated in the north of Pisidia, on the frontier of Phrygia, at an elevation of 2,800 feet above the sea. The only rivers of any importance are the Cestrus and the Eurymedon, both of which take their rise in the highest ranges of Mount Taurus and flow down through deep and narrow valleys to the plain of Pamphylia, which they traverse on their way to the sea.

Notwithstanding its rugged and mountainous character, Pisidia contained in ancient times several considerable towns, the ruins of which have been brought to light by the researches of recent travellers (Arundell, Hamilton, Daniell), and show them to have attained under the Roman empire to a degree of opulence and prosperity far beyond what we should have looked for in a country of predatory mountaineers. The most important of them are Termessus, near the frontier of Lycia, a strong fortress in a position of great natural strength and commanding one of the principal passes into Pamphylia; Cremna, another mountain fortress, north of the preceding, impending over the valley of the Cestrus; Sagalassus, a little farther north, a large town in a strong position, the ruins of which are among the most remarkable in Asia Minor; Selge, on the right bank of the Eurymedon, surrounded by rugged mountains, notwithstanding which it was in Strabo's time a large and opulent city; and Antioch, known for distinction's sake as Antioch in Pisidia, and celebrated for the visit of St. Paul. This was situated in the extreme northeast of the district immediately on the frontier of Phrygia, between Lake Egerdin and the range of the Sultan Dagh. Besides these there were situated in the rugged mountain tract west of the Cestrus Cretopolis, Olba or Olbasa, Pogla, Isinda, Etenna, and Conana. Pednelissus was in the upper valley of the Eurymedon above Selge. The only place in the district at the present day deserving to be called a town is Isbarta, the residence of a pasha; it stands at the northern foot of Mount Taurus, looking over the great plain which extends from thence into Phrygia. North of this and immediately on the borders of Phrygia stood Apollonia, called also Mordiæum. Several other towns are assigned to Pisidia by Strabo, Pliny, and Ptolemy, of which the sites have not yet been determined.

We have no clue to the ethnic character and relations of the Pisidians, except that we learn from Strabo that they were distinct from the neighboring Solymi, who were probably a Semitic race, but we find mention at an early period in these mountain districts of various other tribes, as the Cabali, Milyans, etc., of all which, as well as the neighboring Isaurians and Lycaonians, the origin is wholly unknown, and in the absence of monuments of their language must, in all probability, ever remain so.

PISISTRATUS, citizen and afterwards tyrant of Athens, was the son of Hippocrates, through whom he traced his pedigree to Neleus and Nestor, princes of Messene in the Heroic Age. A branch of the family had reigned at Athens in the persons of Codrus and his descendants. Pisistratus was second cousin to Solon, their mothers having been cousins, and the early friendship between the two men was not entirely broken off even by the wide political differences which separated them in later life. Pisistratus, who was much junior to Solon, was born about 605 B.C. In his youth there was a keen rivalry between Athens and Megara, and Pisistratus as general of Athens contrived by stratagem to defeat the Megarians and capture their port Nisæa (perhaps 570 or a little later).[1] But Pisistratus was ambitious of more than military triumphs, and in the internal condition of Attica he discerned the road to power. The constitution which Solon had given to Athens a few years before (594 B.C.) was too moderate to satisfy either of the extreme parties. The wealthy nobles chafed at the political rights granted to the lower classes, while the poor were dissatisfied with what they regarded as merely a half measure of relief. The nobles themselves were divided into the parties known as the Plain (*Pedieis*) and the Coast (*Paraloi*), the former inhabiting the western lowlands of Attica, the latter the level districts on the southern and eastern coasts.[2] The former were led by the noble Lycurgus, the latter by Megacles, of the proud house of the Alcmæonidæ. Pisistratus took advantage of their dissensions to form a third political party out of the men of the Mountain

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[1] Herod., i. 59; Justin, ii. 8; Frontinus, iv. 7, 44. Other writers (Polyænus, i. 20; Ælian, *Var. Hist.*, vii. 19) erroneously attribute the stratagem to Solon, and refer it to the expedition in which Solon recovered Salamis. Plutarch (*Solon*, 8) falls into this mistake, and adds to it the blunder of representing Pisistratus as having taken part in the expedition, which happened about 600 B.C. The two events (Solon's conquest of Salamis and Pisistratus's capture of Salamis) are distinguished by Justin (ii. 7, 8), and after him by Duncker (*Gesch. des Allerthums*, vi. pp. 145, 244) and others, but they are confused by Thirlwall and Grote. From Plutarch (*Solon*, 8, 9) we may infer that the confusion arose in popular tradition. The account of the stratagem itself in the Greek writers Plutarch and Polyænus differs somewhat from that in the Latin writers Justin and Frontinus. Ælian follows (with some variations) the latter account.

[2] The difference between the Pedieis and the Paraloi seems to have been of the nature of a local feud between two ancient districts of Attica (Schol. on Aristoph., *Lys.*, 58; Strabo, ix. p. 392; Steph. Byz., *s.vv.* Διάκρια, Πάραλος, πεδίον; Suidas, *s. v.* Πάραλοι) rather than a disagreement between two political parties. It is true that Plutarch (*Solon*, 13) represents the Paraloi as a moderate political party, intermediate between the Pedieis (oligarchs) and the Diacrioi (democrats), but this has the appearance of being a mere conjecture of his own. His view is, however, accepted by Curtius and Duncker.

(*Diacreis* or *Diacrioi*), the poor cottars and shepherds of the eastern and northern hills, among whom his own estates lay. He easily won the affection of these simple highlanders. His manners were captivating, his good humor imperturbable; his purse was ever at the service of the needy; his fields and gardens stood open for their enjoyment. Equality and fraternity, together with the maintenance of the constitution, were the watchwords of this eloquent and handsome aristocrat, the people's friend. But his easy and affable deportment hid a boundless ambition. Solon detected his schemes, and warned the people against him, but in vain. One day, not long after a violent dispute with Megacles in the public assembly, Pisistratus drove into the market-place, himself and his mules bleeding from wounds which he had inflicted with his own hand, but which he pretended to have received from his political enemies. The indignant people decreed a guard for the protection of their champion. Of this guard the champion soon availed himself in order to seize the Acropolis and make himself master of Athens (560). Megacles and the Alcmæonidæ fled, but Solon remained and continued to lift his voice against the usurper, who, however, treated the old man with the utmost deference, as a valued friend and counsellor. Solon did not long survive his country's freedom; he died in the next year (559). The government of Pisistratus was marked by great moderation; he maintained the existing laws, to which he exacted obedience from all, and set the example of it himself. Being once accused of murder, he appeared in court like a private citizen to answer the charge, which, however, the accuser did not venture to press. But before he had time to establish himself firmly on the throne, he was expelled by a coalition of the Plain and Coast parties (perhaps in 555).[1] His property was confiscated and sold by auction. But after five or six years Megacles, unable to make head against the party of the Plain proposed to Pisistratus to secure his recall on condition that Pisistratus should marry his daughter Cœsyra. Pisistratus agreed, and his return was effected by stratagem. A tall and beautiful woman, Phya by name, was dressed as the goddess Athene, and drove into Athens on a chariot with Pisistratus at her side, while heralds proclaimed that Athene herself was bringing back Pisistratus. Thus restored, Pisistratus fulfilled his part of the bargain by marrying Cœsyra; but by his former marriage he had already sons approaching manhood (Hippias and Hipparchus), and he treated his young wife so slightingly that Megacles, feeling himself affronted, made peace with his adversaries, and the united parties once more compelled Pisistratus to quit Athens (perhaps in 549). But he did not renounce his designs on the tyranny. The contributions which he received from various cities, especially Thebes, enabled him to hire a body of Argive mercenaries, with which he landed at Marathon in the eleventh year after his expulsion (perhaps in 538). His partisans flocked to him, and he defeated the Athenians at Pallene, and repossessed himself of the tyranny, which he thenceforward held till his death. He now placed his power on a securer basis by keeping a body of mercenaries in his pay, and levying a tax of a tenth or a twentieth on the produce of the soil. A further revenue accrued to him from the Thracian mines, and probably from the silver mines of Laurium, and the harbor and market dues. He now developed his plans for the extension of the naval empire of Athens in the Ægean. The island of Naxos was conquered by him, and handed over to Lygdamis, a native of the island, who had zealously supported the restoration of Pisistratus with men and money. In Naxos Pisistratus deposited the hostages he exacted from those of his enemies who chose to remain at Athens. In Sigeum on the Hellespont, which he conquered from the Mytilenians, he established as tyrant Hegesistratus, his son by an Argive wife, whom he had married in his second exile. The European side of the Hellespont was already in Athenian hands, Miltiades having established an Athenian colony on the Thracian Chersonese during the first tyranny, and with the consent of Pisistratus. Athens thus commanded the straits through which passed the corn trade of the Black Sea. Pisistratus further raised the reputation of Athens by purifying the sacred island of Delos; all the graves within sight of the temple of Apollo were opened and the dead removed to another part of the island. His rule was as wise and beneficent at home as it was glorious abroad. He encouraged agriculture by lending the poorer peasants cattle and seed, and he paid special attention to the cultivation of the olive. He enacted or enforced a law against idleness, and he required that the state should maintain its disabled soldiers. Under his rule and that of his sons Attica was intersected by high roads, which, converging to the capital helped to unite the country and thus to abolish local feuds and factions. To the tyrants Athens further owed those subterranean channels in the rock which still supply it with drinking water from the hills. Pisistratus also adorned Athens with splendid public buildings. The temple of the Pythian Apollo was his work; and he began, but did not finish, the great temple of Zeus, the remaining columns of which still astonish the beholder. Modern authorities[2] further ascribe to him the old Parthenon on the Acropolis, which was afterwards burned by the Persians and replaced by the Parthenon of Pericles. The Lyceum was attributed to him by Theopompus, but to Pericles by the better authority of Philochorus. He caused the Panathenaic festival to be celebrated every fourth year with unusual magnificence.

The well-known story that Pisistratus was the first to collect and publish the poems of Homer in their present form rests on the authority of late writers (Cicero being the earliest), and seems to be sufficiently disproved by the silence of all earlier authorities (see HOMER). The statement of Aulus Gellius that Pisistratus was the first to establish a public library at Athens is perhaps equally void of foundation. The tyrant seems to have been merciful and amiable to the last. It is not recorded of him that he ever put an enemy to death, and the easy good humor with which he submitted to affronts offered to himself and his family reminds us of Cæsar. Solon's description of him appears to have been justified—that apart from his ambition there was not a better-disposed man at Athens than Pisistratus. He died at an advanced age in 527, and was succeeded by his sons Hippias and Hipparchus (the Pisistratidæ), who continued to rule Athens in the same moderate and beneficent spirit.

(J. G. FR.).

PISTACHIO NUT, see NUT, vol. xvii. p. 684. The pistachio nut is the species named in Gen. xliii. 11 (Heb. בָּטְנִים, Ar. *boṭm*) as forming part of the present which Joseph's brethren took with them from Canaan, and in Egypt it is still often placed along with sweetmeats and the like in presents of courtesy. The nut is used in various ways; but the simplest plan is to boil it with salt.

PISTOIA, or PISTOJA, a well-walled ancient city, 21 miles northwest of Florence, on a slight eminence near the Ombrone, one of the tributaries of the Arno; it now contains about 12,500 inhabitants. The chief manufacture of the place is iron-working, especially fire-arms.[1] It is on the site of the Roman *Pistoria*, of which little trace remains. During the Middle Ages Pistoia was at times a dangerous enemy to Florence, and the scene of constant conflicts between the Guelfs and the Ghibellines; it was there that, in the year 1300, the great party struggle took place which resulted in the creation of the Bianchi and Neri factions (see Dante, *Infer.*, xxiv., l. 121 to end). In the early development of architecture and sculpture Pistoia played a very important part; these arts, as they existed in Tuscany before the time of Niccola Pisano, can perhaps be better studied in Pistoia than anywhere else; nor is the city less rich in the later works produced by the school of sculptors founded by Niccola. In the 14th century Pistoia possessed a number of the most skilful artists in silverwork, a wonderful specimen of whose powers exists now in the cathedral—the great silver altar and frontal of St. James, originally made for the high altar, but now placed in a chapel on the south side (see METAL WORK, vol. xvi. p. 81, Fig. 4). The cathedral is partly of the 12th century, but rebuilt by one of the Pisani, and inside sadly modernized in the worst taste. Besides the silver altar it contains many fine works of sculpture; the chief are the monument of Cino da Pistoia, lawyer and poet, Dante's contemporary (1337), and Verrocchio's finest work in marble, the monument to Cardinal Forteguerra (1474), with a large figure of Christ, surrounded by angels, in high relief. Unhappily two of the principal figures were destroyed not many years ago, and replaced by worthless modern ones.[2] Among the very early churches the principal is Sant' Andrea, enriched with sculpture, and probably designed, by Gruamons and his brother Adeodatus in 1136; in the nave is Giovanni Pisano's magnificent pulpit, imitated from his father's pulpit at Pisa. Other churches of almost equal interest are S. Giovanni Evangelista, also with sculpture by Gruamons, about 1160, and S. Bartolomeo in Pantano by the architect Rudolfinus, 1167. S. Piero Maggiore and San Paolo are also churches begun in the 12th century. San Francesco al Prato is a fine church of the school of Niccola Pisano, end of the 13th century. San Domenico, a noble church built about 1380, contains the beautiful tomb of Filippo Lazari by Bernardo di Matteo, 1464. In addition to its fine churches, of which the above is a very incomplete list, Pistoia contains many noble palaces and public buildings. The Palazzo del Commune and the Palazzo Pretorio, once the residence of the podestà, are both fine specimens of 14th century domestic architecture, in very good preservation. The Ospedale del Ceppo, built originally in the 13th century, but remodelled in the 15th, is very remarkable for the reliefs in enamelled and colored terra-cotta with which its exterior is richly decorated. Besides various medallions, there is a frieze of figures in high relief extending along the whole front, over its open arcade. The reliefs consist of a series of groups representing the Seven Works of Mercy and other figures; these were executed by the younger members of the Della Robbia family between 1525 and 1535, and though not equal to the best work of Luca and Andrea, are yet very fine in conception and modelling, and extremely rich in their general decorative effect.

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[1] Out of the thirty-three years which elapsed between Pisistratus's first usurpation and his death in 527 B. C., we know (from Aristotle, *Pol.*, v. p. 1315 b) that he reigned during seventeen. He was twice deposed and banished, and his second exile lasted between ten and eleven years (Herod., i. 62); hence his first must have lasted between five and six. But we cannot fix with certainty the dates of these two exiles. Duncker (with whom Clinton, *Fasti Hellenici* ii. p. 254, and Stein on Herod., i. 64, nearly agree) places the first in 555–550 and the second in 549–538 (see his *Gesch. d. Alterthums*, vi. p. 454 *sq.*).

[2] Curtius and Duncker in their histories of Greece; see also Wachsmuth, *Die Stadt Athen im Alterthum*. vol. i. p. 502.

PITCAIRN, or PITCAIRN'S ISLAND, an island of the eastern Pacific, in 25° 4′ N. lat. and 130° 8′ W. long., may be considered as a member or appendage of the Paumotu, Tuamotu, Low, or dangerous Archipelago, but is nearly 100 miles south of Oeno. It is not more than 3 miles long from east to west and about 2 miles broad. Unlike the other islands of this region it has no coral reef, but rises abruptly from the depths with steep and rugged cliffs of dark basaltic lava. There is no anchorage except on a bank at the west end; and even the best of its three landing places —Bounty Bay on the north coast—is dangerous from the violence of the surf and the existence of a strong undertow. The longer axis of the island is formed by a range of steep hills, attaining in Outlook Ridge a maximum height of 1008 feet. On a plateau about 400 feet above the sea lies the village of Adamstown, with its fields and gardens. The climate is variable and rainy, and snow sometimes falls on the mountains; but, as there are no springs or streamlets, drinking water is apt to grow scarce in a dry season. Vegetation is luxuriant. Neither the bread fruit nor the cocoanut, introduced by the settlers, are fully successful; but the sweet potato, which forms their staple food, banana, yam, taro, pine-apple, etc., produce abundantly. Corn cannot be grown because of rats. The Pitcairn Islanders (not more than ninety in 1878), descended mainly from the mutineers of the "Bounty" and their Tahitian wives, are a healthy, virtuous, cheerful, and hospitable people, proud of their English blood, and grateful for the services rendered them from time to time by the English Government and private liberality.

Stone axes, remains of sculptured stone pillars similar to those of Rapanui (Easter Island), and skeletons with a pearl-mussel beneath their head, have been found in the island, and show that, though it was uninhabited when discovered by Carteret in 1767, it had previously been occupied. Pitcairn was the name of the midshipman who first descried it from the mast-head. On 28th April, 1789 a mutiny broke out on board the "Bounty," then employed by the English Government in conveying young bread-fruit trees from Tahiti to the West Indies. The commander, Lieutenant BLIGH (*q.v.*), was set adrift in the launch with a number of his officers and crew, but managed to make his way to Kupang in Timor (Dutch Indies). The mutineers, twenty-five in number, at first all returned to Tahiti. Of those who chose to be landed on that island, six were condemned to death by court-martial in England, and three of these were ultimately executed (1792). Two years earlier (1790) the other party (consisting of Fletcher Christian, the leader of the mutiny, eight other Englishmen, six Polynesian men, and twelve Polynesian women) had taken possession of Pitcairn and burned the "Bounty." The beautiful island, which might have been a paradise, was soon turned into a little hell. Treachery, drunkenness, madness, and murder fill the first years of its annals. By 1800 all the men were dead except Alexander Smith (afterwards known as John Adams), whose endeavors to train up the youthful generation thus left in his sole charge were crowned with success. An American vessel, the "Topaze," under Mayhew Folger, discovered the strange colony in 1808, and again, by accident, it was visited by the "Briton" Captain Sir F. Staines, and the "Tagus," Captain Pipon, in 1817. On the death of John Adams, 29th March, 1829, George Hunn Nobbs, who, after an adventurous life had settled at Pitcairn in 1828, was appointed pastor and chief magistrate of the settlement. Through fear of drought the islanders, now numbering 87 persons, removed in 1830, to Tahiti, but neither the climate, nor the morals of the place were such as they approved, and in 1831 they returned to their lonely island. Hardly had they settled into their old ways when Joshua Hill, a strange adventurer, rather crazy than criminal, appeared among them; claiming to be under Government authority, he tyrannized over them till his removal by an English man-of-war in 1838. In 1856 the whole population of Pitcairn—60 married persons and 134 young men, women and children—were landed on NORFOLK ISLAND (*q.v.*); and the little island was again left to the occupancy of goats and cattle. In 1858, however, two men, William and Moses Young, chose to return with their families to their old homes, and their example was afterwards followed by a few others.

See Shillibeer, *The "Briton's" Voyage to Pitcairn's Island*, 1818; Beechey, *Voyage to the Pacific*, 1831; Sir John Barrow, *History of the Mutiny of the "Bounty,"* 1831; W. Brodie, *Pitcairn's Island*, 1850; T. B. Murray, *Pitcairn*, 1854; Meinicke, *Die Insel Pitcairn*, 1858; and *Dei Inseln des Stillen Oceans*, vol. ii., 1876; and Lady Belcher, *The Mutineers of the "Bounty,"* 1870.

PITCAIRNE, ARCHIBALD (1652–1713), a distinguished Scottish physician, born at Edinburgh in 1652, and descended of an ancient Fifeshire family which barely escaped extinction at the battle of Flodden,—the proprietor of the estate and his seven sons having fallen in the battle, and the succession being only preserved by the birth of a posthumous child. After obtaining some classical education at the school of Dalkeith, Pitcairne entered Edinburgh university in 1668, and took his degree of M. A. in 1671. Like some men of great general ability, he seems to have remained long undetermined as to his future profession, and before taking to medicine he had made some progress first in divinity and then in law. But, having been sent to France for the benefit of his health, he was induced at Paris to begin the study of medicine. On his return to Scotland he applied himself for a time and with great success to the study of mathematics. Having at last taken vigorously to medicine, first at Edinburgh and afterwards for the second time at Paris, he obtained in 1680 his degree of M. D. from the faculty at Rheims. On returning to Scotland he at once began practice at Edinburgh, and in a short time acquired a great and wide reputation—so much so that in 1692 he was invited to fill a professor's chair at Leyden, and is said to have lectured there with great applause. Among his pupils were at least two men who afterwards rose to great eminence in their profession, Mead and Boerhaave, and both of them are understood to have attributed much of their skill to what they had learned from Pitcairne. In the following year Pitcairne returned to Scotland to fulfil a matrimonial engagement with a daughter of Sir Archibald Stevenson, an eminent physician in Edinburgh; and, the family of the young lady having objected to their daughter going abroad, Pitcairne did not return to Leyden, but settled once more in Edinburgh, speedily acquired a most extensive practice, rose indeed to be the first physician of his time in Scotland, and was frequently called in as consulting physician not only in England but even in Holland.

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[1] The word "pistol" is derived (apparently through *pistolese*, a dagger,—dagger and pistol being both small arms) from Pistoia where that weapon was largely manufactured in the Middle Ages.

[2] One of the chief treasures of the S. Kensington Museum is the original sketch in clay for this monument, about 18 inches high,—now the only record of the original design of the two chief figures.

Soon after his return to Edinburgh, feeling the great want of the means of anatomical study, he importuned the town council to permit himself and certain of his medical friends to dissect the bodies of paupers in "Paul's Work" unclaimed by their relations, and who therefore had hitherto been buried at the town's expense. They offered to attend them gratis when ill, and after dissection to bury them at their own charges. Strangely enough this proposal was strongly opposed by the chief surgeons of the place, but ultimately the town council had the good sense to comply with Pitcairne's request, and in this way he may be said to have the credit of laying the foundation of the great Edinburgh school of medicine.

Though, according to Boerhaave, Pitcairne had not completely emancipated himself from some of the fanciful theories prevalent in his age in the science of medicine, yet the main characteristic of his superiority appears to have been that, like Sydenham and the higher class of physicians in England at that time, he insisted on strict adherence to the Baconian method of attending chiefly to facts of experience and observation. "Nothing," he remarks, "more hinders physic from being improved than the curiosity of searching into the natural causes of the effects of medicines. The business of men is to know the virtues of medicines, but to inquire whence they have that power is a superfluous amusement, since nature lies concealed. A physician ought therefore to apply himself to discover by experience the effects of medicines and diseases, and reduce his observations into maxims, and not needlessly fatigue himself by inquiring into their causes, which are neither possible nor necessary to be known. If all physicians would act thus we should not see physic divided into so many sects."

Pitcairne's medical opinions are chiefly contained in a volume of *Dissertations* which he published in 1701 (second and improved edition, 1713). In these he discusses the application of geometry to physic, the circulation of the blood in the smaller vessels, the difference in the quantity of the blood contained in the lungs of animals in the womb and of the same animals after birth, the motions by which food becomes fit to supply the blood, the question as to inventors in medicine (in which he repels the idea of certain medical discoveries of modern times having been known to the ancients, especially vindicating for Harvey the discovery of the circulation of the blood, and refuting the opinion of Dacier and others that it was known to Hippocrates), the cure of fevers by evacuating medicines, and the effects of acids and alkalies in medicine.

In addition to his great knowledge and skill as a physician, Pitcairne is understood to have been also an accomplished mathematician. He was intimate with the two Gregorys, and is said to have made some improvement on the method of infinite series invented by David Gregory. His strong addiction to mathematics seems to have misled him, along with some other eminent men of his time, into the idea of applying its methods of reasoning to subjects for which they are quite unfitted: in Pitcairne's case the attempt is made in one of his papers to adapt them to medicine.

He was also a very thorough classical scholar, and wrote Latin verses, occasionally with something more than mere imitative cleverness and skill. Some verses of his on the death of Lord Dundee were translated by Dryden, and, as one of the latest editors of Dryden's poetry with perfect justice remarks, "the translation will not be thought so happy as the original."

According to the representations which are left by his contemporaries of his personal bearing and character, he seems to have carried his great faculties very lightly. A strong man all round, with great animal spirits and jovial habits, somewhat contemptuous of the gravities and feeblosities around him, a loudly avowed Jacobite and Episcopalian, rather reckless in his jests and sarcasms, and spending a good deal of his time in clubs, public houses, and drinking jollities, he was evidently regarded with little favor and some suspicion by the sober and decent Presbyterian circles of Edinburgh. "Drunk twice a day," according to the worthy, credulous, gossiping Wodrow (in one of his note books); "an unbeliever," "much given to profane jests," an "atheist," according to others. These reports may be taken for what they are worth, which perhaps is not very much. What is certain is that he was repeatedly involved in violent quarrels with his medical brethren and others, and once or twice got into scrapes with the Government on account of his indiscreet political utterances. Among his friends, however, he was evidently well liked, and he is known to have acted with great kindness and generosity to deserving men who needed his help. Ruddiman, the great Scottish scholar, for example, was rescued from a life of obscurity by his encouragement and assistance, and by no one was his memory more gratefully cherished.

> "—Vale, lux Scotigenum, princepsque Medentum,
> Musarum columen deliciæque, vale!"

are the concluding lines of a Latin epitaph by him on his venerated patron and friend, which still remains on Pitcairne's monument in the Greyfriars churchyard. Mead, too, appears never to have forgotten what he owed to his old teacher at Leyden. A son of Pitcairne's had gone out in the rebellion of 1715, and, having been condemned to death was saved by the earnest interposition of Mead with Sir Robert Walpole. He pleaded, very artfully, that if Walpole's health had been bettered by his skill, or if members of the royal family were preserved by his care, it was owing to the instruction he had received from Dr. Pitcairne. Pitcairne died in October, 1713. Among his other scholarly tastes he had been a great collector of books, and his library, which is understood to have been of considerable value, was, through the influence of Ruddiman, disposed of to Peter the Great of Russia.

PITCH. See Tar.

PITCHER PLANTS. See INSECTIVOROUS PLANTS, vol. xiii. pp. 144, 145.

PITHOM, a city of Egypt, mentioned in Exod. i. 11, along with RAMESES (*q. v.*).

PITHOU, PIERRE (1539–1596), lawyer and scholar, was born at Troyes on November 1, 1539. His taste for literature was early seen, and his father, an advocate, cultivated it to the utmost. He first studied at Troyes, and afterwards went to Paris, where he completed his classical studies under Adrien Turnèbe and Pierre Galand. He next attended the lectures in law of Cujas at Bourges and Valence, and was called to the Paris bar in 1560. Here he achieved but little success as a pleader, but soon acquired a considerable practice as a consulting lawyer. On the outbreak of the second war of religion in 1567, Pithou, who was a Calvinist, withdrew to Sedan and afterwards to Basel, whence he returned to France on the publication of the edict of pacification. Soon afterwards he accompanied the Duc de Montmorency on his embassy to England, returning shortly before the massacre of St. Bartholomew, in which he narrowly escaped with his life. Next year he followed the example of Henry of Navarre, to whose cause he was ardently attached, by abjuring the Protestant faith. Henry, shortly after his own accession to the throne of France, recognized Pithou's talents and services by bestowing upon him various legal appointments. It was considerably after this date that Pithou achieved what was probably the most important work of his life, whether political or literary, by co-operating in the production of the powerful *Satire Menippée* (1593), which did so much to damage the cause of the League; the harangue of Daubray is usually attributed to his pen. He died at Nogent-sur-Seine on November 1, 1596. His valuable library, specially rich in MSS., was for the most part transferred to what is now the Bibliothèque Nationale in Paris.

Pithou wrote a great number of legal and historical books, besides preparing editions of several ancient authors. His earliest publication was *Adversariorum Subsecivorum Lib. II.* (1565), which was highly praised by Turnèbe, Lipsius, and others. Perhaps his edition of the *Leges Visigothorum* (1579) was his most valuable contribution to historical science; in the same line he edited the *Capitula* of Charlemagne, Louis the Pious, and Charles the Bald in 1588, and he also assisted his brother François in preparing an edition of the *Corpus Juris Canonici* (1687). His essay *On the Gallican Liberties* (1594) is reprinted in his *Opera sacra juridica historica miscellanea collecta* (1609). In classical literature he was the first who made the world acquainted with the *Fables* of Phædrus (1596); he also edited the *Pervigilium Veneris* (1587); and Juvenal and Persius (1585).

PITT, WILLIAM, FIRST EARL OF CHATHAM. See CHATHAM.

Born at Hayes, near Bromley, Kent, May 28, 1759.

PITT, WILLIAM (1759–1806), the second son of William Pitt, earl of Chatham, and of Lady Hester Grenville, daughter of Hester, Countess Temple, was born on the 28th of May, 1759. The child inherited a name which, at the time of his birth, was the most illustrious in the civilized world, and was pronounced by every Englishman with pride, and by every enemy of England with mingled admiration and terror. During the first year of his life every month had its illuminations and bonfires, and every wind brought some messenger charged with joyful tidings and hostile standards. In Westphalia the English infantry won a great battle which arrested the armies of Louis XV. in the midst of a career of conquest; Boscawen defeated one French fleet on the coast of Portugal; Hawke put to flight another in the Bay of Biscay; Johnson took Niagara; Amherst took Ticonderoga; Wolfe died by the most enviable of deaths under the walls of Quebec; Clive destroyed a Dutch armament in the Hooghly, and established the English supremacy in Bengal; Coote routed Lally at Wandewash and established the English supremacy in the Carnatic. The nation, while loudly applauding the successful warriors, considered them all, on sea and on land, in Europe, in America, and in Asia, merely as instruments which received their direction from one superior mind. It was the great William Pitt, the great commoner, who had vanquished the French marshals in Germany and French admirals on the Atlantic,—who had conquered for his country one great empire on the frozen shores of Ontario and another under the tropical sun near the mouths of the Ganges. It was not in the nature of things that popularity such as he at this time enjoyed should be permanent. That popularity had lost its gloss before his children were old enough to understand that their father was a great man. He was at length placed in situations in which neither his talents for administration nor his talents for debate appeared to the best advantage. The energy and decision which had eminently fitted him for the direction of war were not needed in time of peace. The lofty and spirit-stirring eloquence which had made him supreme in the House of Commons often fell dead on the House of Lords. A cruel malady racked his joints, and left his joints only to fall on his nerves and on his brain. During the closing years of his life he was odious to the court, and yet was not on cordial terms with the great body of the Opposition. Chatham was only the ruin of Pitt, but an awful and majestic ruin, not to be contemplated by any man of sense and feeling without emotions resembling those which are excited by the remains of the Parthenon and of the Colosseum. In one respect the old statesman was eminently happy. Whatever might be the vicissitudes of his public life, he never failed to find peace and love by his own hearth. He loved all his children, and was loved by them; and of all his children the one of whom he was fondest and proudest was his second son.

Childhood.

The child's genius and ambition displayed themselves with a rare and almost unnatural precocity. At seven the interest which he took in grave subjects, the ardor with which he pursued his studies, and the sense and vivacity of his remarks on books and on events amazed his parents and instructors. One of his sayings of this date was reported to his mother by his tutor. In August, 1766, when the world was agitated by the news that Mr. Pitt had become earl of Chatham, little William exclaimed, "I am glad that I am not the eldest son. I want to speak in the House of Commons like papa." A letter is extant in which Lady Chatham, a woman of considerable abilities, remarked to her lord that their younger son at twelve had left far behind him his elder brother, who was fifteen. "The fineness," she wrote, "of William's mind makes him enjoy with the greatest pleasure what would be above the reach of any other creature of his small age." At fourteen the lad was in intellect a man. Hayley, who met him at Lyme in the summer of 1773, was astonished, delighted, and somewhat overawed, by hearing wit and wisdom from so young a mouth. The poet, indeed, was afterwards sorry that his shyness had prevented him from submitting the plan of an extensive literary work, which he was then meditating, to the judgment of this extraordinary boy. The boy, indeed, had already written a tragedy, bad, of course, but not worse than the tragedies of his friend. This piece is still preserved at Chevening, and is in some respects highly curious. There is no love. The whole plot is political; and it is remarkable that the interest, such as it is, turns on a contest about a regency. On one side is a faithful servant of the crown, on the other an ambitious and unprincipled conspirator. At length the king who had been missing, reappears, resumes his power, and rewards the faithful defender of his rights. A reader who should judge only by internal evidence would have no hesitation in pronouncing that the play was written by some Pittite poetaster at the time of the rejoicings for the recovery of George III. in 1789.

Education.

The pleasure with which William's parents observed the rapid development of his intellectual powers was alloyed by apprehensions about his health. He shot up alarmingly fast; he was often ill, and always weak; and it was feared that it would be impossible to rear a stripling so tall, so slender, and so feeble. Port wine was prescribed by his medical advisers; and it is said that he was, at fourteen, accustomed to take this agreeable physic in quantities which would, in our abstemious age, be thought much more than sufficient for any full-grown man. This regimen, though it would probably have killed ninety-nine boys out of a hundred, seems to have been well suited to the peculiarities of William's constitution; for at fifteen he ceased to be molested by disease, and, though never a strong man, continued, during many years of labor and anxiety, of nights passed in debate and of summers passed in London, to be a tolerably healthy one. It was probably on account of the delicacy of his frame that he was not educated like other boys of the same rank. Almost all the eminent English statesmen and orators to whom he was afterwards opposed or allied—North, Fox, Shelburne, Windham, Grey, Wellesley, Grenville, Sheridan, Canning—went through the training of great public schools. Lord Chatham had himself been a distinguished Etonian; and it is seldom that a distinguished Etonian forgets his obligations to Eton. But William's infirmities required a vigilance and tenderness such as could be found only at home. He was therefore bred under the paternal roof. His studies were superintended by a clergyman named Wilson; and those studies, though often interrupted by illness, were prosecuted with extraordinary success. Before the lad had completed his fifteenth year his knowledge both of the ancient languages and of mathematics was such as very few men of eighteen then carried up to college. He was therefore sent, towards the close of the year 1773, to Pembroke Hall, in the university of Cambridge. So young a student required much more than the ordinary care which a college tutor bestows on undergraduates. The governor to whom the direction of William's academical life was confided was a bachelor of arts named Pretyman,[1] who had been senior wrangler in the preceding year, and who, though not a man of prepossessing appearance or brilliant parts, was eminently acute and laborious, a sound scholar and an excellent geometrician. At Cambridge Pretyman was, during more than two years, the inseparable companion, and indeed almost the only companion of his pupil. A close and lasting friendship sprang up between the pair. The disciple was able, before he completed his twenty-eighth year, to make his preceptor bishop of Lincoln and dean of St. Paul's; and the preceptor showed his gratitude by writing a life of the disciple, which enjoys the distinction of being the worst biographical work of its size in the world.

Entered of Pembroke Hall, Cambridge, spring, 1773.

Pitt, till he graduated, had scarcely one acquaintance, attended chapel regularly morning and evening, dined every day in hall, and never went to a single evening party. At seventeen he was admitted, after the bad fashion of those times, by right of birth, without any examination, to the degree of master of arts. But he continued during some years to reside at college, and to apply himself vigorously, under Pretyman's direction, to the studies of the place, while mixing freely in the best academic society.

M. A., spring of 1776.

The stock of learning which Pitt laid in during this part of his life was certainly very extraordinary. In fact it was all that he ever possessed; for he very early became too busy to have any spare time for books. The work in which he took the greatest delight was Newton's *Principia*. His liking for mathematics, indeed, amounted to a passion, which in the opinion of his instructors, themselves distinguished mathematicians, required to be checked rather than encouraged. The acuteness and readiness with which he solved problems was pronounced by one of the ablest of the moderators, who in those days presided over the disputations in the schools and conducted the examinations of the senate-house, to be unrivalled in the university. Nor was the youth's proficiency in classical learning less remarkable. In one respect, indeed, he appeared to disadvantage when compared with even second-rate and third-rate men from public schools. He had never, while under Wilson's care, been in the habit of composing in the ancient languages; and he therefore never acquired that knack of versification which is sometimes possessed by clever boys whose knowledge of the language and literature of Greece and Rome is very superficial. It would have been utterly out of his power to produce such charming elegiac lines as those in which Wellesley bade farewell to Eton, or such Virgilian hexameters as those in which Canning described the pilgrimage to Mecca. But it may be doubted whether any scholar has ever, at twenty, had a more solid and profound knowledge of the two great tongues of the old civilized world. The facility with which he penetrated the meaning of the most intricate sentences in the Attic writers astonished veteran critics. He had set his heart on being intimately acquainted with all the extant poetry of Greece, and was not satisfied till he had mastered Lycophron's *Cassandra*, the most obscure work in the whole range of ancient literature. This strange rhapsody, the difficulties of which have perplexed and repelled many excellent scholars, "he read," says his preceptor, "with an ease at first sight which, if I had not witnessed it, I should have thought beyond the compass of human intellect."

Subsequent studies at Cambridge.

To modern literature Pitt paid comparatively little attention. He knew no living language except French; and French he knew very imperfectly. With a few of the best English writers he was intimate, particularly with Shakspeare and Milton. The debate in Pandemonium was, as it well deserved to be, one of his favorite passages; and his early friends used to talk, long after his death, of the just emphasis and the melodious cadence with which they had heard him recite the incomparable speech of Belial. He had indeed been carefully trained from infancy in the art of managing his voice, a voice naturally clear and deep-toned. His father, whose oratory owed no small part of its effect to that art, had been a most skilful and judicious instructor. At a later period the wits of Brookes's, irritated by observing, night after night, how powerfully Pitt's sonorous elocution fascinated the rows of country gentlemen, reproached him with having been "taught by his dad on a stool."

His education, indeed, was well adapted to form a great parliamentary speaker. One argument often urged against those classical studies which occupy so large a part of the early life of every gentleman bred in the south of our island is, that they prevent him from acquiring a command of his mother tongue, and that it is not unusual to meet with a youth of excellent parts who writes Ciceronian Latin prose and Horatian Latin alcaics, but who would find it impossible to express his thoughts in pure, perspicuous, and forcible English. There may perhaps be some truth in this observation. But the classical studies of Pitt were carried on in a peculiar manner, and had the effect of enriching his English vocabulary, and of making him wonderfully expert in the art of constructing correct English sentences. His practice was to look over a page or two of a Greek or Latin author, to make himself master of the meaning, and then to read the passage straight forward into his own language. This practice, begun under his first teacher Wilson, was continued under Pretyman. It is not strange that a young man of great abilities, who had been exercised daily in this way during ten years, should have acquired an almost unrivalled power of putting his thoughts, without premeditation, into words well selected and well arranged.

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[1] [George Pretyman (1750–1827) was senior wrangler in 1772. In 1803, on falling heir to a large estate, he assumed the name of Tomline. From Lincoln, to which see he had been elevated in 1787, he was translated to Winchester in 1820. Tomline, to whom Pitt when dying had bequeathed his papers, published his *Memoirs of the Life of William Pitt* (down to the close of 1792) in 1821 (3 vols. 8vo).]

Of all the remains of antiquity, the orations were those on which he bestowed the most minute examination. His favorite employment was to compare harangues on opposite sides of the same question, to analyze them, and to observe which of the arguments of the first speaker were refuted by the second, which were evaded, and which were left untouched. Nor was it only in books that he at this time studied the art of parliamentary fencing. When he was at home, he had frequent opportunities of hearing important debates at Westminster; and he heard them, not only with interest and enjoyment, but with a close scientific attention resembling that with which a diligent pupil at Guy's Hospital watches every turn of the hand of a great surgeon through a difficult operation. On one of these occasions Pitt, a youth whose abilities were as yet known only to his own family and to a small knot of college friends, was introduced on the steps of the throne in the House of Lords to Fox, who was his senior by eleven years, and who was already the greatest debater, and one of the greatest orators, that had appeared in England. Fox used afterwards to relate that, as the discussion proceeded, Pitt repeatedly turned to him, and said, "But surely, Mr. Fox, that might be met thus;" or "Yes; but he lays himself open to this retort." What the particular criticisms were Fox had forgotten; but he said that he was much struck at the time by the precocity of a lad who, through the whole sitting, seemed to be thinking only how all the speeches on both sides could be answered.

One of the young man's visits to the House of Lords was a sad and memorable era in his life. He had not quite completed his nineteenth year when, on the 7th of April, 1778, he attended his father to Westminster. A great debate was expected. It was known that France had recognized the independence of the United States. The duke of Richmond was about to declare his opinion that all thought of subjugating those states ought to be relinquished. Chatham had always maintained that the resistance of the colonies to the mother country was justifiable. But he conceived, very erroneously, that on the day on which their independence should be acknowledged the greatness of England would be at an end. Though sinking under the weight of years and infirmities, he determined, in spite of the entreaties of his family, to be in his place. His son supported him to a seat. The excitement and exertion were too much for the old man. In the very act of addressing the peers, he fell back in convulsions. A few weeks later his corpse was borne, with gloomy pomp, from the Painted Chamber to the Abbey. The favorite child and namesake of the deceased statesman followed the coffin as chief mourner, and saw it deposited in the transept where his own was destined to lie.

His elder brother, now earl of Chatham, had means sufficient, and barely sufficient, to support the dignity of the peerage. The other members of the family were poorly provided for. William had little more than three hundred a year. It was necessary for him to follow a profession. He had already begun to eat his terms. In the spring of 1780 he came of age. He then quitted Cambridge, was called to the bar, took chambers in Lincoln's Inn, and joined the western circuit. In the autumn of that year a general election took place; and he offered himself as a candidate for the university; but he was at the bottom of the poll. It is said that the grave doctors who then sat, robed in scarlet, on the benches of Golgotha thought it great presumption in so young a man to solicit so high a distinction. He was, however, at the request of a hereditary friend, the duke of Rutland, brought into parliament by Sir James Lowther for the borough of Appleby.

Called to the bar, 1780.

M. P. for Appleby, 1780; takes his seat, Jan. 23, 1781.

The dangers of the country were at that time such as might well have disturbed even a constant mind. Army after army had been sent in vain against the rebellious colonists of North America. On pitched fields of battle the advantage had been with the disciplined troops of the mother country. But it was not on pitched fields of battle that the event of such a contest could be decided. An armed nation, with hunger and the Atlantic for auxiliaries, was not to be subjugated. Meanwhile the house of Bourbon, humbled to the dust a few years before by the genius and vigor of Chatham, had seized the opportunity of revenge. France and Spain had united against us, and had recently been joined by Holland. The command of the Mediterranean had been for a time lost. The British flag had been scarcely able to maintain itself in the British Channel. The northern powers professed neutrality; but their neutrality had a menacing aspect. In the East, Hyder had descended on the Carnatic, had destroyed the little army of Baillie, and had spread terror even to the ramparts of Fort St. George. The discontents of Ireland threatened nothing less than civil war. In England the authority of the Government had sunk to the lowest point. The king and the House of Commons were alike unpopular. The cry for parliamentary reform was scarcely less loud and vehement than in the autumn of 1830. Formidable associations, headed, not by ordinary demagogues, but by men of high rank, stainless character, and distinguished ability, demanded a revision of the representative system. The populace, emboldened by the impotence and irresolution of the Government, had recently broken loose from all restraint, besieged the chambers of the legislature, hustled peers, hunted bishops, attacked the residences of ambassadors, opened prisons, burned and pulled down houses. London had presented during some days the aspect of a city taken by storm; and it had been necessary to form a camp among the trees of St. James's Park.

In spite of dangers and difficulties abroad and at home, George III., with a firmness which had little affinity with virtue or with wisdom, persisted in his determination to put down the American rebels by force of arms; and his ministers submitted their judgment to his. Some of them were probably actuated merely by selfish cupidity; but their chief, Lord North, a man of high honor, amiable temper, winning manners, lively wit, and excellent talents both for business and for debate, must be acquitted of all sordid motives. He remained at a post from which he had long wished and had repeatedly tried to escape, only because he had not sufficient fortitude to resist the entreaties and reproaches of the king, who silenced all arguments by passionately asking whether any gentleman, any man of spirit, could have the heart to desert a kind master in the hour of extremity.

The Opposition consisted of two parties which had once been hostile to each other, and which had been very slowly and, as it soon appeared, very imperfectly reconciled, but which at this conjuncture seemed to act together with cordiality. The larger of these parties consisted of the great body of the Whig aristocracy. Its head was Charles, marquis of Rockingham, a man of sense and virtue, and in wealth and parliamentary interest equalled by very few of the English nobles, but afflicted with a nervous timidity which prevented him from taking a prominent part in debate. In the House of Commons the adherents of Rockingham were led by Fox, whose dissipated habits and ruined fortunes were the talk of the whole town, but whose commanding genius, and whose sweet, generous, and affectionate disposition, extorted the admiration and love of those who most lamented the errors of his private life. Burke, superior to Fox in largeness of comprehension, in extent of knowledge, and in splendor of imagination, but less skilled in that kind of logic and in that kind of rhetoric which convince and persuade great assemblies, was willing to be the lieutenant of a young chief who might have been his son.

A smaller section of the Opposition was composed of the old followers of Chatham. At their head was William, earl of Shelburne, distinguished both as a statesman and as a lover of science and letters. With him were leagued Lord Camden, who had formerly held the great seal, and whose integrity, ability, and constitutional knowledge commanded the public respect; Barré, an eloquent and acrimonious declaimer; and Dunning, who had long held the first place at the English bar. It was to this party that Pitt was naturally attracted.

First speech.

On the 26th of February, 1781, he made his first speech in favor of Burke's plan of economical reform. Fox stood up at the same moment, but instantly gave way. The lofty yet animated deportment of the young member, his perfect self-possession, the readiness with which he replied to the orators who had preceded him, the silver tones of his voice, the perfect structure of his unpremeditated sentences, astonished and delighted his hearers. Burke, moved even to tears, exclaimed, "It is not a chip of the old block; it is the old block itself." "Pitt will be one of the first men in parliament," said a member of the Opposition to Fox. "He is so already," answered Fox, in whose nature envy had no place. It is a curious fact, well remembered by some who were very recently living,[1] that soon after this debate Pitt's name was put up by Fox at Brookes's.

On two subsequent occasions during that session Pitt addressed the House, and on both fully sustained the reputation which he had acquired on his first appearance. In the summer, after the prorogation, he again went the western circuit, held several briefs, and acquitted himself in such a manner that he was highly complimented by Buller from the bench, and by Dunning at the bar.

On the 27th of November the parliament reassembled. Only forty-eight hours before had arrived tidings of the surrender of Cornwallis and his army; and it had consequently been necessary to rewrite the royal speech. Every man in the kingdom, except the king, was now convinced that it was mere madness to think of conquering the United States. In the debate on the report of the address, Pitt spoke with even more energy and brilliancy than on any former occasion. He was warmly applauded by his allies; but it was remarked that no person on his own side of the house was so loud in eulogy as Henry Dundas, the lord advocate of Scotland, who spoke from the ministerial ranks. That able and versatile politician distinctly foresaw the approaching downfall of the Government with which he was connected, and was preparing to make his own escape from the ruin. From that night dates his connection with Pitt, a connection which soon became a close intimacy, and which lasted till it was dissolved by death.

About a fortnight later Pitt spoke in the committee of supply on the army estimates. Symptoms of dissension had begun to appear on the treasury bench. Lord George Germaine, the secretary of state who was especially charged with the direction of the war in America, had held language not easily to be reconciled with declarations made by the first lord of the treasury. Pitt noticed the discrepancy with much force and keenness. Lord George and Lord North began to whisper together; and Wellbore Ellis, an ancient placeman who had been drawing salary almost every quarter since the days of Henry Pelham, bent down between them to put in a word. Such interruptions sometimes discompose veteran speakers. Pitt stopped, and looking at the group, said, with admirable readiness, "I shall wait till Nestor has composed the dispute between Agamemnon and Achilles."

After several defeats, or victories hardly to be distinguished from defeats, the ministry resigned. The king, reluctantly and ungraciously, consented to accept Rockingham as first minister. Fox and Shelburne became secretaries of state. Lord John Cavendish, one of the most upright and honorable of men, was made chancellor of the exchequer. Thurlow, whose abilities and force of character had made him the dictator of the House of Lords, continued to hold the great seal.

Declines office in Rockingham ministry, March, 1782.

To Pitt was offered, through Shelburne, the vice-treasurership of Ireland, one of the easiest and most highly paid places in the gift of the crown; but the offer was without hesitation declined. The young statesman had resolved to accept no post which did not entitle him to a seat in the cabinet; and a few days later he announced that resolution in the House of Commons.[2] It must be remembered that the cabinet was then a much smaller and more select body than at present. We have seen cabinets of sixteen. In the time of our grandfathers a cabinet of ten or eleven was thought inconveniently large. Seven was a usual number. Even Burke, who had taken the lucrative office of paymaster, was not in the cabinet. Many therefore thought Pitt's declaration indecent. He himself was sorry that he had made it. The words, he said in private, had escaped him in the heat of speaking; and he had no sooner uttered them than he would have given the world to recall them. They, however did him no harm with the public. The second William Pitt, it was said, had shown that he had inherited the spirit as well as the genius of the first. In the son, as in the father, there might perhaps be too much pride; but there was nothing low or sordid. It might be called arrogance in a young barrister, living in chambers on three hundred a year, to refuse a salary of five thousand a year, merely because he did not choose to bind himself to speak or vote for plans which he had no share in framing; but surely such arrogance was not very far removed from virtue.

Introduces motion for parliamentary reform, May 7, 1782.

Pitt gave a general support to the administration of Rockingham, but omitted, in the meantime, no opportunity of courting that ultra-Whig party which the persecution of Wilkes and the Middlesex election had called into existence, and which the disastrous events of the war, and the triumph of republican principles in America, had made formidable both in numbers and in temper. He supported a motion for shortening the duration of parliaments. He made a motion for a committee to examine into the state of the representation, and, in the speech by which that motion was introduced, avowed himself the enemy of the close boroughs, the strongholds of that corruption to which he attributed all the calamities of the nation, and which, as he phrased it in one of those exact and sonorous sentences of which he had a boundless command, had grown with the growth of England and strengthened with her strength, but had not diminished with her diminution or decayed with her decay. On this occasion he was supported by Fox. The motion was lost by only twenty votes in a house of more than three hundred members. The reformers never again had so good a division till the year 1831.

The new administration was strong in abilities, and was more popular than any administration which had held office since the first year of George III., but was hated by the king, hesitatingly supported by the parliament, and torn by internal dissensions. The chancellor was disliked and distrusted by almost all his colleagues. The two secretaries of state regarded each other with no friendly feeling. The line between their departments had not been traced with precision; and there were consequently jealousies, encroachments, and complaints. It was all that Rockingham could do to keep the peace in his cabinet; and before the cabinet had existed three months Rockingham died.

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[1] [It is to be noted that this and some other allusions in the present article refer to the date of its original appearance, 1859.]

[2] [Lord Stanhope says this announcement was made ten days before the North ministry resigned. See his *Life of Pitt* (London, 1861), vol. i, p. 70.—AM. ED.]

Shelburne ministry.

In an instant all was confusion. The adherents of the deceased statesman looked on the duke of Portland as their chief. The king placed Shelburne at the head of the treasury. Fox, Lord John Cavendish, and Burke immediately resigned their offices; and the new prime minister was left to constitute a Government out of very defective materials. His own parliamentary talents were great; but he could not be in the place where parliamentary talents were most needed. It was necessary to find some member of the House of Commons who could confront the great orators of the Opposition; and Pitt alone had the eloquence and the courage which were required. He was offered the great place of chancellor of the exchequer, and he accepted it. He had scarcely completed his twenty-third year.

Pitt chancellor of the exchequer, July, 1782.

The parliament was speedily prorogued. During the recess a negotiation for peace which had been commenced under Rockingham was brought to a successful termination. England acknowledged the independence of her revolted colonies; and she ceded to her European enemies some places in the Mediterranean and in the Gulf of Mexico. But the terms which she obtained were quite as advantageous and honorable as the events of the war entitled her to expect, or as she was likely to obtain by persevering in a contest against immense odds. All her vital parts, all the real sources of her power, remained uninjured. She preserved even her dignity; for she ceded to the house of Bourbon only part of what she had won from that house in previous wars. She retained her Indian empire undiminished; and, in spite of the mightiest efforts of two great monarchies, her flag still waved on the rock of Gibraltar. There is not the slightest reason to believe that Fox, if he had remained in office, would have hesitated one moment about concluding a treaty on such conditions. Unhappily that great and most amiable man was, at this crisis, hurried by his passions into an error which made his genius and his virtues, during a long course of years, almost useless to his country.

He saw that the great body of the House of Commons was divided into three parties—his own, that of North, and that of Shelburne; that none of those three parties was large enough to stand alone; that, therefore, unless two of them united there must be a miserably feeble administration, or, more probably, a rapid succession of miserably feeble administrations, and this at a time when a strong Government was essential to the prosperity and respectability of the nation. It was then necessary and right that there should be a coalition. To every possible coalition there were objections. But of all possible coalitions that to which there were the fewest objections was undoubtedly a coalition between Shelburne and Fox. It would have been generally applauded by the followers of both. It might have been made without any sacrifice of public principle on the part of either. Unhappily, recent bickerings had left in the mind of Fox a profound dislike and distrust of Shelburne. Pitt attempted to mediate, and was authorized to invite Fox to return to the service of the crown. "Is Lord Shelburne," said Fox, "to remain prime minister?" Pitt answered in the affirmative. "It is impossible that I can act under him," said Fox. "Then negotiation is at an end," said Pitt; "for I cannot betray him." Thus the two statesmen parted. They were never again in a private room together.

As Fox and his friends would not treat with Shelburne, nothing remained to them but to treat with North. That fatal coalition which is emphatically called "The Coalition" was formed. Not three-quarters of a year had elapsed since Fox and Burke had threatened North with impeachment, and had described him night after night as the most arbitrary, the most corrupt, and the most incapable of ministers. They now allied themselves with him for the purpose of driving from office a statesman with whom they cannot be said to have differed as to any important question. Nor had they even the prudence and the patience to wait for some occasion on which they might, without inconsistency, have combined with their old enemies in opposition to the Government. That nothing might be wanting to the scandal the great orators who had, during seven years, thundered against the war determined to join with the authors of that war in passing a vote of censure on the peace.

1783.

The parliament met before Christmas, 1782. But it was not till January, 1783, that the preliminary treaties were signed. On the 17th of February they were taken into consideration by the House of Commons. There had been, during some days, floating rumors that Fox and North had coalesced; and the debate indicated but too clearly that those rumors were not unfounded. Pitt was suffering from indisposition; he did not rise till his own strength and that of his hearers were exhausted; and he was consequently less successful than on any former occasion. His admirers owned that his speech was feeble and petulant. He so far forgot himself as to advise Sheridan to confine himself to amusing theatrical audiences. This ignoble sarcasm gave Sheridan an opportunity of retorting with great felicity. "After what I have seen and heard to-night," he said, "I really feel strongly tempted to venture on a competition with so great an artist as Ben Jonson, and to bring on the stage a second Angry Boy." On a division, the address proposed by the supporters of the Government was rejected by a majority of sixteen.

But Pitt was not a man to be disheartened by a single failure, or to be put down by the most lively repartee. When, a few days later, the Opposition proposed a resolution directly censuring the treaties, he spoke with an eloquence, energy, and dignity which raised his fame and popularity higher than ever. To the coalition of Fox and North he alluded in language which drew forth tumultuous applause from his followers. "If," he said, "this ill-omened and unnatural marriage be not yet consummated, I know of a just and lawful impediment; and, in the name of the public weal, I forbid the banns."

Resignation of Shelburne ministry, March 31, 1783.

The ministers were again left in a minority, and Shelburne consequently tendered his resignation. It was accepted; but the king struggled long and hard before he submitted to the terms dictated by Fox, whose faults he detested, and whose high spirit and powerful intellect he detested still more. The first place at the board of treasury was repeatedly offered to Pitt; but the offer, though tempting, was steadfastly declined. The young man, whose judgment was as precocious as his eloquence, saw that his time was coming, but was not come, and was deaf to royal importunities and reproaches. His Majesty, bitterly complaining of Pitt's faintheartedness, tried to break the coalition. Every art of seduction was practiced on North, but in vain. During several weeks the country remained without a Government. It was not till all devices had failed, and till the aspect of the House of Commons became threatening, that the king gave way. The duke of Portland was declared first lord of the treasury. Thurlow was dismissed. Fox and North became secretaries of state, with power ostensibly equal. But Fox was the real prime minister.

Portland ministry.

Pitt's second motion for parliamentary reform, May 7, 1783.

The year was far advanced before the new arrangements were completed ; and nothing very important was done during the remainder of the session. Pitt, now seated on the Opposition bench,[1] brought the question of parliamentary reform a second time under the consideration of the Commons. He proposed to add to the House at once a hundred county members and several members for metropolitan districts, and to enact that every borough of which an election committee should report that the majority of voters appeared to be corrupt should lose the franchise. The motion was rejected by 293 votes to 149.

After the prorogation, Pitt visited the Continent for the first and last time. His travelling companion was one of his most intimate friends, a young man of his own age who had already distinguished himself in parliament by an engaging natural eloquence, set off by the sweetest and most exquisitely modulated of human voices, and whose affectionate heart, caressing manners, and brilliant wit made him the most delightful of companions, William Wilberforce. That was the time of Anglomania in France; and at Paris the son of the great Chatham was absolutely hunted by men of letters and women of fashion, and forced, much against his will, into political disputation. One remarkable saying which dropped from him during this tour has been preserved. A French gentleman expressed some surprise at the immense influence which Fox, a man of pleasure, ruined by the dice-box and the turf, exercised over the English nation. "You have not," said Pitt, "been under the wand of the magician."

State of parties Nov.-Dec. 1783.

In November, 1783, the parliament met again. The Government had irresistible strength in the House of Commons, and seemed to be scarcely less strong in the House of Lords, but was, in truth, surrounded on every side by dangers. The king was impatiently waiting for the moment at which he could emancipate himself from a yoke which galled him so severely that he had more than once seriously thought of retiring to Hanover; and the king was scarcely more eager for a change than the nation. Fox and North had committed a fatal error. They ought to have known that coalitions between parties which have long been hostile can succeed only when the wish for coalition pervades the lower ranks of both. If the leaders unite before there is any disposition to union among the followers, the probability is that there will be a mutiny in both camps, and that the two revolted armies will make a truce with each other in order to be revenged on those by whom they think that they have been betrayed. Thus it was in 1783. At the beginning of that eventful year North had been the recognized head of the old Tory party, which, though for a moment prostrated by the disastrous issue of the American war, was still a great power in the state. To him the clergy, the universities, and that large body of country gentlemen whose rallying cry was "Church and King" had long looked up with respect and confidence. Fox had, on the other hand, been the idol of the Whigs, and of the whole body of Protestant dissenters. The coalition at once alienated the most zealous Tories from North and the most zealous Whigs from Fox. The university of Oxford, which had marked its approbation of North's orthodoxy by electing him chancellor, the city of London, which had been during two and twenty years at war with the court, were equally disgusted. Squires and rectors who had inherited the principles of the cavaliers of the preceding century could not forgive their old leader for combining with disloyal subjects in order to put a force on the sovereign. The members of the Bill of Rights Society and of the reform associations were enraged by learning that their favorite orator now called the great champion of tyranny and corruption his noble friend. Two great multitudes were at once left without any head, and both at once turned their eyes on Pitt. One party saw in him the only man who could rescue the king; the other saw in him the only man who could purify the parliament. He was supported on one side by Archbishop Markham, the preacher of divine right, and by Jenkinson, the captain of the prætorian band of the king's friends; on the other side by Jebb and Priestley, Sawbridge and Cartwright, Jack Wilkes and Horne Tooke. On the benches of the House of Commons, however, the ranks of the ministerial majority were unbroken; and that any statesman would venture to brave such a majority was thought impossible. No prince of the Hanoverian line had ever, under any provocation, ventured to appeal from the representative body to the constituent body. The ministers, therefore, notwithstanding the sullen looks and muttered words of displeasure with which their suggestions were received in the closet, notwithstanding the roar of obloquy which was rising louder and louder every day from every corner of the island, thought themselves secure.

Fox's India Bill.

Such was their confidence in their strength that, as soon as the parliament had met, they brought forward a singularly bold and original plan for the government of the British territories in India. What was proposed was that the whole authority which till that time had been exercised over those territories by the East India Company should be transferred to seven commissioners, who were to be named by parliament, and were not to be removable at the pleasure of the crown. Earl Fitzwilliam, the most intimate personal friend of Fox, was to be chairman of this board, and the eldest son of North was to be one of the members.

As soon as the outlines of the scheme were known all the hatred which the coalition had excited burst forth with an astounding explosion. The question which ought undoubtedly to have been considered as paramount to every other was whether the proposed change was likely to be beneficial or injurious to the thirty millions of people who were subject to the company. But that question cannot be said to have been even seriously discussed. Burke, who, whether right or wrong in the conclusions to which he came, had at least the merit of looking at the subject in the right point of view, vainly reminded his hearers of that mighty population whose daily rice might depend on a vote of the British parliament. He spoke with even more than his wonted power of thought and language, about the desolation of Rohilcund, about the spoliation of Benares, about the evil policy which had suffered the tanks of the Carnatic to go to ruin; but he could scarcely obtain a hearing. The contending parties, to their shame it must be said, would listen to none but English topics. Out of doors the cry against the ministry was almost universal. Town and country were united. Corporations exclaimed against the violation of the charter of the greatest corporation in the realm. Tories and democrats joined in pronouncing the proposed board an unconstitutional body. It was to consist of Fox's nominees. The effect of his bill was to give, not to the crown, but to him personally, whether in office or in opposition, an enormous power, a patronage sufficient to counterbalance the patronage of the treasury and of the admiralty, and to decide the elections for fifty boroughs. He knew, it was said, that he was hateful alike to king and people; and he had devised a plan which would make him independent of both. Some nicknamed him Cromwell, and some Carlo Khan. Wilberforce, with his usual felicity of expression, and with very unusual bitterness of feeling, described the scheme as the genuine offspring of the coalition, as marked with the features of both its parents, the corruption of one and the violence of the other. In spite of all opposition, however, the bill was supported in every stage by great majorities, was rapidly passed, and was sent up to the Lords. To the general astonishment. when the second reading was moved in the Upper House, the Opposition proposed an adjournment, and carried it by eighty-seven votes to seventy-nine. The cause of this strange turn of fortune was soon known. Pitt's cousin, Earl Temple, had been in the royal closet, and had there been authorized to let it be known that His Majesty would consider all who voted for the bill as his enemies. The ignominious commission was performed, and instantly a troop of lords of the bedchamber, of bishops who wished to be translated, and of Scotch peers who wished to be re-elected made haste to change sides. On a later day the Lords rejected the bill. Fox and North were immediately directed to send their seals to the palace by their under secretaries; and Pitt was appointed first lord of the treasury and chancellor of the exchequer.

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[1] [He disclaimed, however, acting at this time with any party, and Fox supported his reform bill. See Stanhope, vol. i. pp. 116, 118.—Am. Ed.]

Pitt first lord of the treasury and chancellor of the exchequer, Dec.-1783.

The general opinion was that there would be an immediate dissolution. But Pitt wisely determined to give the public feeling time to gather strength. On this point he differed from his kinsman Temple. The consequence was that Temple, who had been appointed one of the secretaries of state, resigned his office forty-eight hours after he had accepted it,[1] and thus relieved the new Government from a great load of unpopularity; for all men of sense and honor, however strong might be their dislike of the India Bill, disapproved of the manner in which that bill had been thrown out. Temple carried away with him the scandal which the best friends of the new Government could not but lament. The fame of the young prime minister preserved its whiteness. He could declare with perfect truth that, if unconstitutional machinations had been employed, he had been no party to them.

He was, however, surrounded by difficulties and dangers. In the House of Lords, indeed, he had a majority; nor could any orator of the opposition in that assembly be considered as a match for Thurlow, who was now again chancellor, or for Camden, who cordially supported the son of his old friend Chatham. But in the other House there was not a single eminent speaker among the official men who sat around Pitt. His most useful assistant was Dundas, who, though he had not eloquence, had sense, knowledge, readiness, and boldness. On the opposite benches was a powerful majority, led by Fox, who was supported by Burke, North, and Sheridan. The heart of the young minister, stout as it was, almost died within him. He could not once close his eyes on the night which followed Temple's resignation. But, whatever his internal emotions might be, his language and deportment indicated nothing but unconquerable firmness and haughty confidence in his own powers. His contest against the House of Commons lasted from the 17th of December, 1783, to the 8th of March, 1784. In sixteen divisions the Opposition triumphed. Again and again the king was requested to dismiss his ministers; but he was determined to go to Germany rather than yield. Pitt's resolution never wavered. The cry of the nation in his favor became vehement and almost furious. Addresses assuring him of public support came up daily from every part of the kingdom. The freedom of the city of London was presented to him in a gold box. He went in state to receive this mark of distinction. He was sumptuously feasted in Grocers' Hall; and the shopkeepers of the Strand and Fleet Street illuminated their houses in his honor. These things could not but produce an effect within the walls of parliament. The ranks of the majority began to waver; a few passed over to the enemy; some skulked away; many were for capitulating while it was still possible to capitulate with the honors of war. Negotiations were opened with the view of forming an administration on a wide basis, but they had scarcely been opened when they were closed. The Opposition demanded, as a preliminary article of the treaty, that Pitt should resign the treasury; and with this demand Pitt steadfastly refused to comply. While the contest was raging, the clerkship of the Pells, a sinecure place for life, worth three thousand a year, and tenable with a seat in the House of Commons, became vacant. The appointment was with the chancellor of the exchequer; nobody doubted that he would appoint himself, and nobody could have blamed him if he had done so; for such sinecure offices had always been defended on the ground that they enabled a few men of eminent abilities and small incomes to live without any profession, and to devote themselves to the service of the state. Pitt, in spite of the remonstrances of his friends, gave the Pells to his father's old adherent, Colonel Barré, a man distinguished by talent and eloquence, but poor and afflicted with blindness. By this arrangement a pension which the Rockingham administration had granted to Barré was saved to the public. Never was there a happier stroke of policy. About treaties, wars, expeditions, tariffs, budgets, there will always be room for dispute. The policy which is applauded by half the nation may be condemned by the other half. But pecuniary disinterestedness everybody comprehends. It is a great thing for a man who has only three hundred a year to be able to show that he considers three thousand a year as mere dirt beneath his feet, when compared with the public interest and the public esteem. Pitt had his reward. No minister was ever more rancorously libelled; but even when he was known to be overwhelmed with debt, when millions were passing through his hands, when the wealthiest magnates of the realm were soliciting him for marquisates and garters, his bitterest enemies did not dare to accuse him of touching unlawful gain.

Dissolves parliament, March, 1784.

At length the hard-fought fight ended. A final remonstrance, drawn up by Burke with admirable skill, was carried on the 8th of March by a single vote in a full house. Had the experiment been repeated, the supporters of the coalition would probably have been in a minority. But the supplies had been voted; the Mutiny Bill had been passed; and the parliament was dissolved.

Returned for Cambridge university, 1784.

The popular constituent bodies all over the country were in general enthusiastic on the side of the new Government. A hundred and sixty of the supporters of the coalition lost their seats. The first lord of the treasury himself came in at the head of the poll for the university of Cambridge. His young friend, Wilberforce. was elected knight of the great shire of York, in opposition to the whole influence of the Fitzwilliams, Cavendishes, Dundases, and Saviles. In the midst of such triumphs Pitt completed his twenty-fifth year. He was now the greatest subject that England had seen during many generations. He domineered absolutely over the cabinet, and was the favorite at once of the sovereign, of the parliament, and of the nation. His father had never been so powerful, nor Walpole, nor Marlborough.

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[1] [Lord Stanhope prints in his life of Pitt (vol. i. p. 162) a letter from Lord Macaulay in reference to this account of Temple's resignation, which we here reproduce with the exception of two irrelevant lines concerning Burke.

HOLLY LODGE, Dec. 2, 1858.

MY DEAR STANHOPE:

I am afraid that I can find no better authority for the account which I have given of Temple's resignation than that of Wraxall, who tells the story very confidently and circumstantially, but whose unsupported testimony is of little value, even when he relates what he himself saw and heard, and of no value when he relates what passed in the secrecy of the Cabinet. After looking at Tomline's narrative and at the Buckingham papers, I am satisfied that I was wrong. Whenever Black reprints the article separately, as he proposes to do, the error shall be corrected.

Ever yours truly,

MACAULAY.

In a letter of 8 March, 1859, Macaulay continues: "I do not believe Lord Temple and Mr. Pitt ever had any quarrel, and I think the former resigned because they would not dissolve the Parliament. I may, however, be mistaken in this."

Stanhope suggests that Temple resigned because he did not receive the personal elevation to which he aspired.—AM. ED.]

This narrative has now reached a point beyond which a full history of the life of Pitt would be a history of England, or rather of the whole civilized world; and for such a history this is not the proper place. Here a very slight sketch must suffice; and in that sketch prominence will be given to such points as may enable a reader who is already acquainted with the general course of events to form a just notion of the character of the man on whom so much depended.

If we wish to arrive at a correct judgment of Pitt's merits and defects, we must never forget that he belonged to a peculiar class of statesmen, and that he must be tried by a peculiar standard. It is not easy to compare him fairly with such men as Ximenes and Sully, Richelieu and Oxenstiern, John de Witt and Warren Hastings. The means by which those politicians governed great communities were of quite a different kind from those which Pitt was under the necessity of employing. Some talents, which they never had any opportunity of showing that they possessed, were developed in him to an extraordinary degree. In some qualities, on the other hand, to which they owe a large part of their fame, he was decidedly their inferior. They transacted business in their closets, or at boards where a few confidential councillors sat. It was his lot to be born in an age and in a country in which parliamentary government was completely established; his whole training from infancy was such as fitted him to bear a part in parliamentary government; and, from the prime of his manhood to his death, all the powers of his vigorous mind were almost constantly exerted in the work of parliamentary government. He accordingly became the greatest master of the whole art of parliamentary government that has ever existed, a greater than Montague or Walpole, a greater than his father Chatham or his rival Fox, a greater than either of his illustrious successors Canning and Peel.

Pitt and parliamentary government.

Parliamentary government, like every other contrivance of man, has its advantages and its disadvantages. On the advantages there is no need to dilate. The history of England during the hundred and seventy years which have elapsed since the House of Commons became the most powerful body in the state, her immense and still growing prosperity, her freedom, her tranquillity, her greatness in arts, in sciences, and in arms, her maritime ascendency, the marvels of her public credit, her American, her African, her Australian, her Asiatic empires, sufficiently prove the excellence of her institutions. But those institutions, though excellent, are assuredly not perfect. Parliamentary government is government by speaking. In such a government, the power of speaking is the most highly prized of all the qualities which a politician can possess; and that power may exist, in the highest degree, without judgment, without fortitude, without skill in reading the characters of men or the signs of the times, without any knowledge of the principles of legislation or of political economy, and without any skill in diplomacy or in the administration of war. Nay, it may well happen that those very intellectual qualities which give a peculiar charm to the speeches of a public man may be incompatible with the qualities which would fit him to meet a pressing emergency with promptitude and firmness. It was thus with Charles Townshend. It was thus with Windham. It was a privilege to listen to those accomplished and ingenious orators. But in a perilous crisis they would have been found far inferior in all the qualities of rulers to such a man as Oliver Cromwell, who talked nonsense, or as William the Silent, who did not talk at all. When parliamentary government is established, a Charles Townshend or a Windham will almost always exercise much greater influence than such men as the great Protector of England, or as the founder of the Batavian commonwealth. In such a government, parliamentary talent, though quite distinct from the talents of a good executive or judicial officer, will be a chief qualification for executive and judicial office. From the Book of Dignities a curious list might be made out of chancellors ignorant of the principles of equity, and first lords of the admiralty ignorant of the principles of navigation, of colonial ministers who could not repeat the names of the colonies, of lords of the treasury who did not know the difference between funded and unfunded debt, and of secretaries of the India board who did not know whether the Mahrattas were Mohammedans or Hindus. On these grounds, some persons, incapable of seeing more than one side of a question, have pronounced parliamentary government a positive evil, and have maintained that the administration would be greatly improved if the power, now exercised by a large assembly, were transferred to a single person. Men of sense will probably think the remedy very much worse than the disease, and will be of opinion that there would be small gain in exchanging Charles Townshend and Windham for the Prince of the Peace, or the poor slave and dog Steenie.

Pitt was emphatically the man of Parliamentary government, the type of his class, the minion, the child, the spoiled child, of the House of Commons. For the House of Commons he had a hereditary, an infantine love. Through his whole boyhood the House of Commons was never out of his thoughts, or out of the thoughts of his instructors. Reciting at his father's knee, reading Thucydides and Cicero into English, analyzing the great Attic speeches on the Embassy and on the Crown, he was constantly in training for the conflicts of the House of Commons. He was a distinguished member of the House of Commons at twenty-one. The ability which he had displayed in the House of Commons made him the most powerful subject in Europe before he was twenty-five. It would have been happy for himself and for his country if his elevation had been deferred. Eight or ten years, during which he would have had leisure and opportunity for reading and reflection, for foreign travel, for social intercourse and free exchange of thought on equal terms with a great variety of companions, would have supplied what, without any fault on his part, was wanting to his powerful intellect. He had all the knowledge that he could be expected to have—that is to say, all the knowledge that a man can acquire while he is a student at Cambridge, and all the knowledge that a man can acquire when he is first lord of the treasury and chancellor of the exchequer. But the stock of general information which he brought from college, extraordinary for a boy, was far inferior to what Fox possessed, and beggarly when compared with the massy, the splendid, the various treasures laid up in the large mind of Burke. After Pitt became minister, he had no leisure to learn more than was necessary for the purposes of the day which was passing over him. What was necessary for those purposes such a man could learn with little difficulty. He was surrounded by experienced and able public servants. He could at any moment command their best assistance. From the stores which they produced his vigorous mind rapidly collected the materials for a good parliamentary case; and that was enough. Legislation and administration were with him secondary matters. To the work of framing statutes, of negotiating treaties, of organizing fleets and armies, of sending forth expeditions, he gave only the leavings of his time and the dregs of his fine intellect. The strength and sap of his mind were all drawn in a different direction. It was when the House of Commons was to be convinced and persuaded that he put forth all his powers.

His oratory.

Of those powers we must form our estimate chiefly from tradition; for, of all the eminent speakers of the last age Pitt has suffered most from the reporters. Even while he was still living, critics remarked that his eloquence could not be preserved, that he must be heard to be appreciated. They more than once applied to him the sentence in which Tacitus describes the fate of a senator whose rhetoric was admired in the Augustan age: "Haterii canorum illud et profluens cum ipso simul exstinctum est." There is, however, abundant evidence that nature had bestowed on Pitt the talents of a great orator; and those talents had been developed in a very peculiar manner, first by his education, and secondly by the high official position to which he rose early, and in which he passed the greater part of his public life.

At his first appearance in parliament he showed himself superior to all his contemporaries in command of language. He could pour forth a long succession of round and stately periods, without premeditation, without ever pausing for a word, without ever repeating a word, in a voice of silver clearness, and with a pronunciation so articulate that not a letter was slurred over. He had less amplitude of mind and less richness of imagination than Burke, less ingenuity than Windham, less wit than Sheridan, less perfect mastery of dialectical fence and less of that highest sort of eloquence which consists of reason and passion fused together than Fox. Yet the almost unanimous judgment of those who were in the habit of listening to that remarkable race of men, placed Pitt, as a speaker, above Burke, above Windham, above Sheridan, and not below Fox. His declamation was copious, polished, and splendid. In power of sarcasm he was probably not surpassed by any speaker, ancient or modern; and of this formidable weapon he made merciless use. In two parts of the oratorical art which are of the highest value to a minister of state he was singularly expert. No man knew better how to be luminous or how to be obscure. When he wished to be understood, he never failed to make himself understood. He could with ease present to his audience, not perhaps an exact or profound, but a clear, popular, and plausible view of the most extensive and complicated subject. Nothing was out of place; nothing was forgotten: minute details, dates, sums of money, were all faithfully preserved in his memory. Even intricate questions of finance, when explained by him, seemed clear to the plainest man among his hearers. On the other hand, when he did not wish to be explicit,—and no man who is at the head of affairs always wishes to be explicit,—he had a marvellous power of saying nothing in language which left on his audience the impression that he had said a great deal. He was at once the only man who could open a budget without notes, and the only man who, as Windham said, could speak that most elaborately evasive and unmeaning of human compositions, a king's speech, without premeditation.

Personal character.

The effect of oratory will always to a great extent depend on the character of the orator. There perhaps never were two speakers whose eloquence had more of what may be called the race, more of the flavor imparted by moral qualities, than Fox and Pitt. The speeches of Fox owe a great part of their charm to that warmth and softness of heart, that sympathy with human suffering, that admiration for everything great and beautiful, and that hatred of cruelty and injustice, which interest and delight us even in the most defective reports. No person, on the other hand, could hear Pitt without perceiving him to be a man of high, intrepid, and commanding spirit, proudly conscious of his own rectitude and of his own intellectual superiority, incapable of the low vices of fear and envy, but too prone to feel and to show disdain. Pride, indeed, pervaded the whole man, was written in the harsh, rigid lines of his face, was marked by the way in which he walked, in which he sat, in which he stood, and, above all, in which he bowed. Such pride, of course, inflicted many wounds. It may confidently be affirmed that there cannot be found, in all the ten thousand invectives written against Fox, a word indicating that his demeanor had ever made a single personal enemy. On the other hand, several men of note who had been partial to Pitt, and who to the last continued to approve his public conduct and to support his administration—Cumberland, for example, Boswell, and Matthias, were so much irritated by the contempt with which he treated them, that they complained in print of their wrongs. But his pride, though it made him bitterly disliked by individuals, inspired the great body of his followers in parliament and throughout the country with respect and confidence. They took him at his own valuation. They saw that his self-esteem was not that of an upstart who was drunk with good luck and with applause, and who if fortune turned, would sink from arrogance into abject humility. It was that of the magnanimous man so finely described by Aristotle in the *Ethics*, of the man who thinks himself worthy of great things, being in truth worthy. It sprang from a consciousness of great powers and great virtues, and was never so conspicuously displayed as in the midst of difficulties and dangers which would have unnerved and bowed down any ordinary mind. It was closely connected, too, with an ambition which had no mixture of low cupidity. There was something noble in the cynical disdain with which the mighty minister scattered riches and titles to right and left among those who valued them, while he spurned them out of his way. Poor himself, he was surrounded by friends on whom he had bestowed three thousand, six thousand, ten thousand a year. Plain Mister himself, he had made more lords than any three ministers that had preceded him. The garter, for which the first dukes in the kingdom were contending, was repeatedly offered to him, and offered in vain.

Private life.

The correctness of his private life added much to the dignity of his public character. In the relations of son, brother, uncle, master, friend, his conduct was exemplary. In the small circle of his intimate associates he was amiable, affectionate, even playful. They loved him sincerely; they regretted him long; and they would hardly admit that he who was so kind and gentle with them could be stern and haughty with others. He indulged, indeed, somewhat too freely in wine, which he had early been directed to take as a medicine, and which use had made a necessary of life to him. But it was very seldom that any indication of undue excess could be detected in his tones or gestures; and, in truth, two bottles of port were little more to him than two dishes of tea. He had, when he was first introduced into the clubs of St. James's Street, shown a strong taste for play; but he had the prudence and the resolution to stop before this taste had acquired the strength of habit. From the passion which generally exercises the most tyrannical dominion over the young he possessed an immunity, which is probably to be ascribed partly to his temperament and partly to his situation. His constitution was feeble; he was very shy; and he was very busy. The strictness of his morals furnished such buffoons as Peter Pindar and Captain Morris with an inexhaustible theme for merriment of no very delicate kind. But the great body of the middle class of Englishmen could not see the joke. They warmly praised the young statesman for commanding his passions, and for covering his frailties, if he had frailties, with decorous obscurity, and would have been very far indeed from thinking better of him if he had vindicated himself from the taunts of his enemies by taking under his protection a Nancy Parsons or a Marianne Clark.

Patronage of letters and art.

No part of the immense popularity which Pitt long enjoyed is to be attributed to the eulogies of wits and poets. It might have been naturally expected that a man of genius, of learning, of taste, an orator whose diction was often compared to that of Tully, the representative, too, of a great university, would have taken a peculiar pleasure in befriending eminent writers to whatever political party they might have belonged. The love of literature had induced Augustus to heap benefits on Pompeians, Somers to be the protector of nonjurors, Harley to make the fortunes of Whigs. But it could not move Pitt to show any favor even to Pittites. He was doubtless right in thinking that, in general, poetry, history, and philosophy ought to be suffered, like calico and cutlery, to find their proper price in the market, and that to teach men of letters to look habitually to the state for their recompense is bad for the state and bad for letters. Assuredly nothing can be more absurd or mischievous than to waste the public money in bounties for the purpose of inducing people who ought to be weighing out grocery or measuring out drapery to write bad or middling books. But, though the sound rule is that authors should be left to be remunerated by their readers, there will, in every generation, be a few exceptions to this rule. To distinguish these special cases from the mass is an employment well worthy of the faculties of a great and accomplished ruler; and Pitt would assuredly have had little difficulty in finding such cases. While he was in power, the greatest philologist of the age, his own contemporary at Cambridge, was reduced to earn a livelihood by the lowest literary drudgery, and to spend in writing squibs for the *Morning Chronicle* years to which we might have owed an all but perfect text of the whole tragic and comic drama of Athens. The greatest historian of the age, forced by poverty to leave his country, completed his immortal work on the shores of Lake Leman. The political heterodoxy of Porson and the religious heterodoxy of Gibbon may perhaps be pleaded in defence of the minister by whom those eminent men were neglected. But there were other cases in which no such excuse could be set up. Scarcely had Pitt obtained possession of unbounded power when an aged writer of the highest eminence, who had made very little by his writings, and who was sinking into the grave under a load of infirmities and sorrows, wanted five or six hundred pounds to enable him, during the winter or two which might still remain to him, to draw his breath more easily in the soft climate of Italy. Not a farthing was to be obtained; and before Christmas the author of the *English Dictionary* and of the *Lives of the Poets* had gasped his last in the river fog and coal smoke of Fleet Street. A few months after the death of Johnson appeared the *Task*, incomparably the best poem that any Englishman then living had produced—a poem, too, which could hardly fail to excite in a well-constituted mind a feeling of esteem and compassion for the poet, a man of genius and virtue, whose means were scanty, and whom the most cruel of all the calamities incident to humanity had made incapable of supporting himself by vigorous and sustained exertion. Nowhere had Chatham been praised with more enthusiasm, or in verse more worthy of the subject, than in the *Task*. The son of Chatham, however, contented himself with reading and admiring the book, and left the author to starve. The pension which long after enabled poor Cowper to close his melancholy life unmolested by duns and bailiffs was obtained for him by the strenuous kindness of Lord Spencer. What a contrast between the way in which Pitt acted towards Johnson and the way in which Lord Grey acted towards his political enemy Scott, when Scott, worn out by misfortune and disease, was advised to try the effect of the Italian air! What a contrast between the way in which Pitt acted towards Cowper and the way in which Burke, a poor man and out of place, acted towards Crabbe! Even Dundas, who made no pretensions to literary taste, and was content to be considered as a hard-headed and somewhat coarse man of business, was, when compared with his eloquent and classically educated friend, a Mæcenas or a Leo. Dundas made Burns an exciseman, with seventy pounds a year; and this was more than Pitt, during his long tenure of power, did for the encouragement of letters. Even those who may think that it is, in general, no part of the duty of a Government to reward literary merit, will hardly deny that a Government which has much lucrative church preferment in its gift is bound, in distributing that preferment, not to overlook divines whose writings have rendered great service the cause of religion. But it seems never to have occurred to Pitt that he lay under any such obligation. All the theological works of all the numerous bishops whom he made and translated are not, when put together, worth fifty pages of the *Horæ Paulinæ*, of the *Natural Theology* or of the *View of the Evidences of Christianity*. But on Paley the all-powerful minister never bestowed the smallest benefice. Artists Pitt treated as contemptuously as writers. For painting he did simply nothing. Sculptors who had been selected to execute monuments voted by parliament had to haunt the ante-chambers of the treasury during many years before they could obtain a farthing from him. One of them, after vainly soliciting the minister for payment during fourteen years, had the courage to present a memorial to the king, and thus obtained tardy and ungracious justice. Architects it was absolutely necessary to employ; and the worst that could be found seem to have been employed. Not a single fine public building of any kind or in any style was erected during his long administration. It may be confidently affirmed that no ruler whose abilities and attainments would bear any comparison with his has ever shown such cold disdain for what is excellent in arts and letters.

His first administration lasted seventeen years. That long period is divided by a strongly marked line into two almost exactly equal parts. The first part ended and the second began in the autumn of 1792. Throughout both parts Pitt displayed in the highest degree the talents of a parliamentary leader. During the first part he was a fortunate and in many respects a skilful administrator. With the difficulties which he had to encounter during the second part he was altogether incapable of contending; but his eloquence and his perfect mastery of the tactics of the House of Commons concealed his incapacity from the multitude.

First administration, 1784–1801.

The eight years which followed the general election of 1784 were as tranquil and prosperous as any eight years in the whole history of England. Neighboring nations which had lately been in arms against her, and which had flattered themselves that, in losing her American colonies, she had lost a chief source of her wealth and of her power, saw, with wonder and vexation, that she was more wealthy and more powerful than ever. Her trade increased. Her manufactures flourished. Her exchequer was full to overflowing. Very idle apprehensions were generally entertained that the public debt, though much less than a third of the debt which we now bear with ease, would be found too heavy for the strength of the nation. Those apprehensions might not perhaps have been easily quieted by reason. But Pitt quieted them by a juggle. He succeeded in persuading first himself and then the whole nation, his opponents included, that a new sinking fund, which, so far as it differed from former sinking funds, differed for the worse, would, by virtue of some mysterious power of propagation belonging to money, put into the pocket of the public creditor great sums not taken out of the pocket of the tax-payer. The country, terrified by a danger which was no danger, hailed with delight and boundless confidence a remedy which was no remedy. The minister was almost universally extolled as the greatest of financiers. Meanwhile both the branches of the House of Bourbon found that England was as formidable an antagonist as she had ever been. France had formed a plan for reducing Holland to vassalage. But England interposed, and France receded. Spain interrupted by violence the trade of our merchants with the regions near the Oregon. But England armed, and Spain receded. Within the island there was profound tranquillity. The king was, for the first time, popular. During the twenty-three years which had followed his accession he had not been loved by his subjects. His domestic virtues were acknowledged. But it was generally thought that the good qualities by which he was distinguished in private life were wanting to his political character. As a sovereign he was resentful, unforgiving, stubborn, cunning. Under his rule the country had sustained cruel disgraces and disasters; and every one of those disgraces and disasters was imputed to his strong antipathies, and to his perverse obstinacy in the wrong. One statesman after another complained that he had been induced by royal caresses, entreaties, and promises to undertake the direction of affairs at a difficult conjuncture, and that as soon as he had, not without sullying his fame and alienating his best friends, served the turn for which he was wanted, his ungrateful master began to intrigue against him and to canvass against him. Grenville, Rockingham, Chatham—men of widely different characters, but all three upright and high-spirited—agreed in thinking that the prince under whom they had successively held the highest place in the Government was one of the most insincere of mankind. His confidence was reposed, they said, not in those known and responsible counsellors to whom he had delivered the seals of office, but in secret advisers who stole up the back stairs into his closet. In parliament his ministers, while defending themselves against the attacks of the opposition in front, were perpetually, at his instigation, assailed on the flank or in the rear by a vile band of mercenaries who called themselves his friends. These men constantly, while in possession of lucrative places in his service, spoke and voted against bills which he had authorized the first lord of the treasury or the secretary of state to bring in. But from the day on which Pitt was placed at the head of affairs there was an end of secret influence. His haughty and aspiring spirit was not to be satisfied with the mere show of power. Any attempt to undermine him at court, any mutinous movement among his followers in the House of Commons, was certain to be at once put down. He had only to tender his resignation and he could dictate his own terms. For he, and he alone, stood between the king and the coalition. He was therefore little less than mayor of the palace. The nation loudly applauded the king for having the wisdom to repose entire confidence in so excellent a minister. His Majesty's private virtues now began to produce their full effect. He was generally regarded as the model of a respectable country gentleman, honest, goodnatured, sober, religious. He rose early, he dined temperately, he was strictly faithful to his wife, he never missed church and at church he never missed a response. His people heartily prayed that he might long reign over them; and they prayed the more heartily because his virtues were set off to the best advantage by the vices and follies of the prince of Wales, who lived in close intimacy with the chiefs of the Opposition.

First period, 1784–1792.

How strong this feeling was in the public mind appeared signally on one great occasion. In the autumn of 1788 the king became insane. The Opposition, eager for office, committed the great indiscretion of asserting that the heir apparent had, by the fundamental laws of England, a right to be regent with the full powers of royalty. Pitt, on the other hand maintained it to be the constitutional doctrine that when a sovereign is, by reason of infancy, disease, or absence, incapable of exercising the regal functions, it belongs to the estates of the realm to determine who shall be the vicegerent, and with what portion of the executive authority such vicegerent shall be entrusted. A long and violent contest followed, in which Pitt was supported by the great body of the people with as much enthusiasm as during the first months of his administration. Tories with one voice applauded him for defending the sick bed of a virtuous and unhappy sovereign against a disloyal faction and an undutiful son. Not a few Whigs applauded him for asserting the authority of parliaments, and the principles of the Revolution, in opposition to a doctrine which seemed to have too much affinity with the servile theory of indefeasible hereditary right. The middle class, always zealous on the side of decency and the domestic virtues, looked forward with dismay to a reign resembling that of Charles II. The palace, which had now been, during thirty years, the pattern of an English home, would be a public nuisance, a school of profligacy. To the good king's repast of mutton and lemonade, despatched at three o'clock, would succeed midnight banquets, from which the guests would be carried home speechless. To the backgammon board at which the good king played for a little silver with his equerries would succeed faro tables from which young patricians who had sat down rich would rise up beggars. The drawing-room, from which the frown of the queen had repelled a whole generation of frail beauties, would now be again what it had been in the days of Barbara Palmer and Louisa de Querouaille. Nay, severely as the public reprobated the prince's many illicit attachments, his one virtuous attachment was reprobated more severely still. Even in grave and pious circles his Protestant mistresses gave less scandal than his Popish wife. That he must be regent nobody ventured to deny. But he and his friends were so unpopular that Pitt could, with general approbation, propose to limit the powers of the regent by restrictions to which it would have been impossible to subject a prince beloved and trusted by the country. Some interested men, fully expecting a change of administration, went over to the Opposition. But the majority, purified by these desertions, closed its ranks, and presented a more firm array than ever to the enemy. In every division Pitt was victorious. When at

The regency, 1788.

length, after a stormy interregnum of three months, it was announced on the very eve of the inauguration of the regent, that the king was himself again, the nation was wild with delight. On the evening of the day on which His Majesty resumed his functions a spontaneous illumination, the most general that had ever been seen in England, brightened the whole vast space from Highgate to Tooting, and from Hammersmith to Greenwich. On the day on which he returned thanks in the cathedral of his capital all the horses and carriages within a hundred miles of London were too few for the multitudes which flocked to see him pass through the streets. A second illumination followed, which was even superior to the first in magnificence. Pitt with difficulty escaped from the tumultuous kindness of an innumerable multitude which insisted on drawing his coach from St. Paul's Churchyard to Downing Street. This was the moment at which his fame and fortune may be said to have reached the zenith. His influence in the closet was as great as that of Carr or Villiers had been. His dominion over the parliament was more absolute than that of Walpole or Pelham had been. He was at the same time as high in the favor of the populace as ever Wilkes or Sacheverell had been. Nothing did more to raise his character than his noble poverty. It was well known that, if he had been dismissed from office after more than five years of boundless power, he would hardly have carried out with him a sum sufficient to furnish the set of chambers in which, as he cheerfully declared, he meant to resume the practice of the law. His admirers, however, were by no means disposed to suffer him to depend on daily toil for his daily bread. The voluntary contributions which were awaiting his acceptance in the city of London alone would have sufficed to make him a rich man. But it may be doubted whether his haughty spirit would have stooped to accept a provision so honorably earned and so honorably bestowed.

To such a height of power and glory had this extraordinary man risen at twenty-nine years of age. And now the tide was on the turn. Only ten days after the triumphant procession to St. Paul's, the states-general of France, after an interval of a hundred and seventy-four years, met at Versailles.

French Revolution.

The nature of the great Revolution which followed was long very imperfectly understood in this country. Burke saw much further than any of his contemporaries; but whatever his sagacity descried was refracted and discolored by his passions and his imagination. More than three years elapsed before the principles of the English administration underwent any material change. Nothing could as yet be milder or more strictly constitutional than the minister's domestic policy. Not a single act indicating an arbitrary temper or a jealousy of the people could be imputed to him. He had never applied to parliament for any extraordinary powers. He had never used with harshness the ordinary powers entrusted by the constitution to the executive Government. Not a single state prosecution which would even now be called oppressive had been instituted by him. Indeed, the only oppressive state prosecution instituted during the first eight years of his administration was that of Stockdale, which is to be attributed, not to the Government, but to the chiefs of the Opposition. In office, Pitt had redeemed the pledges which he had, at his entrance into public life, given to the supporters of parliamentary reform. He had, in 1785, brought forward a judicious plan for the improvement of the representative system, and had prevailed on the king, not only to refrain from talking against that plan but to recommend it to the Houses in a speech from the throne.[1] This attempt failed; but there can be little doubt that, if the French Revolution had not produced a violent reaction of public feeling, Pitt would have performed, with little difficulty and no danger, that great work which, at a later period, Lord Grey could accomplish only by means which for a time loosened the very foundations of the commonwealth. When the atrocities of the slave trade were first brought under the consideration of parliament, no abolitionist was more zealous than Pitt. When sickness prevented Wilberforce from appearing in public, his place was most efficiently supplied by his friend the minister. A humane bill, which mitigated the horrors of the middle passage, was, in 1788, carried by the eloquence and determined spirit of Pitt, in spite of the opposition of some of his own colleagues; and it ought always to be remembered to his honor that, in order to carry that bill, he kept the Houses sitting, in spite of many murmurs, long after the business of the Government had been done and the Appropriation Act passed. In 1791 he cordially concurred with Fox in maintaining the sound constitutional doctrine that an impeachment is not terminated by a dissolution. In the course of the same year the two great rivals contended side by side in a far more important cause. They are fairly entitled to divide the high honor of having added to our statute-book the inestimable law which places the liberty of the press under the protection of juries. On one occasion, and one alone, Pitt, during the first half of his long administration, acted in a manner unworthy of an enlightened Whig. In the debate on the Test Act, he stooped to gratify the master whom he served, the university which he represented, and the great body of clergymen and country gentlemen on whose support he rested, by talking, with little heartiness indeed, and with no asperity, the language of a Tory. With this single exception, his conduct from the end of 1783 to the middle of 1792 was that of an honest friend of civil and religious liberty.

Nor did anything, during that period, indicate that he loved war, or harbored any malevolent feeling against any neighboring nation. Those French writers who have represented him as a Hannibal sworn in childhood by his father to bear eternal hatred to France, as having by mysterious intrigues and lavish bribes, instigated the leading Jacobins to commit those excesses which dishonored the Revolution, as having been the real author of the first coalition, know nothing of his character or of his history. So far was he from being a deadly enemy to France that his laudable attempts to bring about a closer connection with that country by means of a wise and liberal treaty of commerce brought on him the severe censure of the Opposition. He was told in the House of Commons that he was a degenerate son, and that his partiality for the hereditary foes of our island was enough to make his great father's bones stir under the pavement of the Abbey.

Its influence in English politics.

And this man, whose name, if he had been so fortunate as to die in 1792, would now have been associated with peace, with freedom, with philanthropy, with temperate reform, with mild and constitutional administration, lived to associate his name with arbitrary government, with harsh laws harshly executed, with alien bills, with gagging bills, with suspensions of the Habeas Corpus Act, with cruel punishments inflicted on some political agitators, with unjustifiable prosecutions instituted against others, and with the most costly and most sanguinary wars of modern times. He lived to be held up to obloquy as the stern oppressor of England, and the indefatigable disturber of Europe. Poets, contrasting his earlier with his later years, likened him sometimes to the apostle who kissed in order to betray, and sometimes to the evil angels who kept not their first estate. A satirist of great genius introduced the fiends of famine, slaughter, and fire, proclaiming that they had received their commission from one whose name was formed of four letters, and promising to give their employer ample proofs of gratitude. Famine would gnaw the multitude till they should rise up against him in madness. The demon of slaughter would impel them to tear him from limb to limb. But fire boasted that she alone could reward him as he deserved, and that she would cling round him to all eternity. By the French press and the French tribune every crime that disgraced and every calamity that afflicted France was ascribed to the monster Pitt and his guineas. While the Jacobins were dominant it was he who had corrupted the Gironde, who had raised Lyons and Bordeaux against the Convention, who had suborned Paris to assassinate Lepelletier, and Cecilia Regnault to assassinate Robespierre. When the Thermidorean reaction came, all the atrocities of the Reign of Terror were imputed to him. Collot D'Herbois and Fouquier Tinville had been his pensioners. It was he who had hired the murderers of September, who had dictated the pamphlets of Marat and the carmagnoles of Barère, who had paid Lebon to deluge Arras with blood and Carrier to choke the Loire with corpses.

The truth is that he liked neither war nor arbitrary government. He was a lover of peace and freedom, driven, by a stress against which it was hardly possible for any will or any intellect to struggle, out of the course to which his inclinations pointed, and for which his abilities and acquirements fitted him, and forced into a policy repugnant to his feelings and unsuited to his talents.

The charge of apostasy is grossly unjust. A man ought no more to be called an apostate because his opinions alter with the opinions of the great body of his contemporaries than he ought to be called an Oriental traveller because he is always going round from west to east with the globe and everything that is upon it. Between the spring of 1789 and the close of 1792 the public mind of England underwent a great change. If the change of Pitt's sentiments attracted peculiar notice, it was not because he changed more than his neighbors, for in fact he changed less than most of them, but because his position was far more conspicuous than theirs, because he was, till Bonaparte appeared, the individual who filled the greatest space in the eyes of the inhabitants of the civilized world. During a short time the nation, and Pitt as one of the nation, looked with interest and approbation on the French Revolution. But soon vast confiscations, the violent sweeping away of ancient institutions, the domination of clubs, the barbarities of mobs maddened by famine and hatred, produced a reaction here. The court, the nobility, the gentry, the clergy, the manufacturers, the merchants, in short nineteen-twentieths of those who had good roofs over their heads and good coats on their backs, became eager intolerant Antijacobins. This feeling was at least as strong among the minister's adversaries as among his supporters. Fox in vain attempted to restrain his followers. All his genius, all his vast personal influence, could not prevent them from rising up against him in general mutiny. Burke set the example of revolt; and Burke was in no long time joined by Portland, Spencer, Fitzwilliam, Loughborough, Carlisle, Malmesbury, Windham, Elliot. In the House of Commons the followers of the great Whig statesman and orator diminished from about a hundred and sixty to fifty. In the House of Lords he had but ten or twelve adherents left. There can be no doubt that there would have been a similar mutiny on the ministerial benches, if Pitt had obstinately resisted the general wish. Pressed at once by his master and by his colleagues, by old friends and by old opponents, he abandoned, slowly and reluctantly, the policy which was dear to his heart. He labored hard to avert the European war. When the European war broke out, he still flattered himself that it would not be necessary for this country to take either side. In the spring of 1792 he congratulated the parliament on the prospect of long and profound peace, and proved his sincerity by proposing large remissions of taxation. Down to the end of that year he continued to cherish the hope that England might be able to preserve neutrality. But the passions which raged on both sides of the Channel were not to be restrained. The republicans who ruled France were inflamed by a fanaticism resembling that of the Mussulmans, who, with the Koran in one hand and the sword in the other, went forth conquering and converting, eastward to the Bay of Bengal, and westward to the Pillars of Hercules. The higher and middle classes of England were animated by zeal not less fiery than that of the crusaders who raised the cry of *Deus vult* at Clermont. The impulse which drove the two nations to a collision was not to be arrested by the abilities or by the authority of any single man. As Pitt was in front of his fellows, and towered high above them, he seemed to lead them. But in fact he was violently pushed on by them, and, had he held back but a little more than he did, would have been thrust out of their way or trampled under their feet.

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[1] The speech with which the king opened the session of 1785 concluded with an assurance that His Majesty would heartily concur in every measure which could tend to secure the true principles of the constitution. These words were at the time understood to refer to Pitt's Reform Bill.

Second period of first administration, 1792–1801.

He yielded to the current; and from that day his misfortunes began. The truth is that there were only two consistent courses before him. Since he did not choose to oppose himself, side by side with Fox, to the public feeling, he should have taken the advice of Burke, and should have availed himself of that feeling to the full extent. If it was impossible to preserve peace, he should have adopted the only policy which could lead to victory. He should have proclaimed a holy war for religion, morality, property, order, public law, and should have thus opposed to the Jacobins an energy equal to their own. Unhappily he tried to find a middle path; and he found one which united all that was worst in both extremes. He went to war; but he would not understand the peculiar character of that war. He was obstinately blind to the plain fact that he was contending against a state which was also a sect, and that the new quarrel between England and France was of quite a different kind from the old quarrels about colonies in America and fortresses in the Netherlands. He had to combat frantic enthusiasm, boundless ambition, restless activity, the wildest and most audacious spirit of innovation; and he acted as if he had had to deal with the harlots and fops of the old court of Versailles, with Madame de Pompadour and the Abbé de Bernis. It was pitiable to hear him, year after year, proving to an admiring audience that the wicked republic was exhausted, that she could not hold out, that her credit was gone, that her assignats were not worth more than the paper on which they were made,—as if credit was necessary to a government of which the principle was rapine, as if Alboin could not turn Italy into a desert till he had negotiated a loan at five per cent., as if the exchequer bills of Attila had been at par. It was impossible that a man who so completely mistook the nature of a contest could carry on that contest successfully.

War policy.

Military administration.

Great as Pitt's abilities were, his military administration was that of a driveller. He was at the head of a nation engaged in a struggle for life and death, of a nation eminently distinguished by all the physical and all the moral qualities which make excellent soldiers. The resources at his command were unlimited. The parliament was even more ready to grant him men and money than he was to ask for them. In such an emergency, and with such means, such a statesman as Richelieu, as Louvois, as Chatham, as Wellesley, would have created in a few months one of the finest armies in the world, and would soon have discovered and brought forward generals worthy to command such an army. Germany might have been saved by another Blenheim; Flanders recovered by another Ramillies; another Poitiers might have delivered the Royalist and Catholic provinces of France from a yoke which they abhorred, and might have spread terror even to the barriers of Paris. But the fact is that, after eight years of war, after a vast destruction of life, after an expenditure of wealth far exceeding the expenditure of the American War, of the Seven Years' War, of the War of the Austrian Succession, and of the War of the Spanish Succession united, the English army under Pitt was the laughing-stock of all Europe. It could not boast of one single brilliant exploit. It had never shown itself on the Continent but to be beaten, chased, forced to re-embark, or forced to capitulate. To take some sugar island in the West Indies, to scatter some mob of half-naked Irish peasants—such were the most splendid victories won by the British troops under Pitt's auspices.

Naval administration.

The English navy no mismanagement could ruin. But during a long period whatever mismanagement could do was done. The earl of Chatham, without a single qualification for high public trust, was made, by fraternal partiality, first lord of the admiralty, and was kept in that great post during two years of a war in which the very existence of the state depended on the efficiency of the fleet. He continued to doze away and trifle away the time which ought to have been devoted to the public service, till the whole mercantile body, though generally disposed to support the Government, complained bitterly that our flag gave no protection to our trade. Fortunately he was succeeded by George, Earl Spencer, one of those chiefs of the Whig party who, in the great schism caused by the French Revolution, had followed Burke. Lord Spencer, though inferior to many of his colleagues as an orator, was decidedly the best administrator among them. To him it was owing that a long and gloomy succession of days of fasting, and most emphatically of humiliation, was interrupted, twice in the short space of eleven months, by days of thanksgiving for great victories.

It may seem paradoxical to say that the incapacity which Pitt showed in all that related to the conduct of the war is, in some sense, the most decisive proof that he was a man of very extraordinary abilities. Yet this is the simple truth. For assuredly one-tenth part of his errors and disasters would have been fatal to the power and influence of any minister who had not possessed, in the highest degree, the talents of a parliamentary leader. While his schemes were confounded, while his predictions were falsified, while the coalitions which he had labored to form were falling to pieces, while the expeditions which he had sent forth at enormous cost were ending in rout and disgrace, while the enemy against whom he was feebly contending was subjugating Flanders and Brabant, the electorate of Mains and the electorate of Treves, Holland, Piedmont, Liguria, Lombardy, his authority over the House of Commons was constantly becoming more and more absolute. There was his empire. There were his victories—his Lodi and his Arcola, his Rivoli and his Marengo. If some great misfortune, a pitched battle lost by the allies, the annexation of a new department to the French republic, a sanguinary insurrection in Ireland, a mutiny in the fleet, a panic in the city, a run on the bank, had spread dismay through the ranks of his majority, that dismay lasted only till he rose from the treasury bench, drew up his haughty head, stretched his arm with commanding gesture, and poured forth, in deep and sonorous tones, the lofty language of inextinguishable hope and inflexible resolution. Thus, through a long and calamitous period, every disaster that happened without the walls of parliament was regularly followed by a triumph within them. At length he had no longer an Opposition to encounter. Of the great party which had contended against him during the first eight years of his administration more than one-half now marched under his standard, with his old competitor the duke of Portland at their head; and the rest had, after many vain struggles, quitted the field in despair. Fox had retired to the shades of St. Anne's Hill, and had there found, in the society of friends whom no vicissitude could estrange from him, of a woman whom he tenderly loved, and of the illustrious dead of Athens, of Rome, and of Florence, ample compensation for all the misfortunes of his public life. Session followed session with scarcely a single division. In the eventful year 1799 the largest minority that could be mustered against the Government was twenty-five.

Domestic policy.

In Pitt's domestic policy there was at this time assuredly no want of vigor. While he offered to French Jacobinism a resistance so feeble that it only encouraged the evil which he wished to suppress, he put down English Jacobinism with a strong hand. The Habeas Corpus Act was repeatedly suspended. Public meetings were placed under severe restraints. The Government obtained from parliament power to send out of the country aliens who were suspected of evil designs; and that power was not suffered to be idle. Writers who propounded doctrines adverse to monarchy and aristocracy were proscribed and punished without mercy. It was hardly safe for a republican to avow his political creed over his beefsteak and his bottle of port at a chop-house. The old laws of Scotland against sedition, laws which were considered by Englishmen as barbarous, and which a succession of Governments had suffered to rust, were now furbished up and sharpened anew. Men of cultivated minds and polished manners were, for offences which at Westminster would have been treated as mere misdemeanors, sent to herd with felons at Botany Bay. Some reformers, whose opinions were extravagant, and whose language was intemperate, but who had never dreamed of subverting the government by physical force, were indicted for high treason, and were saved from the gallows only by the righteous verdicts of juries. This severity was at the time loudly applauded by alarmists whom fear had made cruel, but will be seen in a very different light by posterity. The truth is that the Englishmen who wished for a revolution were, even in number, not formidable, and in everything but number a faction utterly contemptible, without arms or funds, or plans, or organization, or leader. There can be no doubt that Pitt, strong as he was in the support of the great body of the nation, might easily have repressed the turbulence of the discontented minority by firmly yet temperately enforcing the ordinary law. Whatever vigor he showed during this unfortunate part of his life was vigor out of place and season. He was all feebleness and languor in his conflict with the foreign enemy who was really to be dreaded, and reserved all his energy and resolution for the domestic enemy who might safely have been despised.

Irish policy.

One part only of Pitt's conduct during the last eight years of the 18th century deserves high praise. He was the first English minister who formed great designs for the benefit of Ireland. The manner in which the Roman Catholic population of that unfortunate country had been kept down during many generations seemed to him unjust and cruel; and it was scarcely possible for a man of his abilities not to perceive that, in a contest against the Jacobins, the Roman Catholics were his natural allies. Had he been able to do all that he wished, it is probable that a wise and liberal policy would have averted the rebellion of 1798. But the difficulties which he encountered were great, perhaps insurmountable; and the Roman Catholics were, rather by his misfortune than by his fault, thrown into the hands of Jacobins. There was a third great rising of the Irishry against the Englishry, a rising not less formidable than the risings of 1641 and 1689. The Englishry remained victorious: and it was necessary for Pitt, as it had been necessary for Oliver Cromwell and William of Orange before him, to consider how the victory should be used. It is only just to his memory to say that he formed a scheme of policy so grand and so simple, so righteous and so humane, that it would alone entitle him to a high place among statesmen. He determined to make Ireland one kingdom with England, and, at the same time, to relieve the Roman Catholic laity from civil disabilities, and to grant a public maintenance to the Roman Catholic clergy. Had he been able to carry these noble designs into effect, the Union would have been a union indeed. It would have been inseparably associated in the minds of the great majority of Irishmen with civil and religious freedom; and the old parliament in College Green would have been regretted only by a small knot of discarded jobbers and oppressors, and would have been remembered by the body of the nation with the loathing and contempt due to the most tyrannical and most corrupt assembly that had ever sat in Europe. But Pitt could execute only one half of what he had projected. He succeeded in obtaining the consent of the parliaments of both kingdoms to the Union; but that reconciliation of races and sects, without which the Union could exist only in name was not accomplished. He was well aware that he was likely to find difficulties in the closet. But he flattered himself that, by cautious and dexterous management, those difficulties might be overcome. Unhappily, there were traitors and sycophants in high place who did not suffer him to take his own time and his own way, but prematurely disclosed his scheme to the king, and disclosed it in the manner most likely to irritate and alarm a weak and diseased mind. His majesty absurdly imagined that his coronation oath bound him to refuse his assent to any bill for relieving Roman Catholics from civil disabilities. To argue with him was impossible. Dundas tried to explain the matter, but was told to keep his Scotch metaphysics to himself. Pitt and Pitt's ablest colleagues resigned their offices. It was necessary that the king should make a new arrangement. But by this time his anger and distress had brought back the malady which had, many years before, incapacitated him for the discharge of his functions. He actually assembled his family, read the coronation oath to them, and told them that, if he broke it, the crown would immediately pass to the house of Savoy. It was not until after an interregnum of several weeks that he regained the full use of his small faculties, and that a ministry after his own heart was at length formed.

Resigns office March 14, 1801.

Addington ministry.

The materials out of which he had to construct a Government were neither solid nor splendid. To that party, weak in numbers, but strong in every kind of talent, which was hostile to the domestic and foreign policy of his late advisers, he could not have recourse. For that party, while it differed from his late advisers on every point on which they had been honored with his approbation, cordially agreed with them as to the single matter which had brought on them his displeasure. All that was left to him was to call up the rear ranks of the old ministry to form the front rank of a new ministry. In an age pre-eminently fruitful of parliamentary talents a cabinet was formed containing hardly a single man who in parliamentary talents could be considered as even of the second rate. The most important offices in the state were bestowed on decorous and laborious mediocrity. Henry Addington was at the head of the treasury. He had been an early, indeed a hereditary, friend of Pitt, and had by Pitt's influence been placed, while still a young man, in the chair of the House of Commons. He was universally admitted to have been the best Speaker that had sat in that chair since the retirement of Onslow. But nature had not bestowed on him very vigorous faculties; and the highly respectable situation which he long occupied with honor had rather unfitted than fitted him for the discharge of his new duties. His business had been to bear himself evenly between contending factions. He had taken no part in the war of words; and he had always been addressed with marked deference by the great orators who thundered against each other from his right and from his left. It was not strange that when, for the first time, he had to encounter keen and vigorous antagonists, who dealt hard blows without the smallest ceremony, he should have been awkward and unready, or that the air of dignity and authority which he had acquired in his former post, and of which he had not divested himself, should have made his helplessness laughable and pitiable. Nevertheless, during many months, his power seemed to stand firm. He was a favorite with the king, whom he resembled in narrowness of mind, and to whom he was more obsequious than Pitt had ever been. The nation was put into high good humor by a peace with France. The enthusiasm with which the upper and middle classes had rushed into the war had spent itself. Jacobinism was no longer formidable. Everywhere there was a strong reaction against what was called the atheistical and anarchical philosophy of the 18th century. Bonaparte, now first consul, was busied in constructing out of the ruins of old institutions a new ecclesiastical establishment and a new order of knighthood. That nothing less than the dominion of the whole civilized world would satisfy his selfish ambition was not yet suspected; nor did even wise men see any reason to doubt that he might be as safe a neighbor as any prince of the house of Bourbon had been. The treaty of Amiens was therefore hailed by the great body of the English people with extravagant joy. The popularity of the minister was for the moment immense. His want of parliamentary ability was, as yet, of little consequence; for he had scarcely any adversary to encounter. The old Opposition, delighted by the peace, regarded him with favor. A new Opposition had indeed been formed by some of the late ministers, and was led by Grenville in the House of Lords and by Windham in the House of Commons. But the new Opposition could scarcely muster ten votes, and was regarded with no favor by the country. On Pitt the ministers relied as on their firmest support. He had not, like some of his colleagues, retired in anger. He had expressed the greatest respect for the conscientious scruple which had taken possession of the royal mind; and he had promised his successors all the help in his power. In private his advice was at their service. In parliament he took his seat on the bench behind them, and in more than one debate defended them with powers far superior to their own. The king perfectly understood the value of such assistance. On one occasion, at the palace, he took the old minister and the new minister aside. "If we three," he said, "keep together, all will go well."

Relations between Pitt and Addington.

But it was hardly possible, human nature being what it is, and more especially Pitt and Addington being what they were, that this union should be durable. Pitt, conscious of superior powers, imagined that the place which he had quitted was now occupied by a mere puppet which he had set up, which he was to govern while he suffered it to remain, and which he was to fling aside as soon as he wished to resume his old position. Nor was it long before he began to pine for the power which he had relinquished. He had been so early raised to supreme authority in the state, and had enjoyed that authority so long, that it had become necessary to him. In retirement his days passed heavily. He could not, like Fox, forget the pleasures and cares of ambition in the company of Euripides or Herodotus. Pride restrained him from intimating, even to his dearest friends, that he wished to be again minister. But he thought it strange, almost ungrateful, that his wish had not been divined, that it had not been anticipated by one whom he regarded as his deputy.

Addington, on the other hand, was by no means inclined to descend from his high position. He was, indeed, under a delusion much resembling that of Abou Hassan in the Arabian tale. His brain was turned by his short and unreal caliphate. He took his elevation quite seriously, attributed it to his own merit, and considered himself as one of the great triumvirate of English statesmen, as worthy to make a third with Pitt and Fox.

Such being the feelings of the late minister and of the present minister a rupture was inevitable; and there was no want of persons bent on making that rupture speedy and violent. Some of these persons wounded Addington's pride by representing him as a lacquey, sent to keep a place on the treasury bench till his master should find it convenient to come. Others took every opportunity of praising him at Pitt's expense. Pitt had waged a long, a bloody, a costly, an unsuccessful war. Addington had made peace. Pitt had suspended the constitutional liberties of Englishmen. Under Addington those liberties were again enjoyed. Pitt had wasted the public resources. Addington was carefully nursing them. It was sometimes but too evident that these compliments were not unpleasing to Addington. Pitt became cold and reserved. During many months he remained at a distance from London. Meanwhile his most intimate friends, in spite of his declarations that he made no complaint, and that he had no wish for office, exerted themselves to effect a change of ministry. His favorite disciple, George Canning, young, ardent, ambitious, with great powers and great virtues, but with a temper too restless and a wit too satirical for his own happiness, was indefatigable. He spoke; he wrote; he intrigued; he tried to induce a large number of the supporters of the Government to sign a round robin desiring a change; he made game of Addington and of Addington's relations in a succession of lively pasquinades. The minister's partisans retorted with equal acrimony, if not with equal vivacity. Pitt could keep out of the affray only by keeping out of politics altogether; and this it soon became impossible for him to do. Had Napoleon, content with the first place among the sovereigns of the Continent, and with a military reputation surpassing that of Marlborough or of Turenne, devoted himself to the noble task of making France happy by mild administration and wise legislation, our country might have long continued to tolerate a Government of fair intentions and feeble abilities. Unhappily, the treaty of Amiens had scarcely been signed when the restless ambition and the insupportable insolence of the first consul convinced the great body of the English people that the peace so eagerly welcomed was only a precarious armistice. As it became clearer and clearer that a war for the dignity, the independence, the very existence of the nation was at hand, men looked with increasing uneasiness on the weak and languid cabinet which would have to contend against an enemy who united more than the power of Louis the Great to more than the genius of Frederick the Great. It is true that Addington might easily have made a better war minister than Pitt, and could not possibly have been a worse. But Pitt had cast a spell on the public mind. The eloquence, the judgment, the calm and disdainful firmness which he had during many years displayed in parliament deluded the world into the belief that he must be eminently qualified to superintend every department of politics; and they imagined, even after the miserable failures of Dunkirk, of Quiberon, and of the Helder, that he was the only statesman who could cope with Bonaparte. This feeling was nowhere stronger than among Addington's own colleagues. The pressure put on him was so strong that he could not help yielding to it; yet, even in yielding, he showed how far he was from knowing his own place. His first proposition was that some insignificant nobleman should be first lord of the treasury and nominal head of the administration, and that the real power should be divided betwen Pitt and himself, who were to be secretaries of state. Pitt, as might have been expected, refused even to discuss such a scheme, and talked of it with bitter mirth. "Which secretaryship was offered to you?" his friend Wilberforce asked. "Really," said Pitt, "I had not the curiosity to inquire." Addington was frightened into bidding higher. He offered to resign the treasury to Pitt, on condition that there should be no extensive change in the Government. But Pitt would listen to no such terms. Then came a dispute such as often arises after negotiations orally conducted, even when the negotiators are men of strict honor. Pitt gave one account of what had passed; Addington gave another; and, though the discrepancies were not such as necessarily implied any intentional violation of truth on either side, both were greatly exasperated.

Pitt declines subordinate office.

Meanwhile the quarrel with the first consul had come to a crisis. On the 16th of May, 1803, the king sent a message calling on the House of Commons to support him in withstanding[1] the ambitious and encroaching policy of France; and on the 22d the House took the message into consideration.

Pitt had now been living many months in retirement. There had been a general election since he had spoken in parliament, and there were two hundred members who had never heard him. It was known that on this occasion he would be in his place, and curiosity was wound up to the highest point. Unfortunately, the shorthand writers were, in consequence of some mistake, shut out on that day from the gallery, so that the newspapers contained only a very meagre report of the proceedings. But several accounts of what passed are extant; and of those accounts the most interesting is contained in an unpublished letter written by a very young member, John William Ward, afterwards earl of Dudley. When Pitt rose, he was received with loud cheering. At every pause in his speech there was a burst of applause. The peroration is said to have been one of the most animated and magnificent ever heard in parliament. "Pitt's speech," Fox wrote a few days later, "was admired very much, and very justly. I think it was the best he ever made in that style." The debate was adjourned; and on the second night Fox replied to it in an oration which, as the most zealous Pittites were forced to acknowledge, left the palm of eloquence doubtful. Addington made a pitiable appearance between the two great rivals; and it was observed that Pitt, while exhorting the Commons to stand resolutely by the executive Government against France, said not a word indicating esteem or friendship for the prime minister.

War was speedily declared. The first consul threatened to invade England at the head of the conquerers of Belgium and Italy, and formed a great camp near the Straits of Dover. On the other side of those straits the whole population of our island was ready to rise up as one man in defence of the soil. At this conjuncture, as at some other great conjunctures in our history—the conjuncture of 1660, for example, and the conjuncture of 1688—there was a general disposition among honest and patriotic men to forget old quarrels, and to regard as a friend every person who was ready, in the existing emergency, to do his part towards the saving of the state. A coalition of all the first men in the country would, at that moment, have been as popular as the coalition of 1783 had been unpopular. Alone in the kingdom the king looked with perfect complacency on a cabinet in which no man superior to himself in genius was to be found, and was so far from being willing to admit all his ablest subjects to office that he was bent on excluding them all.

A few months passed before the different parties which agreed in regarding the Government with dislike and contempt came to an understanding with each other. But in the spring of 1804 it became evident that the weakest of ministries would have to defend itself against the strongest of Oppositions, an Opposition made up of three oppositions, each of which would, separately, have been formidable from ability, and which, when united, were also formidable from number. The party which had opposed the peace, headed by Grenville and Windham, and the party which had opposed the renewal of the war, headed by Fox, concurred in thinking that the men now in power were incapable of either making a good peace or waging a vigorous war. Pitt had in 1802 spoken for peace against the party of Grenville, and had in 1803 spoken for war against the party of Fox. But of the capacity of the cabinet, and especially of its chief, for the conduct of great affairs, he thought as meanly as either Fox or Grenville. Questions were easily found on which all the enemies of the Government could act cordially together. The unfortunate first lord of the treasury, who had, during the earlier months of his administration, been supported by Pitt on one side and by Fox on the other, now had to answer Pitt and to be answered by Fox. Two sharp debates, followed by close divisions, made him weary of his post. It was known, too, that the Upper House was ever more hostile to him than the Lower, that the Scotch representative peers wavered, that there were signs of mutiny among the bishops. In the cabinet itself there was discord, and, worse than discord, treachery. It was necessary to give way; the ministry was dissolved, and the task of forming a Government was entrusted to Pitt.

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[1] [Stanhope says 23d, vol. iv. pp. 43, 45.—Am. Ed.]

Addington ministry resigns.

Pitt was of opinion that there was now an opportunity, such as had never before offered itself, and such as might never offer itself again, of uniting in the public service, on honorable terms, all the eminent talents of the kingdom. The passions to which the French Revolution had given birth were extinct. The madness of the innovator and the madness of the alarmist had alike had their day. Jacobinism and Antijacobinism had gone out of fashion together. The most liberal statesman did not think that season propitious for schemes of parliamentary reform; and the most conservative statesman could not pretend that there was any occasion for gagging bills and suspensions of the Habeas Corpus Act. The great struggle for independence and national honor occupied all minds; and those who were agreed as to the duty of maintaining that struggle with vigor might well postpone to a more convenient time all disputes about matters comparatively unimportant. Strongly impressed by these considerations, Pitt wished to form a ministry including all the first men in the country. The treasury he reserved for himself; and to Fox he proposed to assign a share of power little inferior to his own.

The plan was excellent; but the king would not hear of it. Dull, obstinate, unforgiving, and at that time half mad, he positively refused to admit Fox into his service. Anybody else, even men who had gone as far as Fox, or further than Fox, in what His Majesty considered as Jacobinism—Sheridan, Grey, Erskine—should be graciously received, but Fox never. During several hours Pitt labored in vain to reason down this senseless antipathy. That he was perfectly sincere there can be no doubt; but it was not enough to be sincere—he should have been resolute. Had he declared himself determined not to take office without Fox, the royal obstinacy would have given way, as it gave way, a few months later, when opposed to the immutable resolution of Lord Grenville. In an evil hour Pitt yielded. He flattered himself with the hope that, though he consented to forego the aid of his illustrious rival, there would still remain ample materials for the formation of an efficient ministry. That hope was cruelly disappointed. Fox entreated his friends to leave personal considerations out of the question, and declared that he would support, with the utmost cordiality, an efficient and patriotic ministry from which he should be himself excluded. Not only his friends, however, but Grenville and Grenville's adherents answered with one voice that the question was not personal, that a great constitutional principle was at stake, and that they would not take office while a man eminently qualified to render service to the commonwealth was placed under a ban merely because he was disliked at court. All that was left to Pitt was to construct a Government out of the wreck of Addington's feeble administration. The small circle of his personal retainers furnished him with a very few useful assistants, particularly Dundas (who had been created Viscount Melville), Lord Harrowby[1] and Canning.

Such was the inauspicious manner in which Pitt entered on his second administration. The whole history of that administration was of a piece with the commencement. Almost every month brought some new disaster or disgrace. To the war with France was soon added a war with Spain. The opponents of the ministry were numerous, able and active. His most useful coadjutors he soon lost. Sickness deprived him of the help of Lord Harrowby. It was discovered that Lord Melville had been guilty of highly culpable laxity in transactions relating to public money. He was censured by the House of Commons, driven from office, ejected from the Privy Council, and impeached of high crimes and misdemeanors. The blow fell heavy on Pitt. It gave him, he said in parliament, a deep pang; and, as he uttered the word pang his lip quivered, his voice shook, he paused, and his hearers thought that he was about to burst into tears. Such tears shed by Eldon would have moved nothing but laughter. Shed by the warm-hearted and open-hearted Fox, they would have moved sympathy, but would have caused no surprise. But a tear from Pitt would have been something portentous. He suppressed his emotion, however, and proceeded with his usual majestic self-possession.

Second Pitt administration, May 12, 1804.

His difficulties compelled him to resort to various expedients. At one time Addington was persuaded to accept office with a peerage; but he brought no additional strength to the Government. Though he went through the form of reconciliation, it was impossible for him to forget the past. While he remained in place he was jealous and punctilious; and he soon retired again. At another time Pitt renewed his efforts to overcome his master's aversion to Fox; and it was rumored that the king's obstinacy was gradually giving way. But, meanwhile, it was impossible for the minister to conceal from the public eye the decay of his health and the constant anxiety which gnawed at his heart. His sleep was broken. His food ceased to nourish him. All who passed him in the park, all who had interviews with him in Downing Street, saw misery written in his face. The peculiar look which he wore during the last months of his life was often pathetically described by Wilberforce, who used to call it the Austerlitz look.

Still the vigor of Pitt's intellectual faculties and the intrepid haughtiness of his spirit remained unaltered. He had staked everything on a great venture. He had succeeded in forming another mighty coalition against the French ascendency. The united forces of Austria, Russia, and England might, he hoped, oppose an insurmountable barrier to the ambition of the common enemy. But the genius and energy of Napoleon prevailed. While the English troops were preparing to embark for Germany, while the Russian troops were slowly coming up from Poland, he, with rapidity unprecedented in modern war, moved a hundred thousand men from the shores of the ocean to the Black Forest, and compelled a great Austrian army to surrender at Ulm. To the first faint rumors of this calamity Pitt would give no credit. He was irritated by the alarms of those around him. "Do not believe a word of it," he said; "it is all a fiction." The next day he received a Dutch newspaper containing the capitulation. He knew no Dutch. It was Sunday, and the public offices were shut. He carried the paper to Lord Malmesbury, who had been minister in Holland; and Lord Malmesbury translated it. Pitt tried to bear up, but the shock was too great; and he went away with death in his face.

The news of the battle of Trafalgar arrived four days later, and seemed for a moment to revive him. Forty-eight hours after that most glorious and most mournful of victories had been announced to the country came the Lord Mayor's Day; and Pitt dined at Guildhall. His popularity had declined. But on this occasion the multitude, greatly excited by the recent tidings, welcomed him enthusiastically, took off his horses in Cheapside, and drew his carriage up King Street. When his health was drunk, he returned thanks in two or three of those stately sentences of which he had a boundless command. Several of those who heard him laid up his words in their hearts; for they were the last words that he ever uttered in public: "Let us hope that England, having saved herself by her energy, may save Europe by her example."

This was but a momentary rally. Austerlitz soon completed what Ulm had begun. Early in December Pitt had retired to Bath, in the hope that he might there gather strength for the approaching session. While he was languishing there on his sofa arrived the news that a decisive battle had been fought and lost in Moravia, that the coalition was dissolved, that the Continent was at the feet of France. He sank down under the blow. Ten days later he was so emaciated that his most intimate friends hardly knew him. He came up from Bath by slow journeys, and on the 11th of January, 1806, reached his villa at Putney. Parliament was to meet on the 21st. On the 20th was to be the parliamentary dinner at the house of the first lord of the treasury in Downing Street; and the cards were already issued. But the days of the great minister were numbered.

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[1] [Dudley Ryder (1762-1847), first earl of Harrowby, twenty-three years in office, intimate friend of Pitt, negotiator of Pitt's last coalition, discloser of the Cato Street Conspiracy.—AM. ED.]

The only chance for his life, and that a very slight chance, was that he should resign his office, and pass some months in profound repose. His colleagues paid him very short visits, and carefully avoided political conversation. But his spirit, long accustomed to dominion, could not, even in that extremity, relinquish hopes which everybody but himself perceived to be vain. On the day on which he was carried into his bedroom at Putney the Marquis Wellesley, whom he had long loved, whom he had sent to govern India, and whose administration had been eminently able, energetic, and successful, arrived in London after an absence of eight years. The friends saw each other once more. There was an affectionate meeting and a last parting. That it was a last parting Pitt did not seem to be aware. He fancied himself to be recovering, talked on various subjects cheerfully and with an unclouded mind, and pronounced a warm and discerning eulogium on the marquis's brother Arthur. "I never," he said, "met with any military man with whom it was so satisfactory to converse." The excitement and exertion of this interview were too much for the sick man. He fainted away; and Lord Wellesley left the house convinced that the close was fast approaching.

And now members of parliament were fast coming up to London. The chiefs of the Opposition met for the purpose of considering the course to be taken on the first day of the session. It was easy to guess what would be the language of the king's speech, and of the address which would be moved in answer to that speech. An amendment condemning the policy of the Government had been prepared, and was to have been proposed in the House of Commons by Lord Henry Petty, a young nobleman who had already won for himself that place in the esteem of his country which, after the lapse of more than half a century, he still retains.[1] He was unwilling, however, to come forward as the accuser of one who was incapable of defending himself. Lord Grenville, who had been informed of Pitt's state by Lord Wellesley, and had been deeply affected by it, earnestly recommended forbearance; and Fox, with characteristic generosity and good nature, gave his voice against attacking his now helpless rival. "Sunt lacrymæ rerum," he said, "et mentem mortalia tangunt." On the first day, therefore, there was no debate. It was rumored that evening that Pitt was better. But on the following morning his physicians pronounced that there were no hopes. The commanding faculties of which he had been too proud were beginning to fail. His old tutor and friend, the bishop of Lincoln, informed him of his danger, and gave such religious advice and consolation as a confused and obscured mind could receive. Stories were told of devout sentiments fervently uttered by the dying man. But these stories found no credit with anybody who knew him. Wilberforce pronounced it impossible that they could be true; "Pitt," he added, "was a man who always said less than he thought on such topics." It was asserted in many after-dinner speeches, Grub Street elegies, and academic prize poems and prize declamations that the great minister died exclaiming, "Oh! my country." This is a fable, but it is true that the last words which he uttered, while he knew what he said were broken exclamations about the alarming state of public affairs. He ceased to breathe on the morning of the 23d of January, 1806, the twenty-fifth anniversary of the day on which he first took his seat in parliament. He was in his forty-seventh year, and had been during near nineteen years first lord of the treasury, and undisputed chief of the administration. Since parliamentary government was established in England, no English statesman has held supreme power so long. Walpole, it is true, was first lord of the treasury during more than twenty years, but it was not till Walpole had been some time first lord of the treasury that he could be properly called prime minister.

Death, January 23, 1806.

It was moved in the House of Commons that Pitt should be honored with a public funeral and a monument. The motion was opposed by Fox in a speech which deserves to be studied as a model of good taste and good feeling. The task was the most invidious that ever an orator undertook; but it was performed with a humanity and delicacy which were warmly acknowledged by the mourning friends of him who was gone. The motion was carried by 288 votes to 89.

Public funeral.

The 22d of February was fixed for the funeral. The corpse having lain in state during two days in the Painted Chamber, was borne with great pomp to the northern transept of the Abbey. A splendid train of princes, nobles, bishops, and privy councillors followed. The grave of Pitt had been made near to the spot where his great father lay, near also to the spot where his great rival was soon to lie. The sadness of the assistants was beyond that of ordinary mourners. For he whom they were committing to the dust had died of sorrows and anxieties of which none of the survivors could be altogether without a share. Wilberforce, who carried the banner before the hearse, described the awful ceremony with deep feeling. As the coffin descended into the earth, he said, the eagle face of Chatham from above seemed to look down with consternation into the dark house which was receiving all that remained of so much power and glory.

All parties in the House of Commons readily concurred in voting forty thousand pounds to satisfy the demands of Pitt's creditors. Some of his admirers seemed to consider the magnitude of his embarrassments as a circumstance highly honorable to him, but men of sense will probably be of a different opinion. It is far better, no doubt, that a great minister should carry his contempt of money to excess than that he should contaminate his hands with unlawful gain. But it is neither right nor becoming in a man to whom the public has given an income more than sufficient for his comfort and dignity to bequeath to that public a great debt, the effect of mere negligence and profusion. As first lord of the treasury and chancellor of the exchequer, Pitt never had less than six thousand a year, besides an excellent house. In 1792 he was forced by his royal master's friendly importunity to accept for life the office of warden of the Cinque Ports, with near four thousand a year more. He had neither wife nor child; he had no needy relations: he had no expensive tastes; he had no long election bills. Had he given but a quarter of an hour a week to the regulation of his household, he would have kept his expenditure within bounds. Or, if he could not spare even a quarter of an hour a week for that purpose, he had numerous friends, excellent men of business, who would have been proud to act as his stewards. One of those friends, the chief of a great commercial house in the city, made an attempt to put the establishment in Downing Street to rights, but in vain. He found that the waste of the servants' hall was almost fabulous. The quantity of butcher's meat charged in the bills was nine hundred weight a week. The consumption of poultry, of fish, of tea, was in proportion. The character of Pitt would have stood higher if with the disinterestedness of Pericles and of DeWitt he had united their dignified frugality.

Estimates of Pitt.

The memory of Pitt has been assailed, times innumerable, often justly, often unjustly; but it has suffered much less from his assailants than from his eulogists. For, during many years, his name was the rallying cry of a class of men with whom, at one of those terrible conjunctures which confound all ordinary distinctions, he was accidentally and temporarily connected, but to whom, on almost all great questions of principle, he was diametrically opposed. The haters of parliamentary reform called themselves Pittites, not choosing to remember that Pitt made three motions for parliamentary reform, and that, though he thought that such a reform could not safely be made while the passions excited by the French Revolution were raging, he never uttered a word indicating that he should not be prepared at a more convenient season to bring the question forward a fourth time. The toast of Protestant ascendency was drunk on Pitt's birthday by a set of Pittites who could not but be aware that Pitt had resigned his office because he could not carry Catholic emancipation. The defenders of the Test Act called themselves Pittites, though they could not be ignorant that Pitt had laid before George III. unanswerable reasons for abolishing the Test Act. The enemies of free trade called themselves Pittites, though Pitt was far more deeply imbued with the doctrines of Adam Smith than either Fox or Grey. The very negro-drivers invoked the name of Pitt, whose eloquence was never more conspicuously displayed than when he spoke of the wrongs of the negro. This mythical Pitt, who resembles the genuine Pitt as little as the Charlemagne of Ariosto resembles the Charlemagne of Eginhard, has had his day. History will vindicate the real man from calumny disguised under the semblance of adulation, and will exhibit him as what he was—a minister of great talents, honest intentions, and liberal opinions, pre-eminently qualified, intellectually and morally, for the part of a parliamentary leader, and capable of administering with prudence and moderation the government of a prosperous and tranquil country, but unequal to surprising and terrible emergencies, and liable in such emergencies to err grievously, both on the side of weakness and on the side of violence. (M.)

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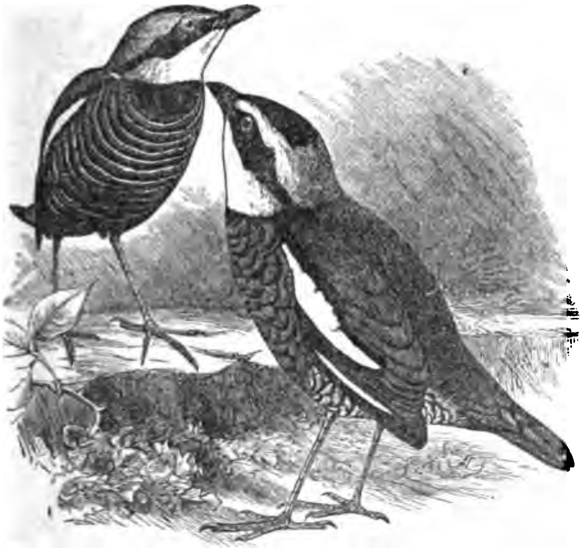
[1] [Henry Petty Fitzmaurice, third marquis of Lansdowne, was born in London, July 2, 1780, and died at Bowood, January 31, 1863. He entered parliament in 1801, and succeeded to the peerage in 1809. For a brief period in 1828 he was secretary of state for the home department, and again, in 1828-29, secretary for foreign affairs. From 1831 to 1841, and from 1846 to 1852, he was lord president of the council.]

PITTA, in Ornithology, from the Telegu *Pitta*, meaning a small Bird, Latinized by Vieillot in 1816 (*Analyse*, p. 42) as the name of a genus, and since adopted by English ornithologists as the general name for a group of Birds, called by the French *Brèves*, and remarkable for their great beauty.[1] For a long while the Pittas were commonly supposed to be allied to the *Turdidæ*, and some English writers applied to them the name of "Water-Thrushes" and "Ant-Thrushes," though there was no evidence of their having aquatic habits or predilections, or of their preying especially upon ants; but the fact that they formed a separate Family was gradually admitted. Their position was at last determined by Garrod, who, having obtained examples for dissection, in a communication to the Zoological Society of London, printed in its *Proceedings* for 1876, proved (pp. 512, 513) that the *Pittidæ* belonged to that section of Passerine Birds which he named *Mesomyodi* (ORNITHOLOGY, vol. xviii. p. 45), since their syrinx, like that of the *Tyrannidæ* (KING-BIRD, vol. xiv. p. 82), has its muscles attached to the middle of its half-rings, instead of to their extremities as in the higher Passerines or *Acromyodi*. This in itself was an unexpected determination, for such a structure had been thought to be confined to Birds of the New World, to which none of the Pittas belong. But it is borne out by, and may even serve to explain, the sporadic distribution of the latter, which seems to point them out as survivors of a somewhat ancient and lower type of *Passeres*. Indeed except on some theory of this kind the distribution of the Pittas is almost unaccountable.



Pitta elegans, male and female.

They form a very homogeneous Family, not to say genus, which it is not easy to split up justifiably, for all its members bear an unmistakable and close resemblance to each other—though the species inhabit countries so far apart as Angola and China, India and Australia; and, to judge from the little that has been recorded, they are all of terrestrial habit, while their power of flight, owing to their short wings, is feeble. Nearly fifty species have now been described, most of them found in the Malay Archipelago, between the eastern and western divisions of which they are pretty equally divided; and, in Mr. Wallace's opinion,[2] they attain their maximum of beauty and variety in Borneo and Sumatra, from the latter of which islands comes the species, *Pitta elegans*, represented in the accompanying woodcut. Few Birds can vie with the Pittas in brightly-contrasted coloration. Deep velvety black, pure white, and intensely vivid scarlet, turquoise-blue and beryl-green—mostly occupying a considerable extent of surface—are found in a great many of the species,—to say nothing of other composite or intermediate hues; and, though in some a modification of these tints is observable, there is scarcely a trace of any blending of shade, each patch of color standing out distinctly. This is perhaps the more remarkable as the feathers have hardly any lustre to heighten the effect produced, and in some species the brightest colors are exhibited by the plumage of the lower parts of the body. Pittas vary in size from that of a Jay to that of a Lark, and generally have a strong bill, a thickset form, which is mounted on rather high legs with scutellated "tarsi," and very short tail. In many of the forms there is a little or no external difference between the sexes. All the species then known were figured in Mr. Elliot's *Monograph of the Pittidæ*, completed in 1863; but so many have since been described that this work but imperfectly represents the existing knowledge of the Family, and even Schlegel's revised catalogue of the specimens contained in the Leyden Museum (*Mus. des Pays-Bas*, livr. 11), published in 1874, is now out of date, so that a new synopsis is very desirable. Many of the lately-discovered species have been figured in Gould's *Birds of Asia and Birds of New Guinea*.

Placed by some authorities among the *Pittidæ* is the genus *Philepitta*, consisting of two species peculiar to Madagascar, while other systematists would consider it to form a distinct Family. This last is the conclusion arrived at by W. A. Forbes (*Proc. Zool. Society*, 1880, pp. 387–391) from its syringeal characters, which, though showing it to be allied to the Pittas, are yet sufficiently different to justify its separation as the type of a Family *Philepittidæ*. The two species which compose it have little outward resemblance to the Pittas, not having the same style of coloration and being apparently of more arboreal habits. The sexes differ greatly in plumage, and the males have the skin round the eyes bare of feathers and caruncalated.

It may be advisable to remark that nomenclatorial purists, objecting to the names *Pitta* and *Philepitta* as "barbarous," call the former *Coloburis* and the latter *Paictes*. *Brachyurus* also has frequently been used for *Pitta*; but, having been previously applied in another sense, it is inadmissible. (A. N.)

PITTACUS of Mytilene in Lesbos, one of the seven sages of Greece, was born in 651 B.C. His father Hyrradius (or Caicus) was a Thracian, his mother was a Lesbian. About 611 B.C. Pittacus, along with the brothers of the poet Alcæus, overthrew Melanchrus, tyrant of Lesbos. In a war between the Mytilenians and Athenians for the possession of the town of Sigeum on the Hellespont, Pittacus, as general of the Mytilenians, slew the Athenian commander Phrynon in single combat, having entangled him in a net (606 B.C.). In 589 his fellow-citizens entrusted Pittacus with despotic power for the purpose of protecting them against the exiled nobles, at the head of whom were Alcæus and Antimenides. Pittacus effected this object, and, without introducing a new constitution, contrived by legislation to restore the existing constitution to regular working order. One of his laws enacted that offences committed during intoxication should be punished with double severity. For the historian of the law of inheritance some interest attaches to the enactment of Pittacus that father and mother should succeed, in equal shares, to the property of a deceased child. He resigned the government after holding it for ten years, and died ten years later (569 B.C.).

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[1] In Ornithology the word is first found as part of the native name, "Ponnunky pitta," of a Bird, given in 1713 by Petiver, in the "Mantissa" to Ray's *Synopsis* (p. 195), on the authority of Buckley (see ORNITHOLOGY, vol. xviii, p. 8, note 6). This Bird is the *Pitta bengalensis* of modern ornithologists, and is said by Jerdon (*Birds of India*, i. p. 503) now to bear the Telegu name of *Pona-inki*.

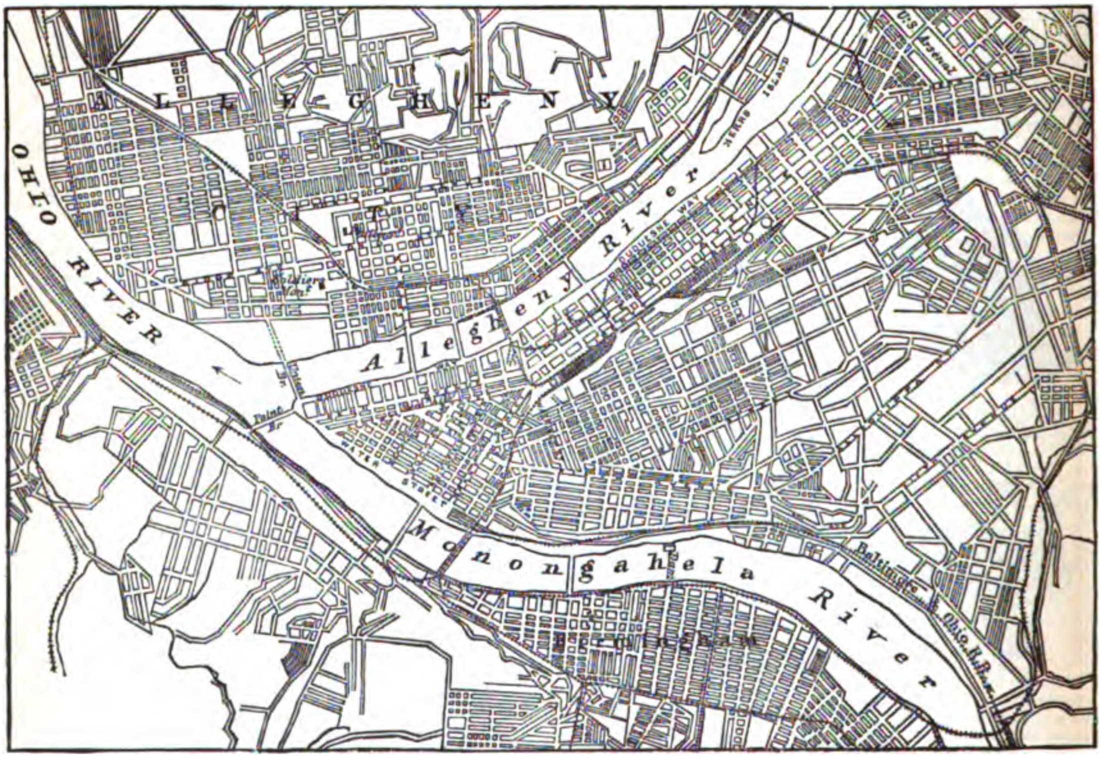
[2] Owing to recent discoveries in Papuasia it is possible that this opinion may require some modification.

The stories which bring Pittacus and Crœsus into connection are probably mere legend, since Crœsus was only twenty-five years of age at the date of Pittacus's death. Pittacus was regarded as a pattern of all the virtues, and this high character is borne out by what we know of him. When Alcæus, who had bitterly assailed him in his poems, fell into his hands, he let him go, saying that forgiveness was better than revenge. Of the lands which his grateful countrymen would have bestowed on him he accepted only a small part. Amongst the sayings attributed to him are these:—it is hard to be good; rule reveals the man; the best rule is that of law; speak ill neither of friend nor foe. Pittacus was also a poet; Diogenes Laertius states that he composed six hundred elegiac verses.

PITTSBURGH, the second largest city of Pennsylvania, and the leading iron, steel, and glass manufacturing centre of the United States, lies at the confluence of the Allegheny and the Monongahela, which unite here to form the Ohio, 250 miles west by north of Philadelphia. The business quarter of the city is built on a nearly level triangular plain, between the two rivers, measuring about three quarters of a mile on each side back to the hills which rise to the east.

The manufacturing establishments stretch for a distance of 7 miles up the Allegheny, 7 up the Monongahela, and 2 down the Ohio, and occupy the strip of low ground usually a few hundred feet broad between the river banks and the hills which generally face them. The slope of the hills to the east of the business quarter is closely built with residences and retail stores for the distance of a mile and a half, but the summits, 400 or 500 feet high, are partially unoccupied. Beyond the hills extends a rolling country which, for a space of about 5 miles long by 2 wide is occupied by the villas of the citizens. The hills facing the rivers are generally precipitous, and vary in height from 300 to 600 feet, but at different points they recede from the river banks and afford sites for the suburbs of Lawrenceville (on the Allegheny), Hazlewood and Birmingham (on the north and south banks respectively of the Monongahela), which are within the municipality of Pittsburgh, and (on the north bank of the Allegheny and Ohio) for the city of Allegheny, which, with its separate municipal government and population of 78,000 inhabitants, is commercially and socially a part of Pittsburgh. The two cities together cover an irregular space of 9 miles between the extreme eastern and western points, with a breadth varying from 2 to 4 miles.

From the character of its site Pittsburgh would naturally be very attractive, but the free use of the bituminous coal which has been the principal agent in its development has so spoiled its beauty as to give it the name of the Smoky City. Not only do the manufacturing quarters show long lines of smoke-stained buildings, but the business quarter, which is composed of rather narrow streets laid out early in the century, is mainly constructed of brick and iron, and in spite of the presence of some fine public buildings in granite and brown stone—the municipal hall, the petroleum exchange, the new United States post office and court-house (1884), the new county court-house (1884), etc.,—has a generally grimy and unattractive appearance. A better opinion of the wealth and taste of the city is obtained from a view of the suburban quarters of the East End and the parks and residence quarters of Allegheny. And, all disfigurement and dirtiness notwithstanding, it is full of interesting and striking sights. The interiors of its rolling-mills and glass-houses, and the views of the city from the surrounding hills, with the manufacturing quarters marked out by their smoke by day and their fires by night, are of a unique and picturesque character. Along the rivers are fleets of steamers towing barges laden with coal for consumption at this point and for shipment to the cities lower down. Joining the various quarters of the city are ten bridges for ordinary traffic and four



Plan of Pittsburgh.

railway viaducts, among which the Point Bridge and the Smithfield Street Bridge are fine examples of engineering in iron. Six inclined-plane railways afford access to the summits of the high hills.

Pittsburgh is of historical interest from the struggle (1755-1758) for its possession between England and France in the Seven Years' War, and the fact that the public and military career of George Washington was commenced with those campaigns (see WASHINGTON). With the termination of that struggle in the capture of the ruins of Fort Duquesne by the British, the history of the place becomes that of an ordinary frontier town. A new fort was erected and named Fort Pitt in honor of the prime minister whose energy had urged the war forward to its capture, and wrested the Ohio valley and Canada from French control. After one or two Indian wars, in which the post was threatened, and on one occasion nearly taken, Fort Pitt lost its military character and became a trading town. The first streets were laid out near the fort in 1764, and in 1769 the first survey of the unsettled lands in the vicinity was made for the proprietors, the heirs of William Penn, under the name of the manor of Pittsburgh. After the termination of the revolution, the legislature of Pennsylvania incorporated Pittsburgh as a village on April 22, 1794, and on March 18, 1816, its charter as a city was granted. During the colonial period a dispute arose between Virginia and Pennsylvania as to the possession of the territory surrounding the town, and in the first few years of its history under the United States it attracted attention from its proximity to the famous "Whiskey Insurrection" of Western Pennsylvania. After it had attained a population of 30,000 it was visited on the 10th of April, 1845, by a disastrous conflagration in which the buildings in the business centre, covering a space of 56 acres, and valued at $5,000,000, were consumed.

In the Pittsburgh of to-day there is little besides names of streets, hills, and suburbs to recall the struggle which decided the Anglo-Saxon character of the country. The locality known as the Point, where Fort Duquesne stood, is covered with thickly built factories and dingy tenements. In a squalid and obscure court a portion of the wall of a blockhouse erected in 1763 by Colonel Boquet, one of the British commandants of Fort Pitt, still forms a part of a building, and on the wall of the staircase of Municipal Hall is a stone bearing the inscription with which that officer commemorated its erection. Immediately across the Monongahela a range of precipitous hills, some 500 feet high, bears the names of Mount Washington and Duquesne Heights. On the first hill rising to the east of the level part of the city, a red granite court-house, to cost $2,000,000, is in process of construction near to the spot where Major Grant was defeated and slain, and the new building will replace the brown stone structure which for many years fronted on the street bearing that unfortunate officer's name. Twelve miles away, the suburb long known as Braddock's Field and now as Braddock's, attracts attention chiefly by the roar and glare of its great steel manufacturing establishment.

Deriving its early importance in commerce from its position at the head of the Ohio, which was until 1855 the principal route between the middle States and the west and southwest, Pittsburgh has since obtained its greatest growth from the coal which underlies nearly all Western Pennsylvania. This has made the city and its immediate suburbs the most important manufacturing district in America, in both pig and bar iron, steel, glass, and copper. In 1883 Allegheny county produced 11½ per cent. of the pig iron produced in the United States, and 21 per cent. of the rolled iron and steel. The iron industry consists of 16 blast furnaces, producing, in 1883, 592,475 tons; 32 rolling mills, producing 472,351 tons of finished iron; and 91 other establishments, turning out a large variety of other manufactures of iron, from boilers to safes and steam pumps. The steel industry comprises 20 large mills with an output for 1883 of 405,530 tons. The blast furnaces and rolling-mills of Pittsburgh employ a capital of $23,910,000 and 21,190 workmen, the steel industry $10,170,000 and 7060 workmen. Next in importance is the glass manufacture, in which 75 establishments are engaged, 24 making table ware, 24 window glass, 10 green glass bottles, and 9 lamp chimneys. The capital invested in them is $5,985,000. They employ 6442 hands, and the value of their last reported annual production is $6,832,683. The coal and coke industry of the district, which is controlled mainly by Pittsburgh, comprises a capital of $26,406,500, employs 23,621 miners and other laborers, and makes an annual output of 7,720,000 tons of coal and 2,760,000 tons of coke, valued at $16,600,000. The total of all the manufacturing industries of the city is 1380 establishments, with $105,401,481 of capital, employing 85,936 workmen of all kinds, and producing to the value of $149,721,619. The wholesale trade of the city is much less important than its manufacturing industries, and with a few exceptions is confined to the immediate vicinity. It includes 90 firms with an aggregate capital of $11,206,000 and total sales of $125,390,472. Within the last year a new and unique industry has been developed. By drilling in the earth to a depth of 1200 to 2000 feet, what is practically the fire-damp of the coal mine is tapped in such quantity that it comes to the surface in great force. It has been found to be useful as a fuel for all the purposes of coal except the smelting of ores in blast furnaces; and, as it is cheaper both for making steam and for the heating of the iron and glass furnaces, its adoption has been general among the manufacturers.

As the railway system has developed, the important boating interest of Pittsburgh has become confined to the transportation of coal from the Monongahela river mines to the down-river cities. The coal is only taken out when freshets have raised the river, and at that time fleets of steamers, each towing from eight to fifteen barges, covering acres in extent and carrying thousands of tons of coal, start down stream. The total steam tonnage of Pittsburgh is 36,845 tons, with 163 vessels, but the addition of the barges brings the tonnage up to 1,359,972 and the number of vessels to 3208.

Pittsburgh is stated to be the origin of more railway freight than any other point in the country. There are a large number of lines, under the control of three great companies. The most important is the Pennsylvania Railroad, whose trunk lines pass through the city, and number among their feeders the West Pennsylvania; the Allegheny Valley; the Pittsburgh, Virginia and Charleston; the Pittsburgh, Cincinnati and St. Louis; the Pittsburgh, Fort Wayne and Chicago; and the Cleveland and Pittsburgh Railroads. The Pittsburgh division of the Baltimore and Ohio Railroad gives a connection with that trunk line, and by the Pittsburgh and Western, and the Pittsburgh, Cleveland and Toledo, reaches the Chicago branch of the same system to the west. The Pittsburgh and Lake Erie affords the New York Central and the New York, Pennsylvania and Ohio lines an access to Pittsburgh, while its extension under the name of the Pittsburgh, MacKeesport, and Youghiogheny penetrates the coal and coke district to the southeast.

In 1796, by the first accurate census on record, the population of Pittsburgh was 1395. By 1810 it had increased to 4968; by 1820 to 7248; by 1830 to 12,452; by 1840 to 21,115; by 1850 to 36,601; by 1860 to 49,221; by 1870 to 86,076. In 1874 the consolidation of outlying boroughs made the population, according to the census of 1870, 121,799; and in 1880 this had increased to 156,389. These figures do not comprise the population of Allegheny, which was 28,702 in 1860, 53,180 in 1870, and 78,682 in 1880. Including the manufacturing and residential suburbs, the total population by the census of 1880 was 274,160; and, with the large extension of manufacturing and building that has gone on since then, it was estimated in 1884 at 325,000.

The municipal governments of Pittsburgh and Allegheny are each composed of a mayor, controller, and treasurer, with city councils in two branches, styled respectively select and common. These are elected by the people, and appoint other administrative officials to take charge of the police and fire departments, assessments and public works. The total assessed valuation of the city of Pittsburgh for purposes of taxation is $101,508,603, on which a revenue is collected for all purposes of $2,777,405. Allegheny has an assessed valuation of $40,707,858, and spends $650,000 annually. The total indebtedness of Pittsburgh is $14,497,800, of which nearly $10,000,000 was expended for waterworks and street pavements. The debt of Allegheny is but $1,400,000.

The school system of each city is governed by a central board of education and ward boards, both elected by popular vote. The Pittsburgh system comprises a fine stone high school overlooking the city, and 52 ward schools, in which are 469 teachers and 23,629 scholars, the approximate annual expenditure being $550,000. In the Allegheny system there are the high school and 18 ward schools, with 207 teachers, 9392 scholars, and an annual expenditure of about $200,000. The principal institutions established by public taxation are the Riverside State Penitentiary, completed in 1884 in the lower part of Allegheny; the Morganza Reform School; the workhouse at Claremont, on the Allegheny river; and the Pittsburgh, Allegheny, and County poorhouses.

The churches and chapels in Pittsburgh and Allegheny number 237; 57 are Roman Catholic, including 13 monastic and conventual establishments; 53 represent the various branches of Presbyterianism; 39 are Methodist Episcopal, and 16 Protestant Episcopal. Among the leading examples of church architecture are St. Paul's Cathedral (Roman Catholic), Trinity and St. Peter's (Protestant Episcopal), the First and Third Presbyterian and the German Lutheran churches in Pittsburgh, and the North Presbyterian in Allegheny. Private charity has established the West Pènn. Hospital with a large branch for the treatment of the insane at Dixmont, the Homœopathic Hospital, the Mercy Hospital, the Pittsburgh Infirmary, the Free Dispensary, the North Side Hospital, and St. Francis Hospital; and 18 asylums for orphans and the aged and infirm are maintained throughout the two cities. The collegiate institutions comprise the Western University, the Western Theological Seminary (Presbyterian), the United Presbyterian Seminary, the Catholic College, the Pennsylvania Female College, and the Pittsburgh Female College.

(J. F. H.)

PITTSFIELD, a township of the United States, the shire town of Berkshire county, Massachusetts, lies at a height of from 1000 to 1200 feet above the sea on a plain between the Hoosacs on the east and the Taconics on the west. It is traversed by the headwaters of the Housatonic and Hoosac rivers, and derives its supply of drinking water from Lake Ashley, a romantic loch on the top of the Washington Hills, 7 miles to the southeast. As the northern terminus of the Housatonic Railroad, and a junction on the Boston and Albany and the Pittsfield and North Adams Railroads, it is an important centre of traffic. Most of the dwelling houses are built of wood. Among the public edifices are a court-house in white marble; the Berkshire Athenæum, with a free library and reading-room; the Roman Catholic Church of St. Joseph, in marble; the Methodist church, a spacious edifice of brick; the First Congregational church (rebuilt in 1853), for thirty years under the charge of Rev. John Todd, author of the *Student's Manual;* and the Maplewood Institute for young ladies. The Berkshire Medical Institute (1822) ceased to exist in 1869. There is a small park with a fine soldiers' monument (1872) in the heart of the town, as well as a larger park with a race-course in the eastern suburb. Cotton and woollen goods, silk, knit goods, shoes, and tacks are among the local manufactures. The population in 1860 was 8045; in 1870, 11,132; in 1880, 13,364. Pittsfield, which once formed part of the Indian domain of Pontoosuc, and for a time was known as Boston Plantation, was incorporated in 1761, and received its present name in honor of the earl of Chatham. Oliver W. Holmes long resided on a small farm two miles south of Pittsfield.

PITTSTON, a borough of the United States, in Luzerne county, Pennsylvania, on the east bank of the Susquehanna, just below the confluence of the Lackawanna, 105 miles north by west of Philadelphia. It is the centre of the Wyoming anthracite region and the seat of the Pennsylvania Coal Company's operations, contains knitting mills, planing mills, terra cotta works, a stove factory, lumber yards, etc., and commands four distinct railway lines. The population was 6760 in 1870 and 7472 in 1880. If West Pittston (a borough on the other side of the Susquehanna, with which Pittston communicates by two bridges) were included, the total would be 10,016.

PIUS I. Hardly anything is known with certainty respecting Pius I., except that he was bishop of Rome from 158 to 167 A.D. He is said to have been born at Aquileia and to have been the son of a certain Rufinus; it is added that he suffered martyrdom, but, although he is celebrated as a martyr in the breviary, there seems no other evidence for this assertion. A few letters extant under his name are spurious.

PIUS II. (Enea Silvio Piccolomini, commonly known in literature as Æneas Sylvius), pope from 1458 to 1464, "whose character reflects almost every tendency of the age in which he lived," was born at Corsignano in the Sienese territory, October 18, 1405, of a noble but decayed family. After studying at the universities of Siena and Florence, he settled in the former city as a teacher, but in 1431 accepted the post of secretary to Domenico Capranica, bishop of Fermo, then on his way to Basel to protest against the injustice of the new pope Eugenius IV. in refusing him the cardinalate for which he had been designated by Martin V. Arriving at Basel after numerous adventures, he successively served Capranica and several other masters. In 1435 he was sent by Cardinal Albergata, Eugenius's legate at the council, on a secret mission to Scotland, the object of which is variously related, even by himself. He visited England as well as Scotland, underwent many perils and vicissitudes in both countries, and has left a valuable account of each. Upon his return he sided actively with the council in its conflict with the pope, and, although still a layman, obtained a leading share in the direction of its affairs. But when in 1442 the council elected Amadeus, duke of Savoy, as an antipope under the name of Felix V., Æneas, perceiving that the step was generally disapproved, found a pretext for withdrawing to the emperor Frederick III.'s court at Vienna. He was there crowned imperial poet laureate, and obtained the patronage of the emperor's chancellor, Kaspar Schlick, a love adventure of whose at Siena he celebrated in his romance, *Eurialus and Lucretia.* His character had hitherto been that of an easy man of the world, with no pretence to strictness in morals or consistency in politics. He now began to be more regular in the former respect, and in the latter adopted a decided line by making his peace with Rome. Being sent on a mission to Rome in 1445, with the ostensible object of inducing Eugenius to convoke a new council, he was absolved from ecclesiastical censures, and returned to Germany under an engagement to assist the pope. This he did most effectually by the diplomatic dexterity with which he smoothed away differences between the court of Rome and the German electors; and he had a leading part in the compromise by which, in 1447, the dying Eugenius accepted the reconciliation tendered by the German princes, and the council and the antipope were left without support. He had already taken orders, and one of the first acts of Eugenius's successor Nicholas V. was to make him bishop of Trieste. In 1450 he was sent ambassador by the emperor Frederick to negotiate his marriage with the Princess Leonora of Naples, which object he successfully achieved; in 1451 he undertook a mission to Bohemia, and concluded a satisfactory arrangement with the Hussite chief George Podiebrad; in 1452 he accompanied Frederick to Rome, where the emperor wedded Leonora and was crowned king of the Romans. In August, 1455, Æneas again arrived in Rome on an embassy to proffer the obedience of Germany to the new pope, Calixtus III. He brought strong recommendations from the emperor and King Ladislaus of Hungary for his nomination to the cardinalate, but delays arose from the pope's resolution to promote his own nephews first, and he did not attain the object of his ambition until December in the following year.

Calixtus III. died on August 6, 1458. On August 10 the cardinals entered into conclave. The wealthy cardinal of Rouen, though a Frenchman and of exceptionable character, seemed certain to be elected. Æneas has told us in a passage of his own history of his times, long retrenched from that work but printed clandestinely in the *Conclavi de' Pontifici Romani*, by what art, energy, and eloquence he frustrated this false step. It seemed but meet that the election should fall upon himself: no other candidate appears to have been seriously thought of; nor, although the sacred college probably included a few men of higher moral standord, had it any on the whole so worthy of the tiara. It was the peculiar faculty of Æneas to accommodate himself perfectly to whatever position he might be called upon to occupy; it was his peculiar good fortune that every step in life had placed him in circumstances appealing more and more to the better part of his nature, an appeal to which he had never failed to respond. The party pamphleteer had been more respectable than the private secretary, the diplomatist than the pamphleteer, the cardinal than the diplomatist; now the unscrupulous adventurer and licentious novelist of a few short years ago seated himself quite naturally in the chair of St. Peter, and from the resources of his versatile character produced without apparent effort all the virtues and endowments becoming his exalted station. After allying himself with Ferdinand, the Aragonese claimant of the throne of Naples, his next important act was to convene a congress of the representatives of Christian princes at Mantua for joint action against the Turks. His long progress to the place of assembly resembled a triumphal procession; and the congress, a complete failure as regarded its ostensible object, at least showed that the impotence of Christendom was not owing to the pope. On his return from the congress Pius spent a considerable time in his native district of Siena, and has described his delight and the charms of a country life in very pleasing language. He was recalled to Rome by the disturbances occasioned by Tiburzio de Maso, who was ultimately seized and executed. The papal states were at this time greatly troubled by rebellious barons and marauding condottieri, but these evils gradually abated. The Neapolitan war was also terminated by the success of the pope's ally Ferdinand. In July, 1461, Pius canonized St. Catherine of Siena, and in October of the same year he gained what at first appeared to be a most brilliant success by inducing the new king of France, Louis XI., to abolish the pragmatic sanction, by which the pope's authority in France had been grievously impaired. But Louis had expected that Pius would in return espouse the French cause in Naples, and when he found himself disappointed he virtually re-established the pragmatic sanction by royal ordinances. Pius was also engaged in a series of disputes with the Bohemian king and the count of Tyrol, and the crusade for which the congress of Mantua had been convoked made no progress. The pope did his best: he addressed an eloquent letter to the sultan urging him to become a Christian; he succeeded in reconciling the emperor and the king of Hungary, and derived great encouragement as well as pecuniary advantage from the discovery of mines of alum in the papal territory. But France was estranged; the duke of Burgundy broke his positive promise; Milan was engrossed with the attempt to seize Genoa; Florence cynically advised the pope to let the Turks and the Venetians wear each other out. Pius was unawares nearing his end, and his malady probably prompted the feverish impatience with which on June 18, 1464, he assumed the cross and departed for Ancona to conduct the crusade in person. It seemed certain that the issue of such an enterprise could only be ridiculous or disastrous. Pius II.'s good genius again stepped in, and rendered it pathetic. He was suffering from fever when he left Rome. The crusading army melted away at Ancona for want of transport, and when at last the Venetian fleet arrived the dying pope could only view it from a window. He expired two days afterwards, August 14, 1464, in his death as in his life a figure picturesque and significant far beyond the wont of Roman pontiffs. He was succeeded by Paul II.

Pius, indeed, regarded as a man and not merely as an historical personage, is the most interesting of all the successors of St. Peter. It is easy to take his character to pieces, but the aroma of something exquisite lingers around every fragment. He had a healthy, sincere, loving nature, frank and naive even in his aberrations and defects, which seem after all sufficiently venial. The failings of other popes have most frequently been those of the priest, and therefore in the true sense of the term inhuman. It is a refreshing transition to the faults of the adventurer, the diplomatist, the man of letters and pleasure. The leading trait of Pius's character was his extreme impressionableness. Chameleon-like he took color from surrounding circumstances, and could always depend on being what these circumstances required him to be. As, therefore, his prospects widened and his responsibilities deepened, his character widened and deepened too; and he who had entered upon life a shifty adventurer quitted it a model chief shepherd. His virtues were not only great, but the most conspicuous were those especially characteristic of the finer natures. While he vied with any man in industry, prudence, wisdom, and courage, he excelled most men in simplicity of tastes, constancy of attachments, kindly playfulness, magnanimity, and mercy. As chief of the church he was able and sagacious, and showed that he comprehended the conditions on which its monopoly of spiritual power could for a season be maintained; his views were far-seeing and liberal; and he was but slightly swayed by personal ends. He is especially interesting as the type of the scholar and publicist who wins his way by intellectual strength, foreshadowing the age to come when the pen should be mightier than the sword: and no less as the figure in whom the mediæval and the modern spirit are most distinctly seen to meet and blend, ere the latter definitively gains the mastery.

Pius was a versatile and voluminous author, one of the best and most industrious of his period. His most important work is his *Commentaries of his own Times*, published in 1584 under the name of Gobelinus, to whom it has been ascribed, but who was in fact only the copyist. It appears to have been altered to some slight extent by his secretary Campanus. Numerous passages suppressed at the time of publication have been recently published in the *Transactions* of the Accademia de' Lincei by Signor Cugnone, together with other inedited works. Pius's *Commentaries* are delightful reading, and their historical value is very great. "Pius II.," says Creighton, "is the first writer who attempted to represent the present as it would look to posterity, who consciously applied a scientific conception of history to the explanation and arrangement of passing events." His *Epistles*, which were collected by himself, are also an important source of historical information. The most valuable of his minor historical writings are his histories of Bohemia and of the emperor Frederick III., the latter partly autobiographical. He sketched geographical treatises on Europe and Asia, and in early and middle life produced numerous tracts on the political and theological controversies of his day, as well as on ethical subjects. Pius was greatly admired as a poet by his contemporaries, but his reputation in belles lettres rests principally upon his *Eurialus and Lucretia*, which continues to be read to this day, partly from its truth to nature, and partly from the singularity of an erotic novel being written by a pope. He also composed some comedies, one of which alone is extant, and as yet only in MS. All these works are in Latin. Pius was not an eminent scholar: his Latin is frequently incorrect, and he knew little Greek; but his writings have high literary qualities, and will always be prized as vivid and accurate reproductions of the spirit of a very remarkable age.

All the chief authorities for Pius's life are sifted and condensed in the admirable biography by Voigt (3 vols., Berlin, 1856-63). Professor Creighton, in his masterly *History of the Papacy during the Reformation* (vol. ii., London, 1882), has given the English reader the substance of Voigt's narrative, while preserving a full independence of judgment. (R. G.)

PIUS III. (Francesco Todeschini), pope from September 22 to October 18, 1503, was born at Siena, May 9, 1439. As the nephew of Pius II. by his sister Laodamia, he was received into favor by that pontiff, who permitted him to assume the name and arms of the Piccolomini, and raised him, when only twenty-two years of age, to the see of Siena and the cardinalate. He was employed by subsequent popes in several important legations, as by Paul II. at the diet of Ratisbon, and by Sixtus IV. to secure the restoration of ecclesiastical authority in Umbria. Amid the disturbances consequent upon the death of Alexander VI. he was, by the not wholly disinterested influence of Cardinal Rovera, elected pope on September 22, 1503, his installation taking place on the 8th October following. He at once took in hand the reform of the papal court and arrested Cæsar Borgia; but after a brief pontificate of twenty-six days he died (October 18, 1503) of an ulcer in the leg, or, as some have alleged, of poison administered at the instigation of Pandolfo Petrucci, governor of Siena. He was succeeded by Julius II.

PIUS IV. (Giovanni Angelo Medici), pope from 1559 to 1565, was born of humble parentage at Milan, March 31, 1499. His early career connects itself in some measure with the romantic rise of his elder brother from the position of bravo to that of Marchese di Marignano. After studying at Bologna and acquiring reputation as a jurist, he went in 1527 to Rome, and as the favorite of Paul III. was rapidly promoted to the governorship of several towns, the archbishopric of Ragusa, the vicelegateship of Bologna, and in April, 1549, to the cardinalate. On the death of Paul IV. he was elected pope on December 28, 1559, and installed on the 6th January, 1560. His first public acts of importance were to grant a general pardon to the participators in the riot which had closed the previous pontificate, and to bring to trial the nephews of his predecessor, of whom Cardinal Carlo Caraffa was strangled, and the duke Paliano, with his nearest connections, beheaded. On the 18th January, 1562, the council of Trent, which had been suspended by Julius III., was opened for the third time. Great skill and caution were necessary to effect a settlement of the questions before it, inasmuch as the three principal nations taking part in it, though at issue with regard to their own special demands, were prepared to unite their forces against the demands of Rome. Pius, however, aided by Morone and Borromeo, proved himself equal to the emergency, and by judicious management and concession brought the council to a termination satisfactory to the disputants and favorable to the pontifical authority. Its definitions and decrees were confirmed by a bull dated January 26, 1564; and, though they were received with certain limitations by France and Spain, the famous Creed of Pius IV., or Tridentine Creed, remained the authoritative expression of the Catholic faith. The more marked manifestations of stringency during his pontificate appear to have been prompted rather than spontaneous, his personal character inclining him to moderation and ease. Thus a monitory, issued in 1564, summoning the queen of Navarre before the Inquisition on a charge of Calvinism, was withdrawn by him in deference to the indignant protest of Charles IX.; and in the same year he published a bull granting the use of the cup to the laity of Austria and Bohemia. One of his strongest passions appears to have been that of building, which somewhat strained his resources in contributing to the adornment of Rome, and in carrying on the work of restoration, erection, and fortification in various parts of the ecclesiastical states. A conspiracy against him, headed by the Catholic fanatic Benedetto Accolti, was discovered and crushed in 1565. He died shortly afterwards, on December 9th of that year, and was succeeded by Pius V.

PIUS V. (Michele Ghislieri), pope from 1566 to 1572, was born at Bosco in the duchy of Milan, January, 17, 1504. At the age of fourteen he entered the Dominican order, passing from the monastery of Voghera, to that of Vigevano, and thence to Bologna. Having been ordained priest at Genoa in 1528, he settled at Pavia, where he lectured for sixteen years. He soon gave evidence of the opinions which found a more practical expression in his pontificate, by advancing at Parma thirty propositions in support of the papal chair and against the heresies of the time. As president of more than one Dominican monastery he proved himself a rigid disciplinarian, and, in accordance with his own wish to discharge the office of inquisitor, received an appointment to that post at Como. His zeal provoking resentment, he was compelled in 1550 to return to Rome, where, after having been employed in several inquisitorial missions, he was elected to the commissariat of the Holy Office. Paul IV., who while still Cardinal Caraffa had shown him special favor, conferred upon him the bishopric of Sutri and Nepi, the cardinalate with the title of Alessandrino, and the honor—unique in one not of pontifical rank—of the supreme inquisitorship. Under Pius IV., he became bishop of Mondovi in Piedmont, but his opposition to that pontiff procured his dismissal from the palace and the abridgment of his authority as inquisitor.

Before Ghislieri could return to his episcopate, Pius IV. died, and on January 7, 1566, he was elected to the papal chair with duly attendant prodigies, his coronation taking place on his birthday, ten days later. Fully alive to the necessity of restoring discipline and morality at Rome to ensure success without, he at once proceeded to reduce the cost of the papal court, compel residence, regulate inns, expel prostitutes, and assert the importance of ceremonial. In his wider policy, which was characterized throughout by a stringency which tended to defeat its own ends, the maintenance and increase of the efficacy of the Inquisition and the enforcement of the canons and decrees of the Tridentine council had precedence over all other considerations. The prudence of Commendone alone saved him at the commencement of his pontificate from trouble with Germany, as in the general diet of the empire at Augsburg (March 26, 1566) Pius saw a threatened invasion of his own supremacy and was desirous of limiting its discussions. In France, where his influence was stronger, he directed the dimissal of Cardinal Odet de Coligny and seven bishops, nullified the royal edict tolerating the extra-mural services of the Reformers, introduced the Roman catechism, restored papal discipline, and strenuously opposed all compromise with the heretics—his exertions leading up in no small degree to the massacre of St. Bartholomew. In the list of more important bulls issued by him the famous bull "In Cœna Domini" (1568) takes a leading place; but amongst others throwing light on his character and policy there may be mentioned his prohibition of quæstuary (February, 1567 and January, 1570); the condemnation of Michael Baius, the heretical professor of Louvain (1567); the reform of the breviary (July, 1568); the denunciation of the *dirum nefas* (August, 1568); the banishment of the Jews from the ecclesiastical dominions except Rome and Ancona (1569); the injunction of the use of the reformed missal (July, 1570); the confirmation of the privileges of the Society of Crusaders for the protection of the Inquisition (October, 1570); the prohibition of discussions concerning the miraculous conception (November, 1570); the suppression of the Fratres Humiliati for alleged profligacy (February, 1571); the approbation of the new office of the Blessed Virgin (March, 1571); the enforcement of the daily recitation of the canonical hours (September, 1571); and the purchase of assistance against the Turks by offers of plenary pardon (March, 1572). His antagonism to Elizabeth was shown, not only in the countenance lent by him to Mary Stuart and those who sought in her name to deliver England "ex turpissima muliebris libidinis servitute," but in the publication of a bull, dated April 27, 1570, excommunicating Elizabeth and releasing her subjects from their allegiance. His energy was in no respect more favorably exhibited than in his persistent and successful endeavors to form a general league against the Turks, as the result of which the battle of Lepanto (October 7, 1571), was won by the combined fleet under Colonna. Three national synods were held during his pontificate—at Naples under Cardinal Alfonso Caraffa (whose family had, after inquiry, been reinstated by Pius V.), at Milan under Carlo Borromeo, and at Mechlin. His death took place on May 1, 1572, and he was canonized by Clement XI. on May 24th, 1712. He was succeeded by Gregory XIII.

PIUS VI. (Giovanni Angelo Braschi), pope from 1775 to 1799, was born at Cesena, December 27, 1717. After taking the degree of doctor of laws in 1735, he went to Ferrara and became the private secretary of

Cardinal Ruffo, in whose bishopric of Ostia and Velletri he held the post of *uditore* until 1753. His skill in the conduct of a mission to the court of Naples won him the esteem of Benedict XIV. who appointed him one of his secretaries and canon of St. Peter's. In 1758 he was raised to the prelature and then to the treasurership of the apostolic chamber by Clement XIII., whose successor, Clement XIV. created him cardinal on the 26th April, 1773. On the death of Clement XIV. and after protracted debate, Braschi was elected to the vacant see on the 15th February, 1775. His assumption of the title Pius VI. even then recalled to the populace the verse current in the pontificate of Alexander VI. "Semper sub Sextis perdita Roma fuit," though his earlier acts gave fair promise of liberal rule and reform in the defective administration of the papal states. He showed discrimination in in his benevolences, reprimanded Potenziani, the governor of Rome, for unsuppressed disorders, appointed a council of cardinals to remedy the state of the finances and relieve the pressure of imposts, called to account Nicolo Bischi for the expenditure of moneys intended for the purchase of grain, reduced the annual disbursements by the suppression of several pensions, and adopted a system of bounties for the encouragement of agriculture. The circumstances of his election, however, involved him in difficulties from the outset of his pontificate. He had received the support of the ministers of the crowns and the anti-Jesuit party upon a tacit understanding that he would continue the action of Clement, by whose brief *Dominus ac Redemptor* (1773) the dissolution of the Society of Jesus had been pronounced. On the other hand the *zelanti*, who believed him secretly inclined towards Jesuitism, expected from him some reparation for the alleged wrongs of the previous reign. As the result of these complications, Pius was betrayed into a series of half measures which gave little satisfaction to either party. The case of Ricci and the other Jesuits imprisoned in the castle of St. Angelo had scarcely been settled, by formal discountenance but informal relaxations and final release, before the question became an international one. Driven from devout Catholic countries, the members of the condemned society found an asylum under the rule of the heretic Frederick II. and the schismatic Catherine II., who welcomed them upon educational grounds. A long correspondence ensued in which both monarchs maintained their right, Catherine carrying the matter still further and wresting from Pius a series of important concessions. Even in countries acknowledging the papal authority practical protests arose which tended to its limitation. In Austria the social and ecclesiastical reforms undertaken by Joseph II. and his minister Kaunitz touched the supremacy of Rome so nearly that in the hope of staying them Pius adopted the exceptional course of visiting Vienna in person. He left Rome on the 27th February, 1782, and was magnificently received by the emperor, but his mission was unattended by any marked success. In Naples difficulties necessitating certain concessions in respect of feudal homage were raised by the minister Tannucci and more serious disagreements arose with Leopold I. and Ricci, bishop of Pistoia and Prato, upon questions of reform in Tuscany. The outbreak of the French Revolution followed and Pius in vain endeavored to preserve the ecclesiastical discipline and property. The old Gallican Church was suppressed; the pontifical and ecclesiastical possessions in France were confiscated and an effigy of himself was burnt by the populace at the Palais Royal. The murder of the Republican agent, Hugo Basseville, in the streets of Rome (January, 1793), gave new ground of offence; the papal court was charged with complicity by the French Convention and Pius threw in his lot with the league against France. In 1796 Napoleon invaded Italy, defeated the papal troops and occupied Ancona and Loreto. Pius sued for peace, which was granted at Tolentino on the 19th February, 1797; but on the 28th December of that year, in a riot created by some Italian and French revolutionists, General Duphot of the French embassy was killed and a new pretext furnished for invasion. General Berthier marched to Rome, entered it unopposed on February 10, 1798, and, proclaiming it a republic, demanded of the pope the renunciation of his temporal authority. Upon his refusal he was taken prisoner, and on February 20th was escorted from the Vatican to Siena, and thence from place to place—in succession to Florence, Parma, Piacenza, Turin, Grenoble and Valence, where he died six weeks later, on the night of the 28th August, 1799. Pius VII. succeeded him.

The name of Pius VI. is associated with many and often unpopular attempts to revive the splendor of Leo X. in the promotion of art and public works—the words "Munificentia Pii VI. P. M.," graven in all parts of the city, giving rise amongst his impoverished subjects to such satire as the insertion of a minute loaf in the hands of Pasquin with that inscription beneath it. He is best remembered in connection with the establishment of the museum of the Vatican, commenced at his suggestion by his predecessor, and with the attempt to drain the Pontine Marshes. In the latter undertaking large sums were expended to such small purpose that the phrase "Sono andate alle paludi Pontine" passed into a proverb applied to funds employed in extravagant projects. The chief result was the restoration of the Appian Way by the removal of the additions of Trajan and Theodoric with later accumulations, and the erection of a new viaduct to Terracina upon the original road of Appius Claudius.

PIUS VII. (Gregorio Luigi Barnaba Chiaramonti), pope from 1800 to 1823, was born at Cesena on August 14, 1742. After studying at Ravenna, he entered the Benedictine monastery of St. Mary in his native town, but was almost immediately sent by his superiors to Padua and to Rome for a further course of studies in theology. He then held various teaching appointments in the colleges of his order at Parma and at Rome. He was created an abbot of his order by Pius VI., who appointed him bishop of Tivoli on the 16th December, 1782, and on February 14, 1785, raised him to the cardinalate and the see of Imola. At the death of Pius VI. the conclave met at Venice on the 1st December, 1799, with the result that Chiaramonti was declared his successor on March 14, 1800, and crowned on the 21st of that month. In the following July he entered Rome, appointed Cardinal Consalvi secretary of state and busied himself with administrative reforms. His attention was at once directed to the ecclesiastical anarchy of France, where, apart from the broad schism on the question of submission to the republican constitution, discipline had been so far neglected that a large proportion of the churches were closed, dioceses existed without bishops or with more than one, Jansenism and marriage had crept into the ranks of the clergy, and indifference or hostility widely prevailed amongst the people. Encouraged by the intimation through Cardinal Martiniani of Napoleon's desire for the re-establishment of the Catholic religion in France, Pius appointed Caselli and Archbishop Spina to arrange a concordat with three nominees of Napoleon—Joseph Bonaparte, Cretet and the Vendean priest Bernier. Difficulties having arisen, the aid of Consalvi was called in, and the concordat, signed at Paris on July 15, was ratified by Pius on the 14th August, 1801. Its value, however, from the pontifical point of view, was considerably lessened by the "Articles Organiques" appended to it by the French Government on the 8th April, 1802. In 1804 Napoleon opened negotiations to secure at the pope's hands his formal consecration as emperor. After some hesitation Pius was induced to perform the ceremony at Notre Dame and to extend his visit to Paris for four months. He returned to Rome on the 16th May, 1805, with many expressions of good-will, but in the October following the French troops, in evacuating the kingdom of Naples, suddenly occupied Ancona upon the alleged necessity of protecting the Holy See. Resistance by force was out of the question, but to a requisition from the emperor that all Sardinians, English, Russians, and Swedes should be expelled from the pontifical states and that vessels of all nations at war with France should be excluded from his ports, Pius replied by asserting the independence and neutrality of his realm. After negotiations had dragged on for two years, in the course of which the French occupied the chief Adriatic ports, Civita Vecchia was seized and the papal troops placed under French officers. On the 2d February, 1808, Rome itself was occupied by General Miollis; a month later the provinces of Ancona, Macerato, Fermo, and Urbino were united to the kingdom of Italy and diplomatic relations between Napoleon and Rome were broken off; finally, by a decree issued from Vienna on May 17, 1809, the emperor declared the papal states reunited to France by resumption of the grant of Charlemagne. Pius retaliated by a bull, drawn up by Fontana and dated June 10, 1809, excommunicating the invaders; and to prevent insurrection Miollis—either on his own responsibility, as Napoleon afterwards asserted, or by order of the latter—employed General Radet to take possession of the pope's person. The palace on the Quirinal was broken open during the night of July 5th, and, on the persistent refusal of Pius to renounce his temporal authority, he was carried off, first to Grenoble, thence after an interval to Savona, and in June, 1812, to Fontainebleau. There he was induced on the 25th January, 1813, to sign a new concordat, which was published as an imperial decree on the 13th February. On conference with the cardinals, however, Pius withdrew his concessions and proposed a concordat upon a new basis. At first no attention was paid to this, and when after the French armies were driven from Germany Napoleon endeavored to purchase a new concordat by offering to restore the papal possessions south of the Apennines, Pius refused to treat with him from any place other than Rome. The order for his departure thither reached him on the 22d January, 1814, and after a brief delay at Cesena he entered Rome on the 24th May, 1814. With his states restored to him by the congress of Vienna and freed from the Napoleonic terror, he devoted the remainder of his life to social and ecclesiastic reform in accordance with the modern spirit, suppressing many of the feudal survivals, abolishing torture, reconstituting civil and judicial procedure, and giving effect to many beneficial changes introduced by the French. His long and in many respects admirable pontificate of more than twenty-three years' duration was brought to a close by an accident. His thigh having been broken by a fall in July, 1823, acute inflammation supervened and he died on the 20th August in that year. His successor was Leo XII.

PIUS VIII. (Francesco Xaviero Castiglioni), pope, was born at Cingoli near Ancona, on November 20, 1761. After having been appointed bishop of Montalto in 1800, cardinal and bishop of Cesena in 1816, and bishop of Frascati in 1821, he was in 1829 declared successor of Leo XII. His unimportant pontificate was of little more than sufficient duration to enable him to give expression to convictions largely characterized by narrowness and intolerance in his choice of Cardinal Albani as head of affairs, and in his encyclical letter against the liberty of the press, civil marriage, and similar impious institutions. His death took place at Rome on the 30th November, 1830. He was succeeded by Gregory XVI.

PIUS IX. (Giovanni Maria Mastai Ferretti), pope from 1846 to 1878, was born 13th May, 1792, at Sinigaglia, near Ancona, the fourth son of Count Jerome and the Countess Catherine Vollazi of the same place. The family of Mastai is of ancient descent, and its representatives have frequently filled the office of mayor in Sinigaglia. The title of count was first given to its head by Prince Farnese, duke of Parma, towards the close of the 17th century. Somewhat later the elder branch, having become allied by marriage with the last representative of the family of Ferretti, assumed its second name. From the age of eleven to sixteen Giovanni received his education at the college of Piarists at Volterra, in Tuscany; a liability to epileptic fits precluded, however, much application to study. On one occasion, when thus attacked, he fell into a lake and was only saved from drowning by the intervention of a herdsman who observed the occurrence. A handsome lad, with a certain charm of expression and demeanor which characterized him throughout his life, he frequently attracted the attention of visitors to the college. On leaving Volterra, he conceived an attachment for a lady (afterwards a duchess), and the non-requital of his passion is said to have been a main cause of his resolution to enter the church. In 1818 he was invited to accompany Monsignor Odescalchi, a prelate attached to the pontifical court, on a visitation tour in his native province. On returning to Rome, he was encouraged by Pius VII. to persevere in his design of entering the church, was admitted (18th December, 1818) to deacon's orders, and celebrated his first mass at the church of S. Maria del Falignani, on Easter Sunday, 1819. His benevolent disposition had led him about this time to interest himself in an orphanage, familiarly known by the name of "Tata Giovanni," and he was now appointed by Pius to preside over the establishment, and continued to fill the post for five years. In 1823 he accompanied the apostolic delegate, Monsignor Muzi, to the republic of Chili, and remained at Santiago for two years, actively engaged in missionary labors. In 1825 he returned to Rome, was made a canon of S. Maria in the Via Lata, and appointed to preside over the hospice of San Michele, a vast charitable institution for destitute children. Here he remained somewhat less than two years, being promoted 21st May, 1827, by Leo XII., to the archbishopric of Spoleto. His residence in that city was marked by many acts of benevolence, and especially by the foundation of a large orphanage where poor children were maintained and educated, and also taught some mechanical art. Here, as at Rome, his genuine kindliness and conciliatory disposition made him deservedly popular, but his defects were also not less apparent. He had allowed the hospice to become financially embarrassed, and after succeeding to the episcopal office showed himself incapable of duly regulating his own expenditure.

During the insurrectionary movements which followed upon the election of Gregory XVI. to the papal chair, headed by Menotti and the two Napoleons—Charles Louis (afterwards emperor of the French), and his brother—Archbishop Mastai did his best to protect the insurgents. He disapproved of the reactionary policy of the new pope, and strongly resented the oppressive rule of the Austrians. When Napoleon (against whom sentence of death had been pronounced) fled to Spoleto, the archbishop, to whom he applied for help, obtained for him the services of an officer who conducted him beyond the frontier to a place of safety. In the following year (1832) he was translated to the bishopric of Imola, and a few years later was elected a cardinal, being reserved *in petto* in the consistory of 23d December, 1839, and proclaimed cardinal 14th December, 1840. It was not until overcome by the persuasion of others that Gregory XVI. consented to bestow this dignity on his future successor. He is said to have expressed his conviction that Mastai's liberal tendencies and impulsive disposition unfitted him for power, and that if he should ever become pope he would be the ruin of the church. During the tenure of his bishopric at Imola, Mastai gained additional reputation by the foundation of various philanthropic institutions and marked simplicity of life.

On the death of Gregory XVI. he repaired to Rome, and on the evening of 16th June, 1846, was elected to the papal chair as Pius IX., having chosen this name out of respect for his predecessor in the see of Imola, Pius VII. His election, at the final scrutiny, proved to be unanimous, the cardinals Patrizzi and De Angelis throwing all their influence in his favor. On the following morning, when it was too late, the Austrian ambassador received instructions from his government to veto the new pope's election.

Pius's first act in his new capacity was to proclaim a general amnesty for political offences, whereby thousands of unhappy beings who had dragged out weary years in prison or in exile, ignorant, many of them, even of the offences with which they were charged, were restored to society. With genuine catholicity of feeling he visited and relieved even the poor Jewish population in the city. He authorized the construction of railways, organized a civil guard, and considerably modified the restrictions on the press. In order to develop further reforms he instituted a commission largely composed of laymen; and in 1847 he brought forward his scheme of a *Consulta*, or council of state, designed to assist him in the general temporal government. But, notwithstanding these concessions, the supreme power remained in the hands of ecclesiastics, and no measure passed by the council could acquire validity until it had been examined and approved in a conclave of cardinals. Hence, although both MAZZINI (*q.v.*) and Garibaldi were among his avowed supporters, the liberal party were still far from satisfied. His policy was regarded, on the one hand, with extreme dissatisfaction by Austria, and on the 17th July, 1847, that power sent a force of 1500 men into Ferrara, where she was entitled by the treaty of 1815 to maintain a garrison. To this direct menace Pius replied, by counter demonstrations and an indignant protest, but hostilities were ultimately averted. His policy was viewed with not less dislike at the court of Naples, but by the rest of Italy and throughout Europe he was at this time regarded as the champion of the national rights of his countrymen. Such was the posture of affairs when the revolution in Paris (February, 1848) fanned into flames the already smouldering elements of insurrection throughout Europe. The Austrians were driven out of Milan; a republic was proclaimed in Venice (see ITALY, vol. xiii. p. 498); and a "free Italy" became the general cry. At first Pius, who felt but little sympathy with the views represented by the son of Philippe Égalité, seemed disposed to head the movement. He dismissed his state-secretary, Gizzi, an irresolute and timorous politician, and appointed Cardinal Ferretti in his place. On 14th March, 1848, appeared the *Statuto Fondamentale*, a more complete scheme for the reorganization of the temporal government of the papal states. By this two deliberative assemblies were created,—the first, the high council, the members of which were to be nominated by the pope himself for life; the second, the council of deputies, to be elected by the people, and to be intrusted with the chief voice in all questions relating to taxation. Over both these bodies, however, the college of cardinals retained the supreme authority; without its consent no measure could acquire legal validity. Liberty of the press was promised, but the ecclesiastical censorship was to be retained. A new ministry was formed, which, with two exceptions (Antonelli and Morichini), was composed of laymen. But at this juncture Pius began to waver. Although he had hitherto shown no sympathy with the Jesuits, he endeavored to protect them against the measures now brought forward with a view to their expulsion, and when his general, Durando, crossed the Po without his orders, and denounced the Austrians as "the enemies of the cross of Christ," he disowned, in an allocution (29th April), all intention of participating in an offensive war for the purpose of rectifying the boundaries of Italy, and at the same time disavowed all complicity in the schemes then in agitation for creating an Italian federal republic, with himself as the nominal head. This apparent desertion of the national cause, at a time when the public mind had been roused to the highest pitch of excitement by the course of events at other centres, created an irreparable breach between Pius and the people. His new chief minister, Mamiani, who wished to see him a constitutional monarch, advocated further concessions—the handing over of the political government to the new assemblies and a responsible ministry. But after the Austrian successes in the north and Radetsky's entry into Milan (5th August), Mamiani was dismissed, and his place was filled by Count Rossi, the French ambassador, a statesman of signal ability and intrepid character, but of conservative views. On the 15th November, 1848, as Rossi was alighting at the steps of the house of assembly, he was assassinated in broad daylight. It was an ominous symptom of the prevailing temper of the capital that this atrocious act elicited no expressions of disapproval in the assembly, and drew forth no marks of sympathy with the victim's family. Two days later a numerous mob, largely composed of disbanded soldiers, assembled in the square of the Quirinal, and proffered fresh demands, at the same time intimating their intention, if these were not conceded, of commencing a general massacre of the inmates, excepting only the pope himself. After his secretary, Palma, had been shot by a bullet, Pius, in order to avert further bloodshed, made the requisite concessions, and assented to the formation of a new ministry, while he himself was made a virtual prisoner. On the 24th November he effected his escape, with the connivance of the French Government, to Gaeta, disguised as a dependant of Count Spaur, the Bavarian minister. Thus terminated what has been described as "the first and only attempt of a pope to govern in a liberal spirit."

From Gaeta he published a formal protest against the violence to which he had been subjected, and whereby his latest enactments had been extorted from him, at the same time declaring all measures decreed in Rome during his absence null and void. Gioberti, the Sardinian minister, endeavored without success to gain his concurrence in a new scheme for the formation of an Italian federation of princes. In the following February it was resolved in a consistory of cardinals to appeal to the chief Catholic powers (France, Austria, Spain, and Naples) for their aid in bringing about the re-establishment of the temporal sovereignty. About the same time (3d February, 1849), as if to mark his undisturbed sense of his spiritual supremacy, Pius himself addressed an encyclic to the superior Catholic clergy throughout the world, enjoining that on appointed days of the year the doctrine of the Immaculate Conception B.V.M. should be preached throughout their dioceses. The decisive defeat of the Sardinian forces at Novara by Radetsky (23d March, 1849) encouraged the papal party now to demand that Pius should be reinstated at Rome without any conditions being attached to his restoration. This demand created a divergence of opinion among the above-named powers; eventually General Oudinot landed at Civita Vecchia with 10,000 French soldiers, and De Tocqueville, the French minister for foreign affairs, sought to induce Pius to resume his sovereignty on the basis of the *Statuto Fondamentale*. This he resolutely refused to do, and after the occupation of Rome by Oudinot's forces he was permitted to return (12th April, 1850), unfettered by any condition whatever.

Pius returned an altered man in relation to his state policy, in which, in fact, he was from this time guided almost entirely by Antonelli. A certain profession of a design to reform abuses was indeed made, but the former ecclesiastical ascendency in the government was re-established, while the pope entered into the closest relations with the Jesuit party. Notwithstanding his specious disclaimers of any desire to take revenge for the past, the *Documenti Officiali*, published in 1860, prove that little mercy was shown to those who were suspected of disaffection. As, however the continuance of the French occupation relieved him from any anxiety with respect to the maintenance of order, Pius was enabled to devote his attention chiefly to the objects which undoubtedly lay nearest to his heart,—the more complete definition of Roman dogma and the enhancement of the prerogatives of his office. In this direction his views had never been characterized by any liberality, as is sufficiently shown by his encyclic of 9th November, 1846, his letter to the archbishop of Cologne (3d July, 1847), and his allocution of 17th December, 1847, in which all the modern tendencies to a more philosophic interpretation of doctrine are visited with unqualified condemnation. He now proceeded skilfully to avail himself of the reaction that began to set in, especially in Germany and in England, after the repression of the revolutionary movements, by taking, as the burden of his allocutions, the essential connection between political innovation and freedom of scientific or religious thought. The activity of the Jesuits was studiously encouraged; the "beatification" of several eminent deceased members of their order was proclaimed; and lives of the saints, full of marvellous and legendary incidents, were widely circulated among the poorer laity. A combination of circumstances, at this period, largely contributed to the success of these efforts both in Europe and in America. By the bull "Ineffabilis Deus" (8th December, 1854) the doctrine of the immaculate conception was formally "defined," as a dogma binding on the acceptance of all the faithful, and in pamphlets favorable to the assumptions of the curia it was pointed out that the supreme pontiff had thus defined the doctrine *without recourse to any council*. In 1862 the canonization of six hundred and twenty missionaries, who had met with martyrdom in Japan some two centuries and a half before, was made the occasion of an imposing ceremonial. In a letter (11th December, 1862) to the archbishop of Munich, the teaching of Frohschammer, a distinguished professor of philosophy in the university in that city, was singled out for severe reprobation. The famous encyclic *Quanta cura*, and the *Syllabus*, or list of prevalent errors calling for special reprobation, appeared in December, 1864.

The war between France and Austria and the treaty of Villafranca (8th July, 1859; see **Italy**, vol. xiii. p. 500) seemed at one time likely to result in placing the temporal power on a basis somewhat resembling that indicated in Gioberti's pamphlet of 1843, and the ultramontane party waited with lively expectation the assembling of the congress. Among the inhabitants of the Romagna themselves, however, discontent with the political administration was intense. The papal rule had become almost as oppressive as that at Naples; and the prisons of Rome were filled with inmates against whom no more definite charge could be brought than that of suspected disaffection towards the Government. The manner in which the currency had been tampered with was alone sufficient to produce the gravest discontent, and the *lira papalina* was eventually accepted at the money-changers' only at a heavy loss to the holder. When, in the spring of 1857, Pius visited central Italy, it was observed that, while in other provinces he was greeted with enthusiasm as the pope, in his own dominions he was received with sullen coldness. A pamphlet published at Paris in December, 1859 (ascribed to imperial inspiration), after describing the condition of the Romagna, openly raised the question of the continuance of the temporal power, and suggested that it would at least be desirable that it should be restricted to the capital itself. Pius replied in an encyclic issued on the 19th of the ensuing January—a document since widely known as his *Non Possumus*. His obstinacy proved of no avail. The Romagna was occupied by Sardinia, and the Central-Italian states shortly afterwards formed themselves into a league to prevent its reoccupation by the pontifical forces. Antonelli rejoined by raising a motley force, composed of French, Belgians, Bavarians, and Irish, who were placed under the command of Lamoricière, an able French officer who had seen active service in Algiers. There can be no doubt that, in making this apparently hopeless effort, the curia was deluded by the belief that, if matters proceeded to extremities, France would intervene in its behalf. After a stubborn resistance at Ancona, the superior forces of Sardinia prevailed, and in September, 1860, the whole of the States of the Church, with the exception of the *patrimonium Petri* (see **Popedom**), were annexed to the kingdom of Victor Emmanuel.

From the reduction of Ancona to the year 1870 Pius was maintained in Rome only by a French garrison. The emperor of the French was reluctant to appear altogether to desert the papal cause, while Cavour was unwilling, in like manner, to proceed to extremities. After the capture of Garibaldi at Aspromonte, however, Victor Emmanuel felt himself strong enough to put in a formal claim for Rome; and it was eventually arranged, by the convention of 15th September, 1864, that the French should withdraw from the city before the end of 1866. This stipulation was duly observed, and on the 11th December, 1866, the last of the French forces quitted the capital. The engagement was, however, virtually violated by the entry, in the following year, of the Antibes legion, and for some time longer the French soldiery continued to ward off both the daring assaults of Garibaldi and the more insidious approaches of Ratazzi. In this manner, at the outbreak of the war of 1870, France had come again to be looked upon as the ally of the papacy; and the overweening claims put forward by Pius in convening a general council to proclaim the dogma of Papal Infallibility were generally interpreted as in a certain sense correlative with the aggressive designs of France on Protestant Germany. The dogma was decreed in the Vatican on the 18th July, but not without strenuous opposition on the part of some of the most distinguished members of the Catholic episcopal order, who, at the same time were stanch supporters of the temporal power (see **Old Catholics**). At nearly the same time the occupation by the French came definitively to an end. Their forces were withdrawn from Civita Vecchia at the outbreak of the war, when the Duc de Gramont announced that his Government relied on the convention of 1864, whereby Italy was bound not to attack the papal territory. That territory being now, however, again exposed to the dangers of revolution, Victor Emmanuel, on receiving the tidings of the battle of Gravelotte, notified to Pius that "the responsibility of maintaining order in the peninsula and the security of the Holy See" had devolved upon himself, and that his army must enter the pontifical dominions. This intimation was received by Pius with demonstrations of the liveliest indignation, but the appearance of the Sardinian troops was hailed by his own subjects with enthusiasm. On arriving outside Rome, General Cadorna summoned the garrison to surrender, and after a short bombardment the white flag was hoisted. On the following day (21st September, 1870) the Zouaves, some nine thousand in number, after receiving, as they stood massed in the square of St. Peter's, the pontifical blessing, marched out of Rome, and the temporal power of the pope had ceased to exist.

For the rest of his days Pius IX. remained unmolested at the Vatican, while the king resided at the Quirinal. The pontiff was virtually a prisoner; and his position, although viewed with comparative indifference in Rome, was regarded with not a little sympathy by the Catholic world at large. The tribute of Peter's Pence was revived in order to supply, in some measure, the loss of his alienated revenues; and numerous pilgrimages, in which distinguished and wealthy individuals took part, were made to St.

Peter's from all parts of Catholic Christendom, and especially from England. His advanced years, fine presence, dignified demeanor, and elasticity of spirits (unbroken by his adverse fortunes) combined to invest both the person and the office of the pope with a kind of fascination for devout minds, which those about him well understood how to turn to the best advantage. Occasionally, however, his naturally impetuous temper still manifested itself. The complicity of the Roman Catholic clergy with the Polish insurrection of 1863 had been punished by Russia with excessive rigor, and, on receiving the Russian deputies who came to offer the customary felicitations on New Year's Day, 1866, Pius so far forgot the proprieties of the occasion as to himself address them in terms of reproach. A suspension of diplomatic relations ensued; and Russia now eagerly availed herself of the pretext afforded by the promulgation of the new dogmas to aim a severe blow at Roman Catholic influence within her dominions, by annexing to the Russian Church the bishopric of Chelm, with a population of over 300,000 souls. Pius showed his resentment by espousing the side of Turkey in the struggle of that country with the Russian power. On the 3d June, 1877, he celebrated the fiftieth anniversary of his consecration to the archbishopric of Spoleto, and the event was made singularly memorable by the spectacle of numerous deputations, bearing costly offerings, from all parts of the world. Pius died on the 8th of the following February, and was succeeded by Cardinal Pecchi as Leo XIII.

The life of Pius has been written by the late J. F. Maguire (2d ed., 1878), and by Leopold Wappmannsperger, *Leben und Wirken des Papstes Pius des Neunten* (Ratisbon, 1878). Both authors write from the ultramontane point of view, but the latter much more in detail, giving original documents and information respecting events subsequent to 1870 not to be found in English sources. Nippold's *Handbuch der neuesten Kirchengeschichte*, vol. ii., supplies an outline of the papal policy in connection with other contemporaneous religious movements; and a concise but more impartial sketch will be found in Ranke, *Die römischen Päpste* (7th ed.), ii. 162–208. The literature connected with the Vatican Council is given under OLD CATHOLICS. (J. B. M.)

PIZARRO, FRANCISCO (*c.* 1471–1541), discoverer of Peru, and the principal hero of its conquest, born at Truxillo in Estremadura, Spain, about the year 1471, was an illegitimate son of Gonzalo Pizarro, who as colonel of infantry afterwards served in Italy under Gonsalvo de Cordova, and in Navarre, with some distinction. Of Pizarro's early years hardly anything is known; but he appears to have been only poorly cared for, and his education was certainly neglected. Shortly after the news of the discovery of the New World had reached Spain he was in Seville, and thence found his way across the Atlantic; there he is first heard of in 1510 as having taken part in an expedition from Hispaniola to Urabá under Alonzo de Ojeda, by whom, in his absence, he was entrusted with the charge of the unfortunate settlement at San Sebastian. Afterwards he accompanied Balboa to Darien; and under Balboa's successor, Pedrarias, he received a "repartimento," and became a cattle farmer at Panama, where in 1522 he entered into a partnership with a priest named Hernando de Luque and a soldier named Diego de Almagro for purposes of exploration and conquest towards the south. An expedition along the coast of New Granada (November, 1524) was unfortunate, but supplied various confirmations of rumors previously heard as to the existence of a great and opulent empire farther to the south. On March 10, 1526, Pizarro, Almagro, and Luque renewed their compact, but in a much more solemn and explicit manner, to conquer and divide equally among themselves this empire still undiscovered, and Pizarro and Almagro, with a force of about one hundred and sixty men, again sailed from Panama. The force was too small to effect much at the time, and was at length recalled by the governor, but Pizarro was not to be shaken, and, though he was left for months with but thirteen followers on a small island without ship or stores, persisted in his enterprise till at length he had coasted as far as to about 9° S. lat., and obtained distinct accounts of the Peruvian empire. The governor still showing little disposition to encourage the adventurers, Pizarro resolved to apply to the sovereign in person for help, and with this object sailed from Panama for Spain in the spring of 1528, reaching Seville in early summer. After long and tedious delays, the queen, in Charles's absence, executed at Toledo on 26th July, 1529, the famous *capitulacion* by which Pizarro was upon certain conditions made governor and captain-general of the province of "New Castile" for the distance of 200 leagues [842 miles by modern Spanish measure] along the newly discovered coast, and invested with all the authority and prerogatives of a viceroy. One of the conditions of the grant was that within six months he should raise a sufficiently equipped force of two hundred and fifty men, of whom one hundred might be drawn from the colonies; but this he had some difficulty in fulfilling. Sailing from San Lucar clandestinely (for his due complement was not yet made up) in January, 1530, Pizarro was afterwards joined by his brother Hernando with the remaining vessels, and when the expedition left Panama in January of the following year it numbered three ships, one hundred and eighty men, and twenty-seven horses. A footing was established on the mainland at Tumbez, whence Pizarro set out for the interior in May, 1532. San Miguel de Piura was founded a few weeks afterwards, and Caxamarca entered on November 15th. The subsequent movements of Pizarro belong to the history of PERU (see vol. xviii. p. 690; and, for authorities, comp. p. 692).

PLAGUE (λοιμός, *Pestis*, *Pestilentia*). This name has been given to any epidemic disease causing a great mortality, and in this sense was used by Galen and the ancient medical writers, but is now confined to a special disease, otherwise called Oriental, Levantine, or Bubonic Plague, which may be shortly defined as a specific febrile disease, transmissible from the sick to healthy persons, accompanied usually by buboes and sometimes by carbuncles. This definition excludes many of the celebrated pestilences recorded in history —such as the plague of Athens, described by Thucydides; that not less celebrated one which occurred in the reign of Marcus Aurelius and spread over nearly the whole of the Roman world (164–180 A.D.),[1] which is referred to, though not fully described, by the contemporary pen of Galen; and that of the 3d century (about 253), the symptoms of which are known from the allusions of St. Cyprian (*Sermo de Mortalitate*). There is a certain resemblance between all these, but they were very different from Oriental plague.

Symptoms.—There are two chief forms: (1) mild plague, *pestis minor*, larval plague (Radcliffe), *peste fruste*, in which the special symptoms are accompanied by little fever or general disturbance; and (2) ordinary epidemic or severe plague, *pestis major*, in which the general disturbance is very severe. Cases which are rapidly fatal from the general disturbance without marked local symptoms have been distinguished as fulminant plague (*pestis siderans*, *peste foudroyante*).

1. In the minor form of the disease spontaneous swellings of the glands occur, chiefly in groins and armpits, but also in neck or other parts, which either undergo resolution or suppurate. There is a certain amount of fever; the temperature is rarely high, but has been known to be 104° Fahr. The duration of the disease is ten to twenty days usually, but may be eight weeks, for most of which time the general health is little impaired and the patient able to go about as usual. It rarely, if ever, causes death, the only fatal case at Astrakhan in 1877 having been so through a complication. The disease is not obviously contagious;

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[1] Amm. Marcell., xxiii. 7; see Hecker, *De Peste Antoniana*, Berlin, 1835.

whether it is propagated by infection or not is unknown. It is possibly rather of a miasmatic character. This form of disease has sometimes preceded or followed severe epidemics, as in Mesopotamia (Irak) on several occasions, 1873–78, and in Astrakhan, 1877; its importance in relation to the origin of plague has only lately been appreciated.[1]

It might be expected that gradations would be found connecting this form with the severe epidemic form; but this appears to be not usually the case, the latter form appearing somewhat suddenly and abruptly. Hence the minor form has probably often been regarded as a distinct disease, even when observed in plague countries.

2. As regards *pestis major*, or severe plague, the symptoms appear to have been nearly the same in all great epidemics for several centuries, if not for two thousand years, but will be best given from modern observations, such as those of Surgeon-Major Colvill, Dr. Cabiadis, and others in Irak, and recent observers in India. The early symptoms are sometimes like those of ague (shivers, often long continued, and pains in the limbs), but combined with nervous symptoms. The patient becomes distracted, tosses about in constant fear of something he cannot describe, has a difficulty in understanding the questions put to him, and is slow in answering. He is often described as staggering like a drunken man. There is severe headache, intense thirst, and severe pain in the epigastrium. The eyes are red and turbid; the tongue swollen, dry, and fissured, sometimes black, sometimes remarkably white (Colvill). This condition may pass into coma even before fever sets in. In other cases bilious vomiting is the earliest symptom. The fever which sets in may last twenty-four to thirty hours, or more. The temperature may be 100° to 107° Fahr., or even higher; but in the most rapidly fatal cases there may be little or no fever. Generally there is obstinate constipation, but sometimes diarrhœa. Besides these symptoms there are certain special ones especially characteristic of plague.

(*a*) Buboes or glandular swellings are observed in all except very rapidly fatal cases. They occur in 45 or 50 per cent. of the cases in the groin, in 35 per cent. in the axilla, also less frequently in the neck or other parts. These swellings may occur before the fever, simultaneously with it, or some hours after it has set in. A sudden pain like that of a stab is felt in some region of the body, which has given rise to the superstition that the unfortunate victim was wounded by the arrow of an invisible demon,—a belief recorded in Constantinople in the 6th century, and said still to survive in Mohammedan countries. The buboes may suppurate, and free discharge of matter from them has in all times been held to be a favorable sign and conducive to recovery.

(*b*) Carbuncles were observed in about 2½ or 3 per cent. of the cases in recent epidemics in Irak. They are always an unfavorable sign.

(*c*) Petechiæ or hæmorrhagic spots on the skin have always been regarded as signs of the worst omen. Under the name of "tokens" they were considered in the English epidemics of the 16th century as the infallible signs of approaching death. "They appear generally only a few hours before death" (Colvill). Hodges (1665) noticed hardness which showed the existence of hæmorrhage under the skin. The skin is sometimes so covered with petechiæ as to become of a dark livid hue after death, recalling the name Black Death (Cabiadis).

The occurrence of the above symptoms, especially the first, in an idiopathic fever attacking many persons at one time is sufficient to make the diagnosis of plague.

A very notable and fatal form of the disease is that in which hæmorrhages from the lungs, stomach, bowels, nose, etc., occur. These are of the worst omen, and are seen in some cases where there are no buboes, and which are rapidly fatal. This was observed in Irak in recent epidemics, in the outbreak on the Volga in 1878–79, and in the plague of India. It was a noticeable symptom in the black death, and was observed even in the plague of the 6th century. The bleeding is mostly from the lungs, and is sometimes associated with other symptoms of lung affection. This form of the disease appears, however, to have no distinct historical or geographical limit. A similar hæmorrhagic form has been observed in small-pox and scarlet fever, and is always extremely fatal.

In all plague epidemics cases occur in which death takes place very rapidly, even within twenty-four hours, without the development of the special symptoms of the disease. Such cases are reported by Diemerbroek, Hodges, and others in the 17th century, and have been observed in recent epidemics in Irak, as well as in the recent plague on the Volga. Some are more like cases of poisoning than of infection, and much resemble the instances of death from the exhalations of dead bodies (cadaveric poisoning) which are met with from time to time. It is these which have given rise to the expression fulminant plague.

Duration.—The duration of an attack of plague may be from some hours to a month. Three-fifths of the cases observed by Mr. Colvill were fatal on the third day, and the majority of cases in India had the same termination (Francis). Five-sixths of fatal cases end by the fifth day. Most of those who survive the fifth day get well; after the seventh day a patient in Baghdad was considered by his friends safe; and in Mr. Colvill's cases only 4 per cent. of fatal cases died after the tenth day. In non-fatal cases with suppurating buboes the disease may be protracted to two or three weeks or a month.

Mortality.—Plague is the most fatal of all known diseases which affect large numbers of people. The mortality, according to official registers in Baghdad, was 55.7 per cent. of those attacked. Dr. Cabiadis thinks this too high, owing to many cases of recovery not being reported. But in some epidemics the proportion of fatal cases is much higher. In Vetlanka it was about 90 per cent., and in some other villages on the Volga every person who took the disease died. The older accounts do not give the proportion of deaths and attacks.

Morbid Anatomy.—Examinations after death have not done much to elucidate the nature of plague, except negatively. The appearances are those of death from an acute infective disease, and resemble those of typhus, except for the special affection of the lymphatic glands. The brain and the lungs are found to contain excess of blood; the right side of the heart distended, the blood dark-colored and undergoing rapid decomposition.[2] The spleen is found enlarged, and in a less degree the liver. The stomach and intestinal canal often show signs of inflammation and hæmorrhage, sometimes ulceration. The characteristic swelling of the lymphatic glands, both external and internal, is often accompanied by inflammation of the cellular tissue around. Petechial patches are sometimes found on the internal organs.[3]

Pathology of Plague.—All that is known of plague goes to show that it is a specific febrile disease depending on the reception into the body of a specific organic contagion which becomes multiplied in the body of the patient. Analogy makes it very probable that this contagion is a living organism of the class *Bacteria*, but the suspected organism has not yet been discovered. The nearest ally of plague is typhus fever, so that some authorities have spoken of it as the typhus of hot climates, modified by temperature, etc., but this opinion does not appear to have ever been held by any competent physician who has examined the disease at first hand. It appears to be as distinct from typhus as this is from enteric fever, or other so-called typhoid diseases. It has also been thought that plague is related to intermittent or remittent malarious fevers; but the most recent observations show that there is no real connection between these diseases. In India, says Dr. Francis, neither intermission nor remission has ever been observed in plague. It is quite distinct from and in no way modified by the types of fever that are caused by malaria. Dr. Cabiadis speaks to the same effect of plague in Irak, and insists that the physical conditions which favor the production of marsh poison are not necessarily favorable to plague.

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[1] Payne, *Trans. Epidem. Soc. of Lond.*, iv. 362; Tholozan, *La Peste en Turquie*, Paris, 1880; J. N. Radcliffe, *Report of Local Government Board*, 1879–80 (Supplement, pp. 24, 49), and article "Plague," in Quain's *Dictionary of Medicine*. London, 1882.

[2] This post-mortem decomposition of the blood is doubtless the cause of some appearances described with great particularity in the older accounts.

[3] Our knowledge of the morbid anatomy of plague is derived almost entirely from the observation of the French physicians in Egypt during the epidemic in 1835–36. Earlier observations are of no value, and in later epidemics of Irak and Russia none have been made. In India Drs. Pearson and Francis made a few autopsies. Clot-Bey, *De la Peste en Egypte*, Paris, 1840; Bulard, *De la Peste Orientale*, Paris, 1839; Francis, *Indian Annals of Medical Science*, vol. i., 1854.

External Conditions of Plague.—The nature of the soil has little influence on plague. It may flourish in alluvial deltas, on calcareous ridges or granitic mountains. Moisture in the soil has generally been thought to be an important factor in its production, but, though often found in marsh situations, such as the banks of the Nile, the Euphrates, or even the Volga, it also occurs in India at elevations approaching 7,000 feet, and in Kurdistan at 5,000 to 6,000 feet above the sea.

The temperature most favorable to plague is a moderately high one. The disease is unknown in the tropics.[1] When prevalent in Egypt it was said never to penetrate farther south than Assouan. It has not crossed the plains of India within historic times. Where the disease does occur, a temperature of 80° to 85° or more, combined with absence of moisture, usually stops the epidemic. In Egypt it was observed to cease as an epidemic almost suddenly about the 22d to 24th of June, and not to begin again till September. In Irak it dies out suddenly during the summer. When the temperature rises above 86° it begins to diminish; and it ceases abruptly at a temperature of 113°. In India it has been observed by Dr. Francis when the temperature of his tent was 83° to 95°, or in a grass hut to 105°, while the air was moist; but he thinks a lower temperature with dryness renders the poison inert.

On the other hand, in northern countries, the disease is usually checked by the cold of winter, starts up in the spring, and is most active in August and September. To this rule there have been some remarkable exceptions, such as the epidemic on the Volga in 1878–79, which raged during severe winter weather, and the great plague of Moscow in 1770.

Sanitary Conditions.—Of all the co-operating causes of the plague *uncleanliness* is the most powerful,—meaning by this the accumulation of decaying animal matter around human bodies or dwellings. The saturation of the soil with filth is perhaps the most important point. A plague seat in Mesopotamia is thus described by Colvill: "The ground is so saturated with moisture that the refuse of the village is neither absorbed nor evaporated, but . . . acquires the form of a bluish-black oily fluid, which surrounds the huts and covers the paths, and stains the walls 2 feet from the ground; and in fact the village is in such a state of filth that it requires to be seen to be believed." Of the people among whom the Pali plague of India raged it is said "they were filthy beyond conception" (Francis). There can be little doubt that European cities in the Middle Ages, and down to the 17th century, presented very similar conditions. These conditions may be considered to act by supplying a suitable environment for the life and growth of the organized poison (or bacterium) outside the human body. Where these are wanting one of the main factors in the spread and permanence of the disease will be absent, a fact which makes it probable that increased cleanliness is the chief cause of the disappearance of plague from Europe.

Overcrowded dwellings, especially with deficient ventilation, greatly favor the spread of the disease; but this is not necessarily correlative with density of population, and plague may flourish in thinly-peopled countries.

Of social conditions *poverty* has by far the most powerful influence on the spread and development of plague. Many plague epidemics have followed on years of famine, or been connected with destruction of crops and cattle. The races among which the disease is endemic are almost without exception under-nourished, if not destitute. In the villages on the Volga there appeared to the writer, in 1879, to be little destitution, though the diet of the people was very meagre. In all city epidemics the poor are the chief or almost the only sufferers. This is as true of Baghdad in the 19th century as it was of London in the 17th. Those of the upper classes who have been attacked have been chiefly doctors, clergy, officials, and others whose occupations take them among the sick.

Origin and Spread of Plague.—Although the above-mentioned conditions are those in which plague originates, and may be considered in a general way essential to its continued existence, it is plain that they do not account for its origin. Poverty, overcrowding, filth, and marsh soil, with a temperature suited to plague, occur in many parts of the world where this disease has never been heard of or has ceased to exist. The geographical distribution of diseases cannot, any more than the distribution of plants or animals, be explained by climatic causes alone. With regard to plague it is quite clear that there are some parts of the world where it is at home, or, as the phrase is, "endemic." In other parts it is probable, (or, as some think, certain) that its existence, and even its periodical recurrence, depend on importation from an endemic centre. Although it is not always easy to distinguish between these cases, they must be considered separately.

In the case of an endemic disease we suppose that the poison is either kept in existence by continued transmission from one case to another, or that it can subsist outside the human body in soil, water or otherwise. The first mode of existence is that of a pure contagious disease, such as small-pox; and it is plain that this mode of continued existence obtains in the case of plague also. It is not, however, clear that the second may not also be one of the modes of existence of plague, which would then be a so-called "miasmatic" disease like ague, as well as a contagious one. In India, for instance, the disease appears as if it depended on a poison in the soil, since it returns years after to the same spot, appearing in many villages simultaneously; and some morbid influence causes the death of animals (rats) which live under ground. Similar facts have been observed in China; and, if further inquiry should confirm the hypothesis, it would show that plague is (like anthrax or the "steppe murrain" of cattle) both miasmatic and contagious. If so, there is no difficulty in supposing the disease to be carried by contagion to a distant part, and there to be established in the soil, for a longer or shorter period, as the conditions are more or less favorable. The adoption of this hypothesis would remove many of the difficulties attending the explanation of plague epidemics, and to some extent reconcile the controversies of the last three centuries between the "contagionist" and "non-contagionist" schools. It has been maintained by the former that European epidemics have always been caused by the importation of the disease from its home in the East, by the latter that it arose on European soil in the same way as in Egypt or Syria.

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[1] [See pp. 178-9. Tong-king Gulf and a part of Yunnan are tropical.—Am. Ed.]

In the case of an imported non-endemic disease, the only question which arises is how the importation is effected,—whether the disease may be brought by the air alone, whether by infected persons only, or whether also by objects which have been in close relation to infected persons. Transmission of the disease by the air cannot be pronounced impossible; and there are facts to show that it is even probable with distances measured by yards, or possibly even hundreds of yards; but there is no evidence whatever that the disease has ever been carried by the air over distances measured by miles. Transmission of the disease by infected persons, over longer or shorter distances, and from one country to another, is an established fact. Transmission by infected objects over great distances and from one country to another seems less clearly established. The last two cases must be separately considered.

1. It is clear that the first necessary condition to such transmission is *contagion*, or transference of the disease from the sick to the healthy. The existence of contagion is shown by such facts as these: when a case of plague breaks out in a house the other inmates are extremely likely to take the disease; and even in severe forms the plague does not cease till it has affected all or nearly all the household. This is indisputably an almost universal law. In the plague of London in 1603 it was said the disease entered hardly any house but it seized all that lived in it. And in 1879, on the Volga, in one village, as was ascertained by Mr. Colvill and the present writer, the plague attacked five houses containing thirty-three persons, all of whom except two took the disease and died. In this respect plague resembles typhus. In the next place the disease will spread from an infected house to persons who have close relations with it. Thus in the villages on the Volga it was noticed that after one family was affected cousins and relations by marriage were the next to be attacked. Doctors and those visiting the house are also exposed to the risk, though in a less degree. In Vetlanka on the Volga three physicians and six surgical assistants died. On the other hand, doctors in some instances have singularly escaped from being attacked by the disease. In Egypt, in 1835, out of ten French physicians engaged one only died, nor was this immunity secured by any precautions. These experiences do not prove that the disease is not contagious, but they modify the exaggerated notions which have been held on the subject. The facts appear to be expressed by saying that it may undoubtedly be communicated from one person to another, but chiefly by breathing the air of the sick room, and this generally from prolonged, not from momentary exposure,—so that the possibility of communication by chance meetings and similar contingencies may be disregarded. This view is that of Dr. Cabiadis and others who have studied plague in Irak, where no doctor or assistant, with one exception, suffered from the disease. It is not inconsistent with the experience recorded in Egypt. But it is clear that the intensity of contagion varies greatly in different epidemics. Modern experience contradicts the belief formerly entertained that contact with plague patients was the only or even the chief means of acquiring the disease. Everything tends to show that the atmosphere immediately surrounding the patient is the most effectual conveyer of contagion, and more effectual in proportion as the poison is concentrated. Precisely the same relations are observed with regard to typhus.

It has been disputed whether dead bodies convey infection of plague. Formerly the contagion from this source was greatly dreaded, and the task of burying thought to be specially dangerous. But the French in Egypt made more than a hundred post-mortem examinations without precautions and without harm. In Mesopotamia and in Russia no autopsies were made, but in the latter country some striking instances were noted of those engaged in burying the dead themselves dying of the plague. On the whole both facts and analogy lead to the belief that the disease may be derived from touching or being near a dead body, but not that there is any special danger of infection from this source.

2. It is a very momentous question whether the contagion is capable of being conveyed by clothes and other objects which have been in contact with the sick. The very general belief that this is so has been controverted only by the French physicians in Egypt, one of whom, Bulard, himself wore a shirt taken direct from the body of a plague patient, for two days. They also state that in Egypt it was customary, when a plague epidemic was over, to sell the clothes and effects of those who had died of plague, without, as is affirmed, communicating the disease. In Constantinople they were customarily sold at once; and it is alleged that the dealers in old clothes did not specially suffer. In 1835 the hospital at Cairo, where 3000 plague patients had been treated, was used, without even changing the bed coverings, immediately after the epidemic for other patients, without harm. Negative instances of this kind might be multiplied, but their importance is diminished by the consideration that the communicability of plague, by whatever means, is always found to become spontaneously weak at the decline of the epidemic, till it is extinct altogether. While the epidemic influence lasts there is abundant evidence that infected clothes, etc., are among the means by which the disease spreads. In Egypt, in 1835, two criminals condemned to death were for the sake of experiment placed in the clothes and beds of those who had died of plague, and both took the disease, one dying. Instances are given by White (*Treatise on the Plague*, p. 161, London, 1847) of the disease spreading "like wildfire" through the distribution of infected garments, and of those engaged in disinfecting clothes and other objects being suddenly seized with the complaint, *e.g.*, on opening a box containing infected garments. While the reality of this mode of communication cannot reasonably be doubted, it admits of some question whether the plague has ever been thus conveyed over great distances, or from one country to another. The best known instance in England is the alleged transmission of plague from London to the village of Eyam in Derbyshire in 1665 by an infected parcel of clothes,—a story which cannot be criticised at this distance of time, but which presents some weak points.[1] Dr. Cabiadis states that he has seen plague thus conveyed in Irak to places outside the existing focus of infection, but gives no details. On the whole we must consider the exportation of plague by clothes over great distances, and into countries not subject to the same epidemic conditions as the infected country, "not proven."

The communication of plague by merchandise or objects not personal, coming from an infected country, rests upon still more defective evidence, though at one time generally believed. In virtue of this belief all goods, especially those regarded as susceptible (as wool, furs, raw cotton, etc.), were, when coming from an infected or suspected country, subjected to disinfection under special regulations. But there is really no evidence that plague was ever thus transmitted or that these regulations kept it out. On the contrary there are numberless instances of the supposed cause having failed to operate when it might have been most expected to do so.

During the plague at Alexandria in 1835, which destroyed 9000 persons in that city, the exportation of cotton from the Government warehouses was never interrupted, though the plague was most destructive in those very buildings. It was loaded on English and other ships without any precautions whatever.

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[1] See W. Wood, *History of Eyam*, London, 1848.

Twenty-five ships, eight of which were infected with plague, conveyed cotton amounting to 31,000 bales to England. Nevertheless, no case of plague is known to have occurred among the quarantine officers or others engaged in unloading these ships or disinfecting their cargoes in quarantine. Equally large quantities were exported to Marseilles and Trieste, and smaller quantities to other ports, with the same result. Further, no case of infection has occurred among quarantine officers or persons employed to disinfect goods, from this cause alone, either at Marseilles since 1720, or at any European lazaretto.[1] The conclusion is that the fear of importation of plague by merchandise coming from an infected country rests on no solid foundation.

By whatever means, there is no doubt that plague is diffused or "spreads" from one place to another, and that its spread is connected mediately or immediately, in most cases at least, with human intercourse. But the diffusion appears to take place as a rule slowly, and to be effected by the formation of new foci of contaminated atmosphere. Such foci on land will be inhabited houses, and the disease will creep in a gradual though irregular manner from house to house and street to street. It was so in London in 1665; and in Russia in 1878, as has been said, the disease was confined to one village for two months, though for great part of the time communication was perfectly open. In 1834 plague existed eight months at Alexandria before passing to Damietta and Mansoorah, though traffic was quite uninterrupted. These new foci of disease are doubtless mostly produced by persons infected with the disease, actually or in incubation, who form a contaminated atmosphere around them in a place previously healthy.

Transmission of the disease by sea may take place in the same manner—a ship forming a focus of disease as easily as a house, and being obviously specially liable to concentrate the poison. It is by a floating atmosphere of plague, and not by casual contaminated objects, that the disease has been conveyed, when it has been, from one port to another of the Mediterranean. The reality of the mode of transmission is shown by the fact that between 1720 and 1846 twenty-five ships arrived at French and Italian ports with the plague among their crews; and in the case of those arriving at Marseilles (ten in number), which were carefully observed, there were several instances of plague being communicated in the lazaretto to surgeons and others, or to those placed in charge of the ships. Of these persons several died—without, however, any extension of the disease to the town. From this it is clear that plague may be transmitted by ships, and may spread at the point to which it is conveyed, if the surrounding circumstances are favorable. In all these cases the ships had left the infected ports at a time when an epidemic of plague, and not merely sporadic cases, prevailed there. No similar facts are on record as to the importation of plague by ships to England—the probable cause of this difference being the greater length of the voyage from the Levantine ports, and the precautions taken at those ports to prevent the shipment of infected persons or goods. Plague has never been brought to an English quarantine station.[2]

In such cases it must remain undetermined whether the disease would have spread, had it not been interrupted by the quarantine. As we have seen, plague will often die out in the cases which convey it without spreading; and hence some have supposed (with Sydenham) that an "epidemic constitution" is necessary at any particular time and place in order that the disease should become general, but the practical value of this law is diminished by the fact that there is no means of recognizing the epidemic constitution except by the actual production of an epidemic.

Plague, like all similar diseases, and in a specially high degree, is subject to the law of periodicity. Even when it is most strictly endemic it seldom prevails continuously, but appears in definite outbreaks, or epidemics, with intervals in which there are either no cases of plague or only so-called sporadic cases. This may be partly due to the general law that the susceptibility of the population to a special disease is exhausted by an epidemic, partly to the immensely increased transmissibility of the disease caused by the increased number of cases, so that when once a certain stage of severity has been reached the disease progresses in a far more rapid ratio. In most epidemics of plague there is at one time a sudden and alarming increase in mortality; but, by a law not yet understood, each epidemic is liable to a spontaneous decline, which is sometimes sudden. This may be connected with the rise or fall in the temperature of the air, but is not always so. The disease may be dormant during the cold or hot weather (as the case may be) and reappear when the temperature is favorable again, but not necessarily. It is generally agreed that plague is transmissible to another country only when it is epidemic, and not from sporadic cases.

Incubation.—It is a very important question what time may elapse between a person receiving the poison and showing symptoms of the disease. The usual time of incubation appears to be from three to five days. In certain very malignant epidemics this period may be shortened, and, it is thought, reduced to even less than a day. In rare cases incubation may be prolonged to eight days. There are doubtful accounts of ten days' incubation. Generally a week's observation[3] would show whether a suspected person was really affected or no. It has been thought that articles contaminated by contact with plague patients may retain the power of communicating the disease for weeks, months, or even years; but of this there is no adequate proof.

Treatment.—No special line of treatment has proved efficacious in checking the disease once established. Special symptoms are treated in accordance with the ordinary rules of practice, and need not here be considered. Free ventilation appears to be of the greatest service in preventing the spread of the disease, and probably in promoting recovery.

Prevention.—There can be no doubt whatever of the efficacy of hygienic measures in rendering a locality unsuitable for the spread of plague. Such measures include, not only personal cleanliness, but especially the removal of all foul organic matters, good drainage, and prevention of overcrowding; all such measures might be looked upon by our readers generally as matters of course, but are quite unknown in most of the homes of plague. Since there is no doubt that plague may be carried from places where it prevails epidemically, measures to prevent such importation cannot be neglected. The best known of such measures is the system of quarantine first produced about 1480. See QUARANTINE. The efficiency of quarantine has been much discussed, and very strong opinions have been expressed for and against it. The subject is too large for discussion here; but it would appear that, while the system as originally applied in the Mediterranean, when traffic was comparatively slow and infrequent, and when European cities presented an extremely favorable soil for plague if introduced, was a real protection, the regulations have long ceased to correspond to the actual state of medical knowledge; and, in addition, it would be impossible to apply them to our crowded traffic. The alternative is a system of medical inspection of all arrivals in our ports, and strict isolation of ships in which plague has occurred or is suspected. Such a ship should then be treated as an infected house.

Prevention of the Spread of Plague.—When cases of plague have once occurred in a town or on board a ship in port, the house or ship should be emptied of its inhabitants, the sick removed to a hospital, the sound placed in an isolated building and subjected to observation for at least a week, or, better, ten days. The clothes of sick persons had better be burnt, their bedding and furniture completely disinfected. The house should in the meantime be rigidly closed until it has been disinfected. If these measures are taken in time, there can be no objection to allowing free emigration of the population. Isolation of the place by a "sanitary cordon" would only be possible in very exceptional positions, and as a rule would aggravate, by overcrowding, the intensity of the disease within.

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[1] Laidlaw, quoted in Prus, *Rapport*, p. 479.

[2] Prus, *Rapport sur la Peste*, Paris, 1846, p. 133; *Report* of Committee of House of Commons, 1819, p. 101.

[3] Prus, *Rapport*, p. 196.

History of the Plague.—The first historical notice of the plague is contained in a fragment of the physician Rufus of Ephesus, who lived in the time of Trajan, preserved in the *Collections of Oribasius.*[1] Rufus speaks of the buboes called pestilential as being specially fatal, and as being found chiefly in Libya, Egypt, and Syria. He refers to the testimony of a physician, Dionysius, who lived probably in the 3d century B.C. or earlier, and to Diascorides and Posidonius, who fully described these buboes in a work on the plague which prevailed in Libya in their time. Whatever the precise date of these physicians may have been, this passage shows the antiquity of the plague in northern Africa, which for centuries was considered as its home. The great plague referred to by Livy (lx., Epitome) and more fully by Orosius (*Histor.*, iv. 11) was probably the same, though the symptoms are not recorded. It is reported to have destroyed a million of persons in Africa, but is not stated to have passed into Europe.

It is not till the 6th century of our era, in the reign of Justinian, that we find bubonic plague in Europe, as a part of the great cycle of pestilence, accompanied by extraordinary natural phenomena, which lasted fifty years, and is described with a singular misunderstanding of medical terms by Gibbon in his forty-third chapter. The descriptions of the contemporary writers Procopius, Evagrius, and Gregory of Tours are quite unmistakable.[2] The plague of Justinian began at Pelusium in Egypt in 542 A.D.; it spread over Egypt, and in the same or the next year passed to Constantinople, where it carried off 10,000 persons in one day, with all the symptoms of bubonic plague. It appeared in Gaul in 546, where it is described by Gregory of Tours with the same symptoms as *lues inguinaria* (from the frequent seat of buboes in the groin). In Italy there was a great mortality in 543, but the most notable epidemic was in 565, which so depopulated the country as to leave it an easy prey to the Lombards. In 571 it is again recorded in Liguria, and in 590 a great epidemic at Rome is connected with the pontificate of Gregory the Great. But it spread in fact over the whole Roman world, beginning in maritime towns and radiating inland. In another direction it extended from Egypt along the north coast of Africa. Whether the numerous pestilences recorded in the 7th century were the plague cannot now be said; but it is possible the pestilences in England chronicled by Bede in the years 664, 672, 679, and 683 may have been of this disease, especially as in 690 *pestis inguinaria* is again recorded in Rome. For the epidemics of the succeeding centuries we must refer to more detailed works.[3]

It is impossible, however, to pass over the great cycle of epidemics in the 14th century known as the Black Death. Whether in all the pestilences known by this name the disease was really the same, may admit of doubt, but it is clear that in some at least it was the bubonic plague. Contemporary observers agree that the disease was introduced from the East; and one eye-witness, Gabriel de Mussis, an Italian lawyer, traced, or indeed accompanied, the march of the plague from the Crimea (whither it was said to have been introduced from Tartary) to Genoa, where with a a handful of survivors of a Genoese expedition he landed probably at the end of the year 1347. He narrates how the few that had themselves escaped the pest transmitted the contagion to all they met.[4] Other accounts, especially old Russian chronicles, place the origin of the disease still further to the east in Cathay (or China), where, as is confirmed to some extent by Chinese records, pestilence and destructive inundations are said to have destroyed the enormous number of thirteen millions. It appears to have passed by way of Armenia into Asia Minor and thence to Egypt and northern Africa. Nearly the whole of Europe was gradually overrun by the pestilence. It reached Sicily in 1346, Constantinople, Greece, and parts of Italy early in 1347, and towards the end of that year Marseilles. In 1348 it attacked Spain, northern Italy, and Rome, eastern Germany, many parts of France, including Paris, and England; from England it is said to have been conveyed to the Scandinavian countries. In England the western counties were first invaded early in the year, and London in November. In 1349 we hear of it in the midlands; and in subsequent years, at least till 1357, it prevailed in parts of the country, or generally, especially in the towns. In 1352 Oxford lost two-thirds of her academical population. The outbreaks of 1361 and 1368, known as the second and third plagues of the reign of Edward III., were doubtless of the same disease, though by some historians not called the black death. Scotland and Ireland, though later affected, did not escape.

The nature of this pestilence has been a matter of much controversy, and some have doubted its being truly the plague. But when the symptoms are fully described they seem to justify this conclusion, one character only being thought to make a distinction between this and Oriental plague, viz., the special implication of the lungs as shown by spitting of blood and other symptoms. Guy de Chauliac notes this feature in the earlier epidemic at Avignon, not in the later. Moreover, as this complication was a marked feature in certain epidemics of plague in India, the hypothesis has been framed by Hirsch that a special variety of plague, *pestis Indica*, still found in India, is that which overran the world in the 14th century. But the same symptoms (hæmoptysis) have been seen, though less notably, in many plague epidemics, even in the latest, that in Russia in 1878–79, and, moreover, according to the latest accounts, are not a special feature of Indian plague. According to Surgeon-General Francis (*Trans. Epidem. Soc.*, vol. v. p. 398) "hæmorrhage is not an ordinary accompaniment" of Indian plague, though when seen it is in the form of hæmoptysis. It seems, therefore, impossible to make a special variety of Indian plague, or to refer the black death to any such special form. Gabriel de Mussis describes it even in the East, before its arrival in Europe, as a bubonic disease.

The mortality of the black death was, as is well known, enormous. It is estimated in various parts of Europe at two-thirds or three-fourths of the population in the first pestilence, in England even higher, but some countries were much less severely affected. Hecker calculates that one-fourth of the population of Europe, or 25 millions of persons, died in the whole of the epidemics. It is hardly necessary to dwell upon the social results of this terrible mortality. In England great part of the country remained untilled, and the deficiency of laborers was such as to cause a sudden rise of wages, which, in spite of attempts to check it by legislation, is thought to have effected the final emancipation of the laboring class. On the other hand a great transfer of property to the church took place, with what results is well known.

In the 15th century the plague recurred frequently in nearly all parts of Europe. In the first quarter it was very destructive in Italy, in Spain (especially Barcelona and Seville), in Germany, and in England, where London was severely visited in 1400 and 1406, and again in 1428. In 1427 80,000 persons died in Dantzic and the neighborhood. In 1438–39 the plague was in Germany, and its occurrence at Basel was described by Æneas Sylvius, afterwards Pope Pius II. In 1448–50 Italy (Kircher), Germany (Lersch, from old chronicles), France, and Spain were ravaged by a plague supposed to have arisen in Asia, scarcely less destructive than the black death. England was probably seldom quite free from plague, but the next great outbreak is recorded in 1472 and following years. In 1466 40,000 persons died of plague in Paris; in 1477–85 the cities of northern Italy were devastated, and in 1485 Brussels. In the fifteenth year of Henry VII. (1499–1500) a severe plague in London caused the king to retire to Calais.

The 16th century was not more free from plague than the 15th. Simultaneously with a terrible pestilence which is reported to have nearly depopulated China, plague prevailed over Germany, Holland, Italy, and Spain in the first decade of the century, and revived at various times in the first half. In 1529 there was plague in Edinburgh; in London in 1537-39, and again 1547-48; and also in the north of England, though probably not absent before. Some of the epidemics of this period in Italy and Germany are known by the accounts of eminent physicians, as Vochs, Fracastor, Mercurialis, Borgarucci, Ingrassia, Massaria, Amici, etc.,[1] whose writings are important because the question of contagion first began to be raised, and also plague had to be distinguished from typhus fever, which began in this century to appear in Europe.

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[1] Lib. xliv. cap. 17,—*Œuvres de Oribase*, ed. Bussemaker and Daremberg, Paris, 1851, vol. iii. p. 607.

[2] Evagrius, *Hist. Eccles.*, iv. 29; Procopius, *De Bello Persico*, ii. 22, 23.

[3] See Noah Webster's *History of Epidemic Diseases*, 8vo. 2 vols., London, 1800 (a work which makes no pretension to medical learning, but exhibits the history of epidemics in connection with physical disasters, as earthquakes, famines, etc.); Lersch *Kleine Pest-Chronik*, 8vo, 1880 (a convenient short compendium, but not always accurate); "Athanasii Kircheri Chronologia Pestium" (to 1656 A.D.), in *Scrutinium Pestis* (Rome, 1658), Leipsic, 1671, 4to; Bascome, *History of Epidemic Pestilences*, London, 1851, 8vo. The most complete medical history of epidemics is Haeser's *Geschichte der epidemischen Krankheiten* (3d edition, Jena, 1882), forming the third volume of his *History of Medicine.*

[4] See the original account reprinted with other documents in Haeser, *Op. cit.;* also Hecker, *Epidemics of the Middle Ages*, trans. by Babington, Sydenham Soc., London, 1844; *Volkskrankheiten des Mittelalters*, ed. Hirsch., Berlin, 1865; R. Hoeniger, *Der Schwarze Tod in Deutschland*, Berlin, 1882.

The epidemic of 1563-64 in London and England was very severe, a thousand dying weekly in London. In Paris about this time plague was an everyday occurrence, of which some were less afraid than of a headache (Borgarucci). In 1570 200,000 persons died in Moscow and the neighborhood, in 1572 50,000 at Lyons; in 1568 and 1574 plague was at Edinburgh, and in 1570 at Newcastle. When, however, in 1575 a new wave of plague passed over Europe, its origin was referred to Constantinople, whence it was said to have spread by sea to Malta, Sicily, and Italy, and by land through the Austrian territories to Germany. Others contended that the disease originated locally; and, indeed, considering previous history, no importation of plague would seem necessary to explain its presence in Europe. Italy suffered severely (Venice, in 1576, lost 70,000); the north of Europe not less, though later; London in 1580-82. In 1585 Breslau witnessed the most destructive plague known in its history. The great plague of 1592 in London seems to have been a part of the same epidemic, which was hardly extinguished by the end of the century, and is noted in London again in 1599. On the whole, this century shows a decrease of plague in Europe.

In the first half of the 17th century plague was still prevalent in Europe, though considerably less so than in the Middle Ages. In the second half a still greater decline is observable, and by the third quarter the disease had disappeared or was disappearing from a great part of western Europe. The epidemics in England will be most conveniently considered in one series. From this time onwards we have the guidance of the "Bills of Mortality" issued in London, which, though drawn up on the evidence of ignorant persons, are doubtless roughly true. The accession of James I. in 1603 was marked by a very destructive plague which killed 38,000 in London. In this and subsequent years the disease was widely diffused in England—for instance, Oxford, Derbyshire, Newcastle. It prevailed at the same time in Holland, and had done so some years previously in northern Germany. In the same year (1603) one million persons are said to have died of plague in Egypt. This plague is said to have lasted eight years in London. At all events in 1609 we have the second great plague year, with a mortality of 11,785. After this there is a remission till about 1620, when plague again began to spread in northern Europe, especially Germany and Holland, which was at that time ravaged by war. In 1625 (the year of the siege of Breda in Holland) is the third great London plague with 35,417 deaths,—though the year 1624 was remarkably exempt, and 1626 nearly so. In 1630 was the great plague of Milan, described by Ripamonti.[2] In 1632 a severe epidemic, apparently plague, was in Derbyshire. 1636 is the fourth great plague year in London with a mortality of 10,400, and even in the next year 3082 persons died of the same disease. The same year 7000 out of 20,000 inhabitants of Newcastle died of plague; in 1635 it was at Hull. About the same time, 1635-37, plague was prevalent in Holland, and the epidemic of Nimeguen is celebrated as having been described by Diemerbroeck, whose work (*Tractatus de Peste*, 4to, 1641-65) is one of the most important on the subject. The English epidemic was widely spread and lasted till 1647, in which year, the mortality amounting to 3597, we have the fifth epidemic in London. The army diseases of the Civil Wars were chiefly typhus and malarial fevers, but plague was not unknown among them, as at Wallingford Castle (Willis, "Of Feavers," *Works*, ed. 1681, p. 131) and Dunstar Castle. From this time till 1664 little was heard of plague in England, though it did not cease on the Continent. In Ireland it is said to have been seen for the last time in 1650.[3]

In 1656 one of the most destructive of all recorded epidemics in Europe raged in Naples; it is said to have carried off 300,000 persons in the space of five months. It passed to Rome, but there was much less fatal, making 14,000 victims only—a result attributed by some to the precautions and sanitary measures introduced by Cardinal Gastaldi, whose work, a splendid folio, written on this occasion (*Tractatus de avertenda et profliganda peste politico-legalis*, Bologna, 1684) is historically one of the most important on the subject of quarantine, etc. Genoa lost 60,000 inhabitants from the same disease, but Tuscany remained untouched. The comparatively limited spread of this frightful epidemic in Italy at this time is a most noteworthy fact. Minorca is said to have been depopulated. Nevertheless, the epidemic spread in the next few years over Spain and Germany, and a little later to Holland, where Amsterdam in 1663-64 was again ravaged with a mortality given as 50,000, also Rotterdam and Haarlem. Hamburg suffered in 1664.

The Great Plague of London.—The preceding enumeration will have prepared the reader to view the great plague of 1664-65 in its true relation to others, and not as an isolated phenomenon. The preceding years had been unusually free from plague, and it was not mentioned in the bills of mortality till in the autumn of 1664 (November 2d) a few isolated cases were observed in the parishes of St. Giles and St. Martin's, Westminster, and a few occurred in the following winter, which was very severe. About May, 1665, the disease again became noticeable, and spread, but somewhat slowly. Boghurst, a contemporary doctor, notices that it crept down Holborn and took six months to travel from the western suburbs (St. Giles) to the eastern (Stepney) through the city. The mortality rapidly rose from 43 in May to 590 in June, 6137 in July, 17,036 in August, 31,159 in September, after which it began to decline. The total number of deaths from plague in that year, according to the bills of mortality was 68,596, in a population estimated at 460,000,[4] out of whom two-thirds are supposed to have fled to escape the contagion. This number is likely to be rather too low than too high, since of the 6432 deaths from spotted fever many were probably really from plague, though not declared so to avoid painful restrictions. In December there was a sudden fall in the mortality which continued through the winter; but in 1666 nearly 2000 deaths from plague are recorded.

According to some authorities, especially Hodges, the plague was imported into London by bales of merchandise from Holland, which came originally from the Levant; according to others it was introduced by Dutch prisoners of war; but Boghurst regarded it as of local origin. It is in favor of the theory that it spread by some means from Holland that plague had been all but extinct in London for some seventeen years, and prevailed in Holland in 1663-64. But from its past history and local conditions, London might well be deemed capable of producing such an epidemic. In the bills of mortality since 1603 there are only three years when no deaths from plague are recorded. The uncleanliness of the city was comparable to that of Oriental cities at the present day, and, according to contemporary testimony (Garencières, *Angliæ Flagellum*, London, 1647, p. 85), little improved since Erasmus wrote his well-known description. The spread of the disease only partially supported the doctrine of contagion, as Boghurst says: "The disease spread not altogether by contagion at first, nor began only at one place and spread further and further as an eating sore doth all over the body, but fell upon several places of city and suburbs like rain." In fact dissemination seems to have taken place, as usual, by the conversion of one house after another into a focus of disease, a process favored by the fatal custom of shutting up infected houses with all their inmates, which was not only almost equivalent to a sentence of death on all therein, but caused a dangerous concentration of the poison. The well-known custom of marking such houses with a red cross and the legend "God have mercy upon us!" was no new thing: it is found in a proclamation in the possession of the present writer dated 1641: and it was probably older still. Hodges testifies to the futility and injurious effects of these regulations. The lord mayor and magistrates not only carried out the appointed administrative measures, but looked to the cleanliness of the city and the relief of the poor, so that there was little or no actual want; and the burial arrangements appear to have been well attended to. The college of physicians, by royal command, put forth such advice and prescriptions as were thought best for the emergency. But it is clear that neither these measures nor medical treatment had any effect in checking the disease. Early in November with colder weather it began to decline; and in December there was so little fear of contagion that those who had left the city "crowded back as thick as they fled." As has often been observed in other plague epidemics, sound people could enter infected houses and even sleep in the beds of those who had died of the plague "before they were even cold or cleansed from the stench of the diseased" (Hodges). The symptoms of the disease being such as have been generally observed need not be here considered. The disease was, as always, most destructive in squalid, dirty neighborhoods and among the poor, so as to be called the "poor's plague." Those who lived in the town in barges or ships did not take the disease; and the houses on London Bridge were but little affected. Of those doctors who remained in the city some eight or nine died, not a large proportion. Some had the rare courage to investigate the mysterious disease by dissecting the bodies of the dead. Hodges implies that he did so, though he left no full account of his observations. Dr. George Thomson, a chemist and a disciple of Van Helmont, followed the example, and nearly lost his life by an attack which immediately followed.[1]

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[1] Vochs, *Opusculum de Pestilentia*, 1537; Fracastorius, "De Contagione, etc.," *Opera*, Ven., 1555; Hieron. Mercurialis, *De Peste præsertim de Veneta et Patavina*, Basel, 1577; Prosper Borgarutius, *De Peste*, Ven., 1565, 8vo; Filippo Ingrassia, *Informatione del pestifero morbo . . . Palermo e . . . Regno di Sicilia*, 1575-76, 4to, Palermo, 1576-77; A. Massaria, *De Peste*, Ven., 1597; Diomedes Amicus, *Tres tractatus*, Ven., 1599, 4to; Victor de Bonagentibus, *Decem Problemata de Peste*, Ven., 1556, 8vo; Georgius Agricola, *De Peste libri tres*, Basel, 1554, 8vo. The works of English physicians of this period are of little medical value; but Lodge's *Treatise of the Plague* (London, 1603) deserves mention.

[2] Josephus Ripamontius, *De Peste anni* 1630, Milan, 1641, 4to.

[3] For this period see Index to *Remembrancia* in *Archives of City of London*, 1579-1664, Lond., 1878; Richardson, *Plague and Pestilence in North of England*, Newcastle, 1852.

[4] Graunt, *Observations on the Bills of Mortality*, 3d ed., London, 1665.

The plague of 1665 was widely spread over England, and was generally regarded as having been transmitted from London, as it appeared mostly later than in the metropolis, and in many cases the importation by a particular person could be traced. Places near London were earliest affected, as Brentford, Greenwich, Deptford; but in July or August, 1665, it was already in Southampton, Sunderland, Newcastle, etc. A wider distribution occurred in the next year. Oxford entirely escaped, though the residence of the court and in constant communication with London. The exemption was attributed to cleanliness and good drainage.

After 1666 there was no epidemic of plague in London or any part of England, though sporadic cases appear in bills of mortality up to 1679; and a column filled up with "0" was left till 1703, when it finally disappeared. The disappearance of plague in London was attributed to the Great Fire, but no such cause existed in other cities. It has also been ascribed to quarantine, but no effective quarantine was established till 1720, so that the cessation of plague in England must be regarded as spontaneous.

But this was no isolated fact. A similar cessation of plague was noted soon after in the greater part of western Europe. In 1666 a severe plague raged in Cologne and on the Rhine, which was prolonged till 1670 in the district. In the Netherlands there was plague in 1667–69, but there are no definite notices of it after 1672. France saw the last plague epidemic in 1668, till it reappeared in 1720. In the years 1675–84 a new plague epidemic appeared in North Africa, Turkey, Poland, Hungary, Austria, and Germany, progressing generally northward. Malta lost 11,000 persons in 1675. The plague of Vienna in 1679 was very severe, causing 76,000 or probably more deaths. Prague in 1681 lost 83,000 by plague. Dresden was affected in 1680, Magdeburg and Halle in 1682,—in the latter town with a mortality of 4397 out of a population of about 10,000. Many North German cities suffered about the same time; but in 1683 the plague disappeared from Germany till the epidemic of 1707. In Spain it ceased about 1681; in Italy certain cities were attacked till the end of the century, but not later (Hirsch).

Plague in the 18th Century.—At the beginning of this period plague was very prevalent in Constantinople and along the Danube. In 1703 it caused great destruction in the Ukraine. In 1704 it began to spread through Poland, and later to Silesia, Lithuania, Prussia, and a great part of Germany and Scandinavia. In Prussia and Lithuania 283,000 persons perished; Dantzic, Hamburg, and other northern cities suffered severely. Copenhagen was attacked in 1710. In Stockholm there was a mortality of 40,000. Certain places near Brunswick (10° E. long.) marked the western limit of the epidemic; and cholera was arrested at the same spot in later years (Haeser).

At the same time the plague spread westward from the Danube to Transylvania and Styria, and (1713) appeared in Austria and Bohemia, causing great mortality in Vienna. Thence it passed to Prague and Ratisbon—to the former, possibly to the latter, almost certainly conveyed by human intercourse. This city (12° E. long.) was the western limit reached in this year. Haeser states that the plague disappeared everywhere in Europe after the great hurricane of February 27, 1714.

In 1717 plague raged severely in Constantinople; and in 1719 it made a fresh progress westwards into Transylvania, Hungary, Galicia, and Poland, but not farther (about 20° E. long.). It thus appears that each successive invasion had a more easterly western limit, and that the gradual narrowing of the range of plague, which began in the 17th century, was still going on.

This process suffered a temporary interruption by the outbreak of plague of southern France in 1720–22. In 1720 Marseilles became affected with an epidemic plague the origin of which was attributed by some to contagion through the ship of a Captain Chataud which arrived, May 20, 1720, from Syria, where plague at that time prevailed, though not epidemically when he sailed. Six of the crew had died on the voyage to Leghorn, but the disease was declared not to be plague. Cases of plague occurred, however, on the ship, and on June 22 among porters unloading the cargo. Hence, according to believers in contagion, the disease passed to families in the "old town," the poorest and unhealthiest quarter. In the meantime other ships had arrived from Syria, which were put in quarantine. According to others the plague arose in Marseilles from local causes; and recently discovered data show that suspicious cases of contagious disease occurred in the town before the arrival of Chataud's ship.[2] Opinions were divided, and the evidence appears even now nearly balanced, though the believers in contagion and importation gained the victory in public opinion. The pestilence was fearfully severe. Thousands of unburied corpses filled the streets, and in all 40,000 to 60,000 persons were carried off. In December, 1721, the plague passed away, though isolated cases occurred in 1722. It passed to, or at least broke out in, Arles and Aix in 1720, causing great mortality, but in Toulon not till 1721, when it destroyed two-thirds of the population. The epidemic spread generally over Provence, but not to other parts of France, notwithstanding that, as confessed by D'Antrechaus, consul of Toulon, a believer in the exclusive power of contagion, there were abundant opportunities. The disease was in fact, as in other cases, self-limited. In all 87,659 persons are said to have died out of a population of nearly 250,000.[3]

This great epidemic caused a panic in England; which led to the introduction (under Mead's advice) of quarantine regulations, never previously enforced, and also led to the publication of many pamphlets, etc., besides Mead's well-known *Discourse on Pestilential Contagion* (London, 1720).

Plague in Sicily in 1743.—An outbreak of plague at Messina in 1743 is important, not only for its fatality, but as one of the strongest cases in favor of the theory of imported contagion. Messina had been free from plague since 1624, and the Sicilians prided themselves on the rigor of the quarantine laws which were thought to have preserved them. In May, 1743, a vessel arrived from Corfu, on board of which had occurred some suspicious deaths. The ship and cargo were burnt, but soon after cases of a suspicious form of disease were observed in the hospital and in the poorest parts of the town; and in the summer a fearful epidemic of plague developed itself which destroyed 40,000 or 50,000 persons, and then became extinct without spreading to other parts of Sicily.

Spread of Plague from the East.—Independent of the episodes of Marseilles and Messina, the spread of plague from the East continued to exhibit the above-mentioned law of limitation. In 1738–44 the disease was in the Ukraine, Hungary, the borders of Carniola, Moravia, and Austria, extending along the Carpathians as far as Poland (20° E. long.), and also in Bukowina (25° E. long.). It lasted till 1745, and then disappeared from those parts for fifteen years. In 1755–57 plague prevailed in parts of European Turkey, whence it on one occasion extended into Transylvania, in the neighborhood of Cronstadt, where it was checked (25°.5 E. long.).[4]

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[1] On the plague of 1665 see Nath. Hodges, *Loimologia sive Pestis nuperæ apud populum Londinensem narratio*, London, 1672, 8vo.—in English by Quincy, London, 1720 (the chief authority); *λοιμογραφία, or an Experimental Relation of the last Plague in the City of London*, by William Boghurst, apothecary in St. Giles's-in-the-Fields, London, 1666,—a MS. in British Museum (Sloane, 349), containing important details; George Thomson, ΛΟΙΜΟΤΟΜΙΑ, *or the Pest Anatomized*, 8vo., London, 1666; Sydenham, "Febris pestilentialis et pestis annorum 1665–66," *Opera*, ed. Greenhill, p. 96, London, 1844; *Collection of Scarce Pieces on the Plague in* 1665. London, 1721, 8vo; Defoe's fascinating *Journal of a Citizen*, which should be read and admired as a fiction, but accepted with caution as history; T. Vincent (minister of the gospel), *God's Terrible Voice in the City*, 8vo., London, 1667; *Calendar of State Papers*, 1665–6 (Domestic Series), by M. E. Green.

[2] *Relation historique de la Peste de Marseille*, Cologne, 1721, Paris, 1722, etc.; Chicoyneau, Verny, etc., *Observations et Reflections . . . de la Peste*, Marseilles, 1721; Chicoyneau, *Traité de la Peste*, Paris, 1744; Littré, article "Peste," in *Dictionnaire de Médicine*, vol. xxiv., Paris, 1841.

[3] D'Antrechaus, *Relation de la Peste de Toulon en* 1721. Paris, 1756; G. Lambert, *Histoire de la Peste de Toulon en* 1721, Toulon, 1861, quoted by Haeser, *Gesch. der epidem. Krankh.*

[4] Adam Chenot, *Abhandlung von der Pest*, Dresden, 1776: *De Peste*, Vienna, 1766.

In 1770 a destructive plague arose in Moldavia during the Russo-Turkish War, and shortly afterwards in Wallachia, apparently endemic in the former country at least. It affected also Transylvania and part of Hungary, and still more severely Poland, but was confined to Podolia, Volhynia, the Ukraine, and the eastern part of Galicia (25° E. long.), not even penetrating as far as Warsaw. After destroying, it is said, 300,000 persons, and without being checked by any quarantine regulations, the plague died out finally in March, 1771, being remarkable for its short duration and spontaneous limitation (Haeser).

In another direction the plague spread over Little Russia in 1770, and desolated Kieff, while in the next year it broke out in Moscow and produced one of the most destructive epidemics of modern times. More than 50,000 persons, nearly one-fourth of the population, were carried off.[1]

The remaining European plague-epidemics of the 18th century were inconsiderable, but on that very account noteworthy. Transylvania was again affected in 1785, Slavonia and Livonia (a district of eastern Galicia) in 1795–96 (25° E. long.), Volhynia in 1798. The disease, while reappearing in the seats of the terrible earlier epidemics, was more limited in its range and of shorter duration.[2] An epidemic in Dalmatia in 1783–84 is noteworthy in connection with later outbreaks in the same region. In the last years of the century (1799–1800) there was a new epidemic in Syria and Egypt, where it affected the French and afterwards the English army.

Plague in the 19th Century.—This history divides itself naturally into two periods—1800–1845, and 1853 to the present time.

1800–1845.—Plague appeared at Constantinople in 1802–3, about the same time in Armenia (Kars), and in 1801 in Baghdad. It had prevailed since 1798 in Georgia and the Caucasus, and in 1803–6 began to spread from the north of the Caucasus into Russia, till in 1806 it was established at or near Astrakhan, and in 1807 reached Zareff, 200 miles higher up the Volga. These localities are interesting as being near those where plague appeared in 1877–78. It is also said to have entered the government of Saratoff, but probably no great distance.[3] The plague remained in the Caucasus and Georgia till 1819 at least. In 1828–31 it was in Armenia, and again in 1840–43, since which time it has not been heard of in that country.

In 1808 plague was at Constantinople, in 1809 at Smyrna. In 1812 was a more general epidemic affecting these places and also Egypt. An outbreak at Odessa is supposed to have been brought from Constantinople and thence to have passed to Transylvania. In 1813 a severe plague at Bucharest is supposed to have been brought from Constantinople. About the same time plague prevailed in Bosnia, and is supposed to have passed thence to Dalmatia in 1815. In 1814–15 it again appeared in Egypt, and once more invaded the continent of Europe in Albania and Bosnia. Two insular outbreaks, Malta in 1813 and Corfu in 1815, attracted much attention as being both thought to be cases of importation by sea-traffic,[4] and there seems good reason for this opinion.

A panic spread through Europe in 1815 in consequence of an outbreak in Noja on the eastern coast of Italy, its last appearance in that country. According to one view it was imported from the opposite coast of Dalmatia, though no definite history of contagion was established; according to others, it originated endemically in that place. It remained, however, strictly confined to a small district, perhaps in consequence of the extraordinarily rigorous measures of isolation adopted by the Italian Government. In 1828 an isolated epidemic appeared in Greece in the Morea, supposed to have been brought by troops from Egypt.[5] In 1824–25 an outbreak took place at Tutchkoff in Bessarabia; the town was strictly isolated by a military cordon and the disease did not spread.[6] Cronstadt in Transylvania was the scene of a small outbreak in 1828, which was said to be isolated by similar measures (Lorinser). A far more serious epidemic was connected with the campaign of the Russian army against Turkey in 1828–29. Moldavia, Wallachia, and Bessarabia were widely affected; the disease broke out also in Odessa and the Crimea, and isolated cases occurred in Transylvania. The most northerly points reached by the plague were near Czernowitz on the frontier of Bessarabia and Bukowina, and its limitation was as before attributed to the Russian and Austrian military cordons.

In 1831 another epidemic occurred in Constantinople and Roumelia; in 1837 again in Roumelia, and in Odessa,—its last appearance in those regions, and the last on the European continent except an isolated outbreak in Dalmatia in 1840, and one in Constantinople in 1841, and one on the Volga in 1878–9.[7]

The plague-epidemics in Egypt between 1833 and 1845, when it was last observed in that country, are very important in the history of plague, since the disease was almost for the first time scientifically studied in its home by skilled European physicians, chiefly French. The disease was found to be less contagious than reported to be by popular tradition, and most of the French school went so far as to deny the contagiousness of the disease altogether. The epidemic of 1834–35 was not less destructive than many of those notorious in history; but in 1844–45 the disease disappeared, and it has never been seen since in the country which was for centuries regarded as its native home. This result can hardly be attributed to quarantine, though it is probable that increased attention to sanitary measures under the influence of educated medical officials may have had much to do with it. But on the large scale it is a part of the great eastward recession of the plague, which is an undoubted fact, however it is to be explained. In 1840 Dalmatia (17°E. long.), in 1841 Constantinople (29° E. long.), in 1843–44 the eastern parts of Egypt (31° E. long.), were the western boundaries of plague. The same law has, with one notable exception, been observed since.

1853–84.—Since the apparent extinction of plague in Egypt in 1845, it has appeared in several points of Asia and Africa, and once in Europe.

In 1853 plague appeared in a district of western Arabia, the Asir country in North Yemen, and it is known to have occurred in the same district in 1815, as it did afterwards in 1874 and 1879. In 1874 the disease extended within four days' march of Mecca. From the scantiness of population the mortality has not been great, but it is clear that this is one of the endemic seats of plague.[8]

In June, 1858, intelligence was received in Constantinople of an outbreak of disease at the small town Benghazi, in the district of Barca, province of Tripoli, North Africa, which though at first misunderstood was clearly bubonic plague. From later researches there is reason to believe that it commenced in 1856 or in 1855. The disease did not spread, and ceased in the autumn, to return with less violence in 1859, when it died out. In the autumn of 1873 it returned, but apparently came again to a spontaneous termination. At all events it has not been heard of since.[9]

After the epidemic of Benghazi in 1856–59, plague was next heard of in the district of Maku, in the extreme northwest of Persia in November, 1863. It occurred in a scattered population, and the mortality was not absolutely large.[10]

In 1867 an outbreak of plague was reported in Mesopotamia (Irak), among the marshes of Hindieh bordering on the lower Euphrates; and, as it has prevailed at intervals up to the present time in the same country, great importance attaches to its history. The epidemic began in December, 1866 (or probably earlier) and ceased in June, 1867. But numerous cases of non-fatal mild bubonic disease (mild plague or *pestis minor*) occurred both before and after the epidemic, and according to Tholozan similar cases had been observed nearly every year from 1856 to 1865.[11]

The next severe epidemic of plague in Irak began in December, 1873. But facts collected by Tholozan show that *pestis minor*, or sporadic cases of true plague, had appeared in 1868 and subsequent years. The outbreak of 1873–74 began about 60 miles from the origin of that of 1867. It caused a much greater mortality and extended over a much wider area than that of 1867, including the towns of Kerbela and Hilleh. After a short interval it reappeared at Divanieh in December, 1874, and spread over a much wider area than in the previous epidemics. This epidemic was carefully studied by Surgeon-Major Colvill.[12]

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[1] Samoilowitz, *Mémoire sur la Peste en Russie*, 1771, Paris, 1783; Mertens, *De la Peste en* 1771, Paris, 1784.

[2] Lorinser, *Pest des Orients*, Berlin, 1837, p. 103; Schraud, *Pest in Syrmien*, 1795, 2 vols., Pesth, 1801.

[3] From the annals of the Moravian community of Sarepta on the Volga, *Geschichte der Brüder-Gemeinde Sarepta*, by A. Glitsch, Sarepta and Berlin, 1865; also Tholozan, *Épidémies de Peste du Caucase*, Paris, 1879.

[4] Faulkner, *On the Plague in Malta*. London, 1820, 8vo; J. D. Tully, *History of the Plague in Malta, Gozo, Corfu, and Cephalonia*, London, 1821, 8vo; White, *Treatise on the Plague* (at Corfu), London, 1847; Calvert, "On the Plague in Malta, 1813," *Med-Chi. Transactions*, vi. 1.

[5] L. A. Gosse, *Relation de la Peste en Grèce*, 1827-28, Paris, 1838.

[6] Lorinser, *Pest des Orients*, p. 319.

[7] For the authorities, see Haeser, *Op. cit.*

[8] J. N. Radcliffe, *Report of Local Government Board*, 1879–80, suppl., p. 42.

[9] Tholozan, *La Peste en Turquie dans les Temps Modernes*, Paris, 1880.

[10] J. Netten Radcliffe, *Report of the Medical Officer of the Privy Council*, etc., 1875; also in *Papers on Levantine Plague*, presented to parliament, 1879, p. 7.

[11] Tholozan, *La Peste en Turquie*, p 86.

[12] See his report cited by Radcliffe, *Papers on Levantine Plague*, 1879.

He estimated the mortality at 4000. The epidemic ceased in July, but broke out again early in 1876, and in this year extended northwards to Baghdad and beyond. The whole area now affected extended 250 miles from northwest to southeast, and the total number of deaths was believed to be 20,000. In 1877 plague also occurred at Shuster in southwest Persia, probably conveyed by pilgrims returning from Irak, and caused great mortality.

After its customary cessation in the autumn (a pause attributed as before to the efficiency of quarantine regulations), the epidemic began again in October, 1876, though sporadic cases occurred all the summer. The disease appeared in 1877 in other parts of Mesopotamia also with less severity than in 1876, but over a wider area, being now announced at Samara, a town 70 miles above Baghdad on the Tigris. Since then the existence of plague in Baghdad or Mesopotamia has not been announced till the year 1884, when accounts again appeared in the newspapers, and in July the usual official statement occurs that the plague has been stamped out. The above account of plague in Irak is the most complete history of a succession of epidemics in one country which we have had of late years.

To complete the history of plague in Persia it should be stated that in 1870–71 it appeared in a district of Mukri in Persian Kurdistan to the south of Lake Urumiah (far removed from the outbreak of 1863). The epidemic appears, however, to have died out in 1871, and no further accounts of plague there have been received. The district had suffered in the great epidemic of plague in Persia in 1829–35. In the winter 1876–77 a disease which appears to have been plague appeared in two villages in the extreme north of the province of Khorásán, about 25 leagues from the southeast angle of the Caspian Sea. In March, 1877, plague broke out in Resht, a town of 20,000 inhabitants, in the province of Ghilan, near the Caspian Sea at its southwest angle, from which there is a certain amount of trade with Astrakhan. In 1832 a very destructive plague had carried off half the inhabitants. In 1877 the plague was very fatal. From March to September 4,000 persons were calculated to have died. The disease continued till the spring of 1878. In 1877 there was a doubtful report of the same disease at Astrabad, and also in some parts near the Perso-Afghan frontier. In 1878 plague again occurred in Kurdistan in the district of So-uj-Bulak, said by Dr. Tholozan to be the same as in the district of Mukri where it occurred in 1870–71. These scattered outbreaks of plague in Persian territory are the more remarkable because that country has been generally noted for its freedom from plague (as compared with Asiatic Turkey and the Levant).

It has since been known that a few cases of plague occurred in January, 1877, at Baku on the west shore of the Caspian, in Russian territory.[1]

The last outbreak of plague on European soil was that of 1878–79 on the banks of the Volga, which caused a panic throughout Europe.[2] It is now known that in the summer of 1877 a disease prevailed in several villages in the neighborhood of Astrakhan and in the city itself which was clearly a mild form of plague (*pestis minor*). It caused no deaths (or only one due to a complication) and died out apparently spontaneously. An official physician, Dr. Kastorsky, who investigated the matter for the Government, declared the disease to be identical with that prevailing in the same year at Resht in Persia; another physician, Dr. Janizky, even gave it the name of *pestis nostras*. In October, 1878, some cases appeared in the *stanitsa* or Cossack military settlement of Vetlanka, 130 miles from Astrakhan on the right bank of the Volga, which seem to have puzzled the physicians who first observed them, but on November 30th, were recognized as being but the same mild plague as had been observed the year before near Astrakhan by Dr. Döppner, chief medical officer of the Cossacks of Astrakhan. His report on the epidemic is the only original one we have. At the end of November[3] the disease became suddenly more severe, and most of those attacked died; and from the 21st December it became still more malignant, death occuring in some cases in a few hours, and without any buboes being formed. No case of recovery was known in this period. At the end of the year it rapidly declined, and in the first weeks of January still more so. The last death was on January 24. In the second half of December, when the disease had already lasted two months, cases of plague occurred in several neighboring villages, all of an extremely malignant type, so that in some places all who were attacked died. In most of these cases the disease began with persons who had been at Vetlanka, though this was not universally established. The inhabitants of these villages, terrified at the accounts from Vetlanka, strictly isolated the sick, and thus probably checked the spread of the disease. But it evidently suffered a spontaneous decline. By the end of January there were no cases left in the district except at one village (Selitrennoye), where the last occurred on the 9th February. The total number of cases in Vetlanka, out of a population of about 1,700, was 417, of whom 362 died. In the other villages there were about 62 deaths from plague, and not more than two or three cases of recovery. In consequence of the alarm excited by this last appearance of plague upon European soil, most European Governments sent special commissions to the spot. The British commissioners were Surgeon-Major Colvill and the present writer, who, like all the foreign commissioners, reached the spot when the epidemic was over. With respect to the origin of this epidemic, the possibility of its having originated on the spot, as in Resht and on the Euphrates in very similar situations, is not to be denied. An attempt was made to show that the contagion was brought home by Cossacks returning from the Turkish War, but on absolutely no evidence. In the opinion of the writer the real beginning of the disease was in the year 1877, in the vicinity of Astrakhan, and the sudden development of the malignant out of a mild form of the disease is no more than has been observed in other places. The Astrakhan disease may have been imported from Resht or Baku, or may have been caused concurrently with the epidemics of these places by some cause affecting the basin of the Caspian generally. But the conditions under which these mild or miasmatic forms of plague are spread are as yet unknown.

Plague in India.—It used to be held as a maxim that plague never appeared east of the Indus; nevertheless it has been observed during this century in more than one distinct centre in India. So long ago as 1815 the disease appeared in Guzerat, Kattywar, and Cutch, "after three years of severe famine." It reappeared early next year, in the same locality, when it extended to Sind as far as Hyderabad, and in another direction southeast as far as Ahmedabad and Dhollerah. But it disappeared from these parts in 1820 or early in 1821, and was not heard of again till July, 1836, when a disease broke out into violence at the town of Pali in Marwar in Rajputana. It spread from Pali to the province of Meywar, but died out spontaneously in the hot season of 1837, and has never been heard of again in that part of India. The origin of these two epidemics was obscure. No importation from other countries could be traced.

In 1823 (though not officially known till later) an epidemic broke out at Kedarnath in Gurwhal, a sub-district of Kumaon on the southwest of the Himalayas, on a high situation. In 1834 and 1836 other epidemics occurred, which at last attracted the attention of Government. In 1849–50, and again in 1852, the disease raged very severely and spread southward. In 1853 Dr. Francis and Dr. Pearson were appointed a commission to inquire into the malady. In 1876–77 another outbreak occurred, since which time no accounts of the epidemic have been received. The symptoms of this disease, called *maha murree* by the natives, are precisely those of Oriental plague. The feature of blood-spitting, to which much importance has been attached, appears to be not a common one. A very remarkable circumstance is the death of animals (rats, and more rarely snakes), which occurs at the outbreak of an epidemic. The rats bring up blood, and the body of one examined after death by Dr. Francis showed an affection of the lungs. Maha murree is intensely communicable, but does not show much tendency to spread, since pilgrims who visit the mountain shrines are not affected and do not convey the disease. It is doubtless connected with uncleanliness and poverty, but Dr. Francis believes that the poison exists in the soil, which becomes more and more contaminated with it. The disease is pretty clearly endemic, not imported.[4]

It is remarkable that of late years reports have come of the occurrence of Oriental plague in China. It has been observed in the province of Yunnan since 1871, and also at Pakhoi, a port in the Tong-king Gulf, as lately as 1882,—but said to have prevailed there at least fifteen years. In

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[1] J. Netten Radcliffe, *Reports;* Tholozan *Histoire de la Peste Buboneque en Perse*. Paris, 1874.

[2] See Radcliffe, *Reports*, 1879–80; Hirsch and Sommerbrodt, *Pest-Epidemie*, 1878–9; *in Astrachan*, Berlin, 1880; Zuber, *La Peste d' Astrakhan en* 1878–9; Paris, 1880; Colvill and Payne, *Report to the Lord President of the Council*, 1879.

[3] The dates are all reduced to new style.

[4] On Indian plague, see Francis, *Trans. Epidem. Soc. Lond.*, vol. iv. pp. 407–8; John Murray, *ibid.*, vol. iv. part 2; J. N. Radcliffe, *Reports of Local Government Board*, 1875, 1876, 1877, and for 1879–80; *Parliamentary Papers*, 1879; Frederick Forbes, *On Plague in Northwest Provinces of India*, Edinburgh, 1840 (Dissertation); Hirsch, *Handbuch der historischen-geogr. Pathologie*, vol. i. p. 209, 1860 (Eng. trans. by Creighton, London, 1883); Hecker's *Volkskrankheiten des Mittelalters*, Berlin, 1865, p. 101; Webb, *Pathologia Indica*, 2d ed., Calcutta, 1848.

Yunnan it appears to be endemic, though there are rumors of its having been brought from Burmah, and become more noticeable after the suppression of a rebellion in that province. The climate is temperate and the country partly mountainous. Some regard the disease as being conveyed from Pakhoi to Yunnan. In both places the symptoms were the same, of undoubted bubonic plague. It has always been noticed, as in India, that rats leave their holes and die at the beginning of an epidemic; and the same mortality has been observed among cats, dogs, cattle, ponies, deer, etc. At Pakhoi it recurs nearly every year.[1] Uncleanly habits have much to do with fostering the disease.

It thus appears that at the present time plague exists, or has existed within ten years, in the following parts of the world:—(1) Benghazi, Africa; (2) Persian Kurdistan; (3) Irak, on the Tigris and Euphrates; (4) the Asír country, western Arabia; (5) on the lower Volga, Russia; (6) northern Persia and the shores of the Caspian; (7) Kumaon and Gurwhal, India; (8) Yunnan and Pakhoi, China. Except Benghazi all these places show an eastward recession as compared with the old seats of plague known to us.

Literature.—See the following works, besides those already quoted:[2]—Kamintus, *Regim en contra epidimiam sive pestem*, 4to, *circa* 1494 (many editions); Jacobus Soldus, *Opus insigne de Peste*, 4to, Bologna, 1478; Alex. Benedictus, *De Observatione in Pestilentia*, 4to, Ven., 1493; Nicolaus Massa, *De Febre Pestilentia*, 4to, Ven., 1556, etc.; [Floravanti, *Regimento della Peste*, 8vo, Ven., 1565]; John Woodall, *The Surgeon's Mate*, folio, London, 1639; Van Helmont, *Tumulus Pestis*, 8vo, Cologne, 1644, etc.; [Muratori, *Trattato del Governo della Peste*, Modena, 1714]; John Howard, *An Account of Lazarettoes in Europe*, etc., 4to, London, 1789; Patrick Russell, *A Treatise of the Plague*, 4to, London, 1791; Thomas Hancock, *Researches into the Laws of Pestilence*, 8vo, London, 1821; [Foderé, *Leçons sur les Epidémies*, etc., 4 vols. 8vo, Paris, 1822-24]; [Ségur Dupeyron, *Recherches Historiques*, etc., *sur la Peste*, 1837]; Bulard, *La Peste Orientale*, 8vo, Paris, 1839; Griesinger, *Die Infectionskrankheiten*, 2d ed., 8vo, Erlangen, 1864. (J. F. P.)

PLAICE (*Pleuronectes platessa*), a species of Flatfish, common on the coasts of northern Europe from Iceland to the Bay of Biscay. It is readily recognized by the yellow or orange-colored spots which are placed in a row along the dorsal and anal fins, and scattered over the body. The eyes are on the right side, and the teeth in the jaws compressed and truncate. The scales are minute and smooth. In the dorsal fin from sixty-seven to seventy-seven rays may be counted, in the anal from fifty to fifty-seven. Plaice, like other flat-fishes, prefer a sandy flat bottom to a rocky ground, and occur in suitable localities in great abundance; and, as they belong to the better class of fishes for the table, immense quantities are brought to the market. They spawn early in spring, and are in finest condition in the month of May. Individuals of seven or eight pounds weight are considered fish of large size, but specimens of double that weight have been caught. Plaice grow quickly and are tenacious of life; and, as they thrive in brackish water, their culture in littoral back-waters would seem to be deserving of every attention.

PLAINFIELD, a city of the United States, in Union county, New Jersey, lies at the foot of Mount Orange, and on the left side of the Green Brook, a tributary of the Raritan. It may to some extent be regarded as a residential suburb of New York, from which it is distant 24 miles by the Central Railroad. The local manufactures—hats and clothing—are comparatively trifling. Laid out in 1735 and made a city in 1869, Plainfield had 5095 inhabitants in 1870 and 8125 in 1880. A railroad consisting of narrow iron bands nailed down to wooden logs was constructed between Plainfield and Elizabeth as early as 1838. Two miles to the southwest is Washington's Rock, a coign of vantage from which the general used to watch the British movements,

PLAIN SONG, or **PLAIN CHANT** (*Gregorian Music*; Lat. *Cantus planus*; Ital. *Canto Gregoriano*; Fr. *Plain Chant*), a style of music, easily recognizable by certain strongly-marked characteristics, some very ancient fragments of which are believed to have been in use under the Jewish dispensation from a remote period, and to have been thence transferred to the ritual of the Christian church.

The theories advanced as to the origin of this solemn form of ecclesiastical music are innumerable. The most widely-spread opinion is that the older portion of it originated with the Psalms themselves, or at least sprang from the later synagogue music. Another theory traces the origin of plain song to the early Greeks; and the supporters of this view lay much stress on the fact that the scales in which its melodies are composed are named after the old Greek "modes." But, beyond the name, no connection whatever exists between the two tonalities, which bear not the remotest resemblance to each other. Less reasonable hypotheses attribute the origin of plain song to the Phœnicians, to the Egyptians, to the early Christian converts, and to the musicians of the Middle Ages. These divergent views, however, though entirely hypothetical, are defended by arguments so voluminous that for the elucidation of the subject we must content ourselves with referring the reader to the works of Gerbert, P. Martini, P. Kircher, Mersennus, P. Lambillotte, the Abbé Raillard, Coussemaker, Kiesewetter, Jakob, Ambros, and other authors, who have treated it at great length.

The earliest important fact upon which we can rest with absolute confidence is that towards the close of the 4th century Ambrose of Milan, fearing the loss or corruption of the venerable melodies which up to that time had been preserved to the church by means of oral tradition only, endeavored to restore them as nearly as possible to their primitive purity, and at the same time to teach the clergy to sing them with greater precision than had previously been attempted. A still more extensive work of the same nature was undertaken, two centuries later, by Pope Gregory the Great. And thus arose the two schools of ecclesiastical music, still known as the "Ambrosian" and the "Gregorian chant,"—the first of which is now practiced only in the diocese of Milan, while the latter is universally accepted as the authorized "Roman use." In order to explain the essential differences existing between these two schools, we must here describe in detail some of the peculiar characteristics of plain song to which allusion has been made.

The melodies which collectively form the *repertoire* of plain chant are not written in modern major and minor scales, but in certain tonalities bearing names analogous to those of the early Greek "modes," though constructed on very different principles. Of these "modes," fourteen exist in theory, though twelve only are in practical use. The intervals of each "mode" are derived from a fundamental sound, called its "final."[3] The compass of each mode comprises eight sounds,—that of the first, third, fifth, seventh, ninth, eleventh, and thirteenth "modes," extending to the octave above the "final," and that of the second, fourth, sixth, eighth, tenth, twelfth, and fourteenth, extending from the fourth note below the final to the fifth note above it. Consequently, the "finals" of the first series, called the "authentic modes," occupy the lowest place in each system of sounds, and those of the second series, called the "plagal modes," the middle place,—the same "final" being common to one "authentic" and one "plagal mode." The following table exhibits the entire system, expressed in the alphabetical notation peculiar to modern English music,—the "final" being indicated in each case by an asterisk, and the position of the semitones, from which each mode derives its distinctive character, by brackets.

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[1] See J. N. Radcliffe's *Report* for 1879-80, p. 45; Manson in *Reports of Imperial Chinese Customs*, special series No. 2, for half-year ended 31st March, 1878, 15th issue, Shanghai; Lowry, "Notes on Epidemic Disease at Pakhoi," 1882, *ibid.*, 24th issue, p. 31.

[2] Those in square brackets [ ] have not been seen by the writer.

[3] Analogous to the tonic or key-note of the modern scale.

Authentic Modes.	*Plagal Modes.*
1. Dorian, *D, E, F, G, A, B, C, D.	2. Hypodorian, A, B, C, *D, E, F, G, A.
3. Phrygian, *E, F, G, A, B, C, D, E.	4. Hypophrygian, B, C, D, *E, F, G, A, B.
5. Lydian, *F, G, A, B, C, D, E, F.	6. Hypolydian, C, D, E, *F, G, A, B, C.
7. Mixolydian, *G, A, B, C, D, E, F, G.	8. Hypomixolydian, D, E, F, *G, A, B, C, D.
9. Æolian, *A, B, C, D, E, F, G, A.	10. Hypoæolian, E, F, G, *A, B, C, D, E.
11. *Locrian, *B, C, D, E, F, G, A, B.*	12. *Hypolocrian, F, G, A, *B, C, D, E, F.*
13. Ionian, *C, D, E, F, G, A, B, C.	14. Hypoionian, G, A, B, *C, D, E, F, G.

Nos. 11 and 12 in this series are rejected. for technical reasons into which we have not space to enter; they are practically useless.[1]

Of these modes Ambrose used four only—the first four "authentic modes," now numbered 1, 3, 5, and 7. Gregory acknowledged, and is said by some historians of credit to have invented, the first four "plagal modes,"—Nos. 2, 4, 6, and 8. The use of the remaining "modes," except perhaps the ninth, was not formally authorized until the reign of Charlemagne, who published an official decision upon the subject. In one or other of the twelve "modes" recognized by this decision, every plain chant melody is composed. The number of such melodies preserved to us the genuineness of which is undoubted is immensely large; and the collection is divided into several distinct classes, the most important of which are the melodies proper to the *Psalm-Tones* and *Antiphons;* the *Ordinarium Missæ;* the *Introits*, *Graduals*, and *Offertoria;* the *Præfationes*, *Versiculi*, and *Responsoria;* the *Hymns* and *Sequences;* and the *Lamentationes*, *Exultet*, and other music used in Holy Week.

Of these classes the most interesting by far is that which includes the psalm-tones, or psalm-tunes, called by modern English historians, the "Gregorian-tones." The oldest of these are tones 1, 3, 5, and 7, as sung by Ambrose. The antiquity of tones 2, 4, 6, and 8, is less firmly established, though there is no doubt that Gregory the Great sanctioned their use on strong traditional evidence. In addition to these, a peculiarly beautiful melody in mode 9, known as the *Tonus peregrinus*, has been sung from time immemorial only to the psalm *In exitu Israel.* The oldest version of this melody now extant is undoubtedly to a certain extent impure; but tradition imputes to it a very high antiquity, and even our doubts as to the authenticity of the now generally accepted reading extend only to one single note. A widely-accepted tradition points out this melody as the tune sung to *In exitu Israel*, as part of the Great Hallel (see PSALMS), which is generally (but hardly rightly) identified with the hymn sung by our Lord and His apostles immediately after the institution of the Last Supper.

One very powerful argument in favor of the Jewish origin of the psalm-tones lies in the peculiarity of their construction. We are not aware that this argument has ever been previously brought forward; but it is impossible to subject the venerable melodies to minute examination without observing their perfect adaptation to the laws of Hebrew poetry, as opposed to those which governed Greek and Latin verse. The division of the tune in every case, without exception, into two distinct strains, exactly balancing each other, points assuredly to the intention of singing it to the two contrasted phrases which, inseparable from the constitution of a Hebrew verse, find no place in any later form of poetry. And it is very remarkable that this constructional peculiarity was never imitated, either in the earliest hymns or antiphons we possess or in those of the Middle Ages, —evidently because it was found impossible to adapt it to any mediæval form of verse—even to the *Te Deum*, which, though a manifest reproduction of the Hebrew psalm, was adapted by Ambrose to a melody of very different formation, and naturally so since so many of its phrases consist of a single clause only, balanced in the following verse. This peculiarity now passes for the most part unnoticed; and the *Te Deum* is constantly sung to a psalm-tune, very much to the detriment of both. But in the Middle Ages this abuse was unknown; and so it came to pass that, until the "School of the Restoration" gave birth, in England, to the single chant, avowedly built upon the lines of its Gregorian predecessor, and a somewhat later period to the double one, so constructed as to weld two verses of the psalm into one, often with utter disregard to the sense of the words, the venerable psalm-tones stood quite alone—the only melodies in existence to which the psalms could be chanted. And so intimate is the adaptation of these plain-chant melodies to the rhythm as well as to the sense of the sacred text, even after its translation into more modern languages, so strongly do they swing with the one and emphasize the other, that it is difficult to believe that the composition of the music was not coeval with that of the poetry.

Next in antiquity to the psalm tones are the melodies adapted to the antiphons, the offertoria, the graduals, and the introits, sung at high mass. Those proper to the *Ordinarium Missæ* are probably of later date. Those belonging to hymns and sequences are of all ages. Among the latest we possess—perhaps the very latest of any great importance—is that of *Lauda Sion*,—a very fine one, in modes 7 and 8, adapted to the celebrated sequence written by Thomas Aquinas about 1261.

To the melodies adapted to the *Lamentationes* and the *Exultet*, as sung in the Church of Rome during Holy Week, it is absolutely impossible to assign any date at all. All we know is that they are of extreme antiquity, and beautiful beyond all description. The melody of *Exultet* is, indeed, very frequently cited as the finest example of plain song in existence.

To assert that melodies so old as these have been handed down to us in their original purity would be absurd. But the presence of corruption rarely passes undetected by the initiated; and vigorous efforts have been made from time to time to purify the received text by reference to the oldest and most trustworthy MSS. attainable. Such an effort was made on a very extensive scale by the "Congregation of Rites," at the instigation of Pope Pius IX., in the year 1868; and the labors of that learned body, still in active progress, are doing all that can now be done towards the restoration of plain chant to the highest state of purity possible in the present stage of its existence. (W. S. R.)

PLANARIANS. The name *Planaria* was first applied by O. F. Müller in his *Prodromus Zoologiæ Danicæ* (1776) to a group of worms, inhabitants of fresh and salt water, characterized, so far as was then known, by a flattened leaf-like form. Ehrenberg in 1831 changed this name to *Turbellaria* on account of the cilia with which the body is furnished, by means of which the worms create a whirlpool in the surrounding water. The extent of this group was subsequently more restricted, and at present the name *Turbellaria* is applied to all those (mainly free-swimming) Platyhelminths whose body is clothed externally with a ciliated epidermis (Fig. 9), and which possess a mouth and (with the exception of one division) an alimentary canal, but are without an anus. The Turbellarians, excluding the NEMERTINES (*q.v.*), which until recently were classed with them, form an order of the class *Platyhelminthes*, and the old name *Planaria* is now confined to a group of the fresh-water representatives of this order.

Size and External Characters.—Many forms of the

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[1] For fuller information on the subject see the article "Modes, the Ecclesiastical," in Sir G. Grove's *Dictionary of Music.*

Turbellarians are so minute as to be hardly visible with the naked eye, while others attain to a length of several inches, and a land Planarian of no less than 9 inches in length has been described by Moseley. The freshwater forms are generally small, the largest representatives of the order being marine or terrestrial. The smaller species are mostly cylindrical, or convex dorsally and flat ventrally; the anterior extremity is commonly truncated and the posterior extremity pointed (Fig. 1, *a*, *b*). The larger aquatic forms are thinner in proportion to the increasing surface of the body, so that they come to resemble thin leaf-like lamellæ (*d*), while the large land Planarians instead of increasing in superficies grow in length (*e* and *f*), so that they may be best compared to leeches. The larger aquatic forms are frequently provided with tentacles in the shape of paired finger-like processes or ear-like folds of the anterior part of the body (*d* and *g*); sometimes the tentacles are papillary outgrowths of the dorsal surface; the land Planarians are often to be distinguished by a crescent-shaped area at the fore end of the body, which is separated off from the rest (*f*). In many cases the whole dorsal surface is beset with papillæ (*d*). The aperture of the mouth varies greatly in its position; sometimes it is situated at the anterior extremity, sometimes in the middle of the ventral surface of the body, occasionally quite close to the posterior extremity; the single common or distinct male and female generative apertures are also situated upon the ventral surface of the body, and the former in rare cases open in common with the mouth; the genital apertures always lie behind the mouth. Many Turbellarians have a sucker which serves to attach the animal to surrounding objects, or to another individual during copulation.

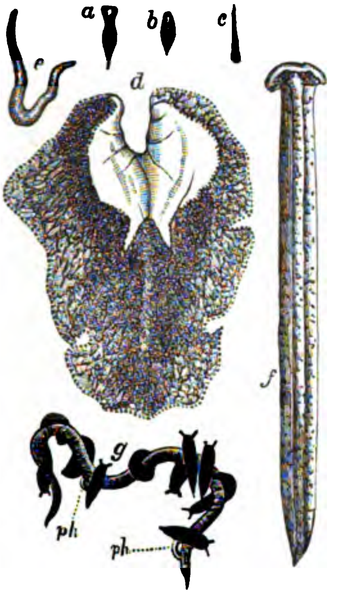

FIG. 1.—*a*, *Convoluta paradoxa*, Oe.; *b*, *Vortex viridis*, M. Sch.; *c*, *Monotus fuscus*, Gff.; *d*, *Thysanozoon brochii*, Gr., with elevated anterior extremity (after Joh. Schmidt); *e*, *Rhynchodemus terrestris*, O. F. Müller (after Kennel); *f*, *Bipalium ceres*, Mos. (after Moseley); *g*, *Polycelis cornuta*, O. Sch., attached by the pharynx (*ph*) to a dead worm (after Johnson). All the figures of natural size, and viewed from the dorsal surface.

Integument.—The integument is composed of a single layer of ciliated epithelium; between the cilia there are often long flagella and stiff tactile hairs and even (in a single instance) chitinous spines; these latter must be regarded as local thickenings of the firm cuticle which covers the epidermic cells. The epidermic cells are flat or columnar, and are united to each other by smooth opposed margins or by denticulate processes which fit into similar processes in the adjacent cells (Fig. 2). Sometimes the epidermic cells are separated by an interstitial nucleated tissue. The structure and functions of the cells of the epidermis differ, and four varieties are to be found:—(*a*) indifferent ciliated cells; (*b*) cells containing certain definite structures (rhabdites, nematocysts); (*c*) gland cells; and (*d*) glutinous cells (Klebzellen). The rhabdites are refracting homogeneous rod-like bodies, of a firm consistency, which are met with in most Turbellaria, and often fill all the cells of the epidermis; they are not always found entirely within the cells, but the extremity often projects freely on to the exterior of the body. They are readily extruded from the cells by pressure, and are often found in great abundance in the mucus secreted by the glandular cells (many Turbellarians, like snails, deposit threads of mucus along their track); in this case the epidermic cells become perforated like a sieve. In many Turbellarians the rhabdites are chiefly massed in the anterior part of the body; frequently there are several varieties of rhabdites in one and the same species,—some being pointed at both ends, others cylindrical with truncated extremities. These structures are either formed directly in the ordinary epidermis cells as a kind of secreted product of the cell, or in special formative cells which lie beneath the integument and are connected with the epidermis cells by protoplasmic filaments, by means of which the rhabdites reach the surface of the body. These cells must be regarded as epidermic cells which have become disconnected with the epidermis itself, and wandered into the subjacent parenchyma. The function of the rhabdites seems to be to support the tactile sense. In rare instances nematocysts are present which in structure and development entirely resemble those of the *Cœlentera* (see vol. xii. p. 580). Very commonly structures known as pseudo-rhabdites are present; these have a rod-like form, but instead of being homogeneous are finely granular; they are an intermediate step between the rhabdites proper and a granulated secretion occasionally thrown off by the gland cells. The unicellular glands are either situated among the epidermic cells or in the parenchyma, in which case they are connected with the exterior only by the excretory duct. A peculiar modification of the epidermic cells are the so-called "glutinous cells," which occur on the ventral surface or at the hinder end of the body of many Turbellarians, and compensate for the suckers; the surface of these cells is furnished with numerous minute processes by means of which and a sticky secretion the animals can attach themselves to surrounding objects. Sometimes the epidermic cells contain calcareous concretions, and very commonly pigment is found either in the cells themselves or within the interstitial tissue. The colors of Turbellarians are, however, not always due to the pigment of the epidermis but to pigment contained in the parenchyma. Beneath the epidermis is a basement membrane (Fig. 2, *bm*), which is in some cases very delicate and structureless, and in other cases much thicker and enclosing branched cells; this membrane

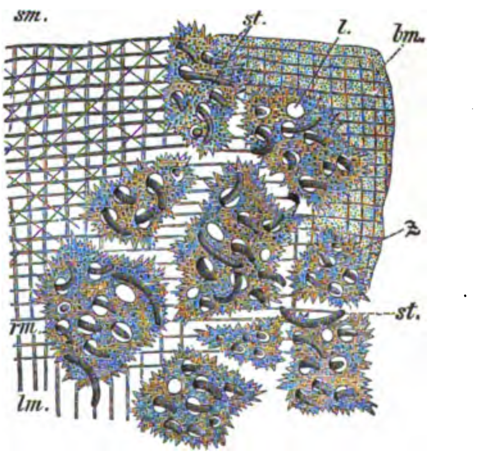

FIG. 2.—Integument of *Mesostoma lingua*, O. Sch. On the right hand is the epidermis (*z*) with perforations (*l*) through which the rhabdites (*st*) project. Beneath this the basement membrane (*bm*), and beneath this again the muscular layers consisting of circular (*rm*), diagonal (*sm*), and longitudinal (*lm*) fibres.

is attached more firmly to the subjacent tissue than to the epidermis. Since this tissue is the strongest in the body, and serves as a surface of attachment for the muscles, it has been termed by Lang a skeletal membrane.

The third section of the integument is formed by the muscular layers. These form a continuous covering to the rest of the body, but their arrangement and thickness are very different in different forms. In the smaller species (*Rhabdocœlida*) there are two layers, an outer circular and an inner longitudinal, only in a few cases the circular layer is external to the longitudinal; sometimes there are three distinct layers, as in Fig. 2, where a diagonal layer is interposed. The larger forms (*Dendrocœlida*) have a much more complicated muscular system: in the most differentiated forms there are six separate layers (two circular, two diagonal, and two longitudinal), which are, however, always less developed upon the dorsal than upon the ventral surface in that the thickest layer of the ventral surface (the innermost longitudinal) is absent or very feebly developed upon the dorsal side. Besides the integumentary muscular system, there are also found dorso-ventral muscular bands which traverse the whole body from the dorsal to the ventral basement membrane, being branched at both extremities, and the special muscles of the pharynx, genital organs, and suckers.

The perivisceral cavity, bounded by the integument and traversed by the dorso-ventral muscles, contains the organs of the body—alimentary canal, excretory system, nervous system, and genital glands. The space left between these organs is filled with parenchyma; the latter varies much in appearance and is very difficult to study. Generally it consists of a network of fibres and trabeculæ, which contain nuclei, and between which is a system of cavities filled during life with the perivisceral fluid. These cavities are generally but few in number and vary with the stronger or feebler development of the reticulum; they occasionally contain free cells.

Alimentary Canal.—All Turbellarians are furnished with a mouth, which, as there is no anus, serves both to take in nutriment and expel the undigested remains of food. The alimentary canal consists of a muscular pharynx and an intestine. The pharynx (Figs. 3, 5 to 8, *ph*) is cylindrical in form, rather complicated in structure, and surrounded by a muscular sheath, which opens on to the exterior by the mouth (*m*). Often the pharynx consists merely of a circular fold lying within the pharyngeal pouch (Fig. 8); it can be protruded through the mouth and acts like a sucker, so that the animal can fasten itself upon its prey and draw it into the intestine by suction. At the junction of the pharynx with the intestine open the salivary glands, which are frequently large and well-developed (Fig. 5, *s*). The intestine (*i*) has a very characteristic form in the different sections, and has long served to divide the *Turbellaria* into two groups: (1) *Rhabdocœlida*, with a straight unbranched intestine (Figs. 5, 6), and (2) *Dendrocœlida*, with a branched intestine (Figs. 7, 8). In the latter group Lang has recently called attention to further differences that exist in the form of the intestine: in the *Tricladida* (Fig. 7) there is no central "stomach," but three equally-sized intestinal branches (which have secondary ramifications) unite together to open into the pharynx; in the second group, the *Polycladida* (Fig. 8), there is a median stomach (*st*), from which numerous intestinal branches arise; this stomach communicates directly with the pharynx; the branches of the intestine are much ramified and often form an anastomosing network. The epithelium of the intestine is a single layer of cells generally not ciliated, capable of protruding amœboid processes by which the food is absorbed; the digestion of these animals is intracellular. Sometimes a muscular coat surrounds the intestine, the lumen of which is thus capable of being totally or partially contracted. To the above-mentioned divisions of the group, distinguished from each other by the varying form of the alimentary tract, another has been added, viz., the *Acœla* (Ulianin), which are characterized by the entire absence of any intestine. In these forms (Fig. 4) the mouth leads directly into the parenchyma of the body by a short tube which is merely an invagination of the integument; the parenchyma is a syncytium, consisting of a soft protoplasmic mass with scattered nuclei, which represents the elements of the intestine and the body parenchyma (ento- and mesoderm) completely fused and without any traces of differentiation. This fact, as well as the disappearance of a nervous and excretory system, reduces the *Acœla* to the lowest position not only among the *Turbellaria*, but among the whole group of the *Vermes*.

Excretory System.—The excretory system of the Turbellarians is quite similar to that of the Trematodes and Cestoids; it consists of (1) the main trunks with their external aperture, (2) the secondary branches of these, and (3) the excretory cells with the fine tubules leading from them. Rarely is there but a single main excretory trunk present opening at the hinder end of the body (*Stenostoma*); generally there are a pair of such trunks which open in common at the hinder end of the body, or separately (most *Rhabdocœla*), or by the mouth (Fig. 3). In the *Tricladida* there are two or four lateral trunks present which open by a number of pores arranged in pairs upon the dorsal surface of the body; the same appears to be the case in the *Polycladida*. The main trunks of the excretory system are generally much twisted in their course, and anastomose with each other; they receive the fine tubules either directly or, as in the *Rhabdocœla*, there is a network of secondary tubules interposed. The excretory cells are pear-shaped, they are branched and furnished with a nucleus and a large vacuole which is directly continuous with the lumen of the tubule; from the boundary wall of the vacuole springs a single flagellum, which depends into the lumen of the tubule and is capable of active movement. Lang discovered in a marine form of the *Tricladida* (*Gunda*) similar vacuolated cells with a single flagellum among the epithelial cells of the intestine, and came to the conclusion that the excretory cells were on that account derived from the epithelium of the intestine. The movements of the excretory fluid towards the external pore are directed by this flagellum as well as by cilia developed upon the walls of the fine tubules; the motion of all these cilia is such as to drive the contents of the tubules towards the excretory pore. The main trunks of the excretory system are either sparsely (*Tricladida* according to Jijima) or completely (*Polycladida* according to Lang) lined with cilia.

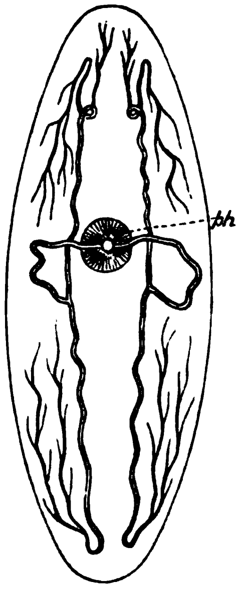

FIG. 3.—Main trunks of the excretory system of *Mesostoma ehrenbergii*, O. Sch. Open on to the exterior through the mouth. *ph*, pharynx.

Nervous System.—The central organ of the nervous system, the brain (*cn*) is a double ganglion at the anterior end of the body, and has been noticed in all the known forms with the exception of the *Acœla*. It is situated in front of or above the pharynx; in those species in which a process of the intestine extends beyond the region of the brain (*cf.* Figs. 7 and 8 viewed from the ventral surface) it is placed below this. In such cases there is sometimes a commissure encircling the prolongations of the intestine. Each of the two ganglia gives off a strong longitudinal nerve cord (Figs. 5–8, *ln*) from which arise branches going to the various organs of the body. The structure of the nervous system is somewhat different in the *Rhabdocœla*, *Tricladida*, and *Polycladida*. In the first group (Figs. 5, 6) the two longitudinal cords and their branches are the most feebly developed, and there is but rarely (*Mesostoma*, *Monotus*) a transverse commissure uniting the longitudinal cords. These cords are very large in the *Tricladida*, where the brain is to be regarded as a simple thickening of them; in this group there are numerous transverse commissures between the longitudinal nerve cords (Fig. 7), and the nerves arising from them and passing to the periphery form a subcutaneous nerve plexus within the muscular coat. Lang has observed a similar nerve plexus in the *Polycladida*, the central nervous system of which differs from that of the *Tricladida* in that a number of stout nerve cords radiate outwards from the brain as well as the two longitudinal cords; they are all united together by numerous commissures, and a network is thus formed which extends throughout the body.

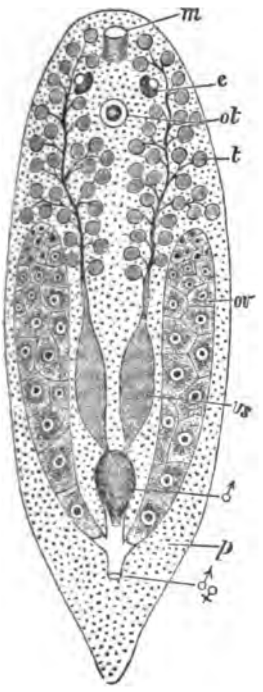

Fig 4.

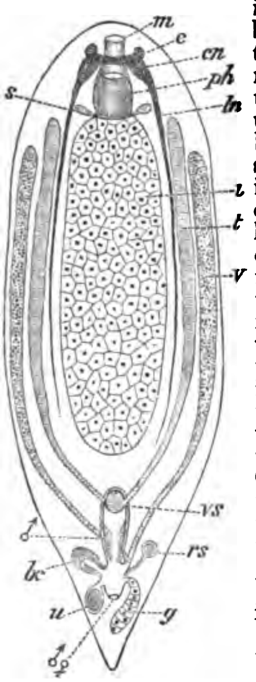

Fig. 5.

FIG. 4.—Plan of an Acœlous Turbellarian. *e*, eye; *m*, mouth; *ot*, otolith; *ov*, ovary; *p*, digesting parenchyma; *t*, testicular follicles; *vs*, vesicula seminalis; ♂, male organ of copulation; ♂ ♀, common sexual aperture.

FIG. 5.—Plan of a Rhabdocœlous Turbellarian. *bc*, bursa copulatrix; *cn*, brain; *e*, eye; *g*, germarium; *i*, intestine; *ln*, longitudinal nerve trunk; *m*, mouth; *ph*, pharynx; *rs*, receptaculum seminis; *s*, salivary gland; *t*, testis; *u*, uterus (containing an egg); *v*, yelk gland; *vs*, vesicula seminalis; ♂, chitinous copulatory organ; ♂ ♀, common sexual aperture.

Sense Organs.—These are represented by tactile organs, auditory organs (otoliths), and eyes. The whole surface of the body is very sensitive and (*e. g.*, in the *Polycladida*) contains cells which end in tufts of fine hairs, so that certain regions thus become specially sensitive and serve as tactile organs. The anterior pointed extremity of the body in the *Rhabdocœla* is characterized by an abundant development of rhabdites and tactile hairs, and thus becomes a special tactile organ; in other cases this region of the body is transformed into a conical tactile proboscis which can be retracted into a sheath (*Proboscida*). In the freshwater *Tricladida* the anterior margin of the head is richly innervated, and is beset with a special row of tactile cells which contain no rhabdites; in the terrestrial forms of the same family (*Bipalium*) Mosely has described a row of papillæ along the crescent-shaped anterior extremity which can be extended and form tactile organs; between the papillæ are peculiar ciliated grooves connected with nerves. In the *Polycladida* there are tactile cells with stiff hair-like processes on the summit of the dorsal papillæ and the various tentacular structures: the tentacles in this family also serve to support the eyes.

The majority of the Turbellarians possess eyes; the *Rhab*[illegible]*ida* commonly have two or four, as also have the *Tricladida;* the latter, however, are in some instances furnished with a greater number arranged in a continuous row round the anterior end of the body; in the *Polycladida* there are from fourteen to several hundred eyes arranged in two symmetrical groups round the brain or scattered over the whole of the anterior margin of the body and upon the tentacles. The eyes are always situated beneath the integument within the parenchyma, sometimes directly upon the brain or connected with it by special optic nerves. In its simplest form the eye is a pigmented spot with or without a refractory lens-like body; the more complicated eyes consist of a pigmented sheath containing a number of refracting rods which are connected at their outer extremity with a series of retinal cells, one to each rod; the retinal cells are prolonged into a nerve thread running to the brain; the arrangement of the visual elements is therefore precisely the same as in the vertebrate eye. Of great interest is the fact that in the *Polycladida* the number of eyes increases with the growth of the animal, and Lang has shown that the eyes increase in number by actual division. On the other hand Carrière has discovered by experimenting with certain freshwater *Tricladida* that the compound eyes (those containing a number of rods) are formed by the coalescence of several simple eyes. Only a single eye is found in the *Monotida*, which has the form of a simple pigment spot in front of the otolith.

Auditory organs are found in the shape of vesicles filled with fluid and containing circular lenticular or spindle-shaped otoliths formed of carbonate of lime. Otolithic vesicles of this kind are found in many *Rhabdocœlida* (*Acœlo*, *Monotida*, Fig. 4, *ot*) embedded in a depression on the anterior surface of the brain. In the *Dendrocœlida* these organs are but rarely present.

As a sensory organ of unknown function must be mentioned the paired lateral ciliated grooves which are met with on either side of the brain in many *Rhabdocœla* (Fig. 9, *c*); they are also found commonly in NEMERTINES (*q. v.*), but are here more complicated in structure.

Reproductive Organs.—With a few exceptions all the Turbellarians are hermaphrodite, and reproduce themselves sexually. Only among the *Microstomida* is there an asexual as well as a sexual reproduction. The male and female organs open to the exterior, either through a common cloaca (*atrium genitale*) on the ventral surface (most *Rhabdocœlida* and all *Tricladida*, Figs. 4–7), or there are separate male and female apertures. In this case the male aperture is generally placed in front of the female aperture (some *Rhabdocœlida* and all *Polycladida*, Fig. 8), but occasionally the positions are reversed (certain *Rhabdocœlida*). The genital glands display a primitive condition in being paired, though frequently the germarium (Fig. 5, *g*) of the *Rhabdocœla*, and occasionally also the testis, is developed only upon one side of the body.

The structure of the female organs varies. In some cases there are simple ovaries (*ov* in Figs. 4, 8) in which the ova originate and become fully mature without being furnished with the secretion of a second gland; in other cases there is a division into germarium (Fig. 5–7, *g*) and yelk gland (*v*); the primordial ova or germs originate in the former, and absorb the products of the yelk gland in the atrium, where they become ready for fertilization. An intermediate condition is seen in those forms where there is but a simple gland present which produces germs in its upper portion and yelk in the lower portion. The ovaries are generally compact round or tubular glands (Fig. 4); sometimes they are formed of a number of pear-shaped follicles (Fig. 8); there is usually a simple or paired uterus (*u*) which retains the ova for some time before they are deposited; sometimes, however, the ova undergo their development within the uterus and are completely developed before expulsion; in some cases the egg-shell is detached within the uterus so that the young are produced alive.

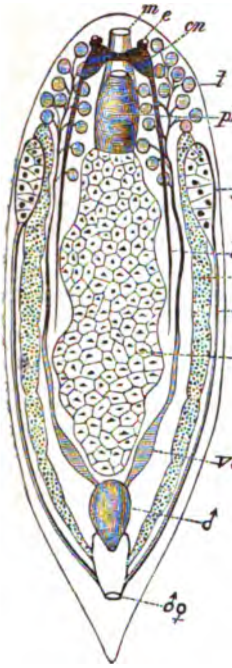

Fig. 6.

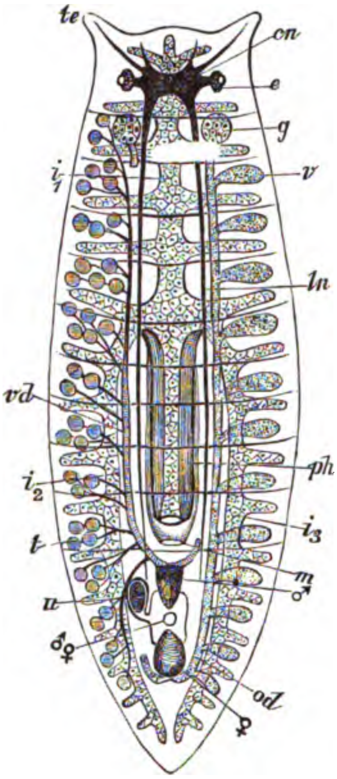

Fig. 7.

FIG. 6.—Plan of an Alloiocœlous Turbellarian. Lettering as in Fig. 5.

FIG. 7.—Plan of a Tricladid. i_1, anterior, and i_2, i_3, paired posterior branches of intestine; *od*, oviduct; *te*, tentacle; *vd*, vas deferens; ♂, male, and ♀, female copulatory organ. Other letters as in Fig. 5.

In Turbellarians without a yelk gland the uterus is a simple widening of the oviduct (Fig. 8); in those forms which possess additional yelk glands the uterus is a simple or paired diverticulum of the atrium genitale (Figs. 5, 7). The ova are either surrounded by a more or less hard chitinous shell, or one shell contains a number of ova ("cocoon" of *Tricladida* and many *Polycladida*). The *Polycladida* deposit an egg-string which like that of the *Gastropoda* consists of a number of eggs bound together by a transparent albumen-like mass. Many Rhabdocœl Turbellarians (*e. g.*, *Mesostoma ehrenbergii*) produce two sorts of ova, thin-shelled summer ova and thick-shelled winter ova; the latter are capable of withstanding a considerable amount of desiccation, and are deposited in the autumn. The accessory female organs of reproduction are represented by bursæ seminales, which receive the semen during copulation and retain it until fertilization is accomplished. A further division of labor is brought about by the presence of two diverticula of the atrium genitale, one of which serves as a bursa copulatrix (Fig. 5, *bc*) and the other as a receptaculum seminis (*rs*) in the same sense as the equivalent organs of insects. In the place of a special receptaculum seminis the efferent duct of the ovary is often (*Mesostomida*) metamorphosed into a chamber to contain the semen. In the *Tricladida* and *Polycladida* the female efferent duct is often differentiated into a muscular vagina which closely resembles the penis (Figs. 7, 8, ♀).

Finally, the female generative apparatus is furnished with a number of glands which have been termed cement glands, albuminiparous glands, and shell glands.

The male sexual glands (Figs. 4–8, *t*) resemble the ovaries in being either compact tubular (Fig. 5) or follicular (Figs. 4, 6, 7, 8) structures. The vasa deferentia (*vd*) are often widened out into vesiculæ seminales (Figs. 4, 6, *vs*); or there are special vesiculæ seminales present, formed by a portion of the penis (Fig. 5, *vs*). In the male organ of copulation there is frequently found in addition to the spermatozoa an accessory granulated secretion produced by special glands, but of unknown function.

The muscular penis, especially in the *Rhabdocœla*, has a number of chitinous spines and hooks which serve to assist the animal in maintaining a firm hold during copulation, but also in capturing and retaining its prey. In *Macrorhynchus helgolandicus*, Gff., there is a peculiar poison dart connected with the male copulatory organ which only serves the latter purpose. Very remarkable is the opening of the penis into the mouth cavity in *Stylostomum* (*Polycladida*) and *Prorhynchus* (*Rhabdocœla*), and also the existence of several (2–15) pairs of male copulatory organs and genital apertures in certain *Polycladida*.

The spermatozoa vary much in form, especially in the *Rhabdocœlida*, where frequently the species of one and the same genus are distinguished by the different form of the spermatozoa. Copulation in the Turbellarians is generally reciprocal; only in those cases where both summer and winter ova (see above) are formed do the former arise from self-fertilization; the latter are the result of the copulation of two individuals. The fertilization of the ova always takes place in the atrium genitale. Many Turbellarians, especially the *Acœla*, display the phenomenon known as "successive hermaphroditism," the male organs of an individual attain to maturity first, and the female organs become ripe subsequently. During copulation, therefore, one individual is physiologically a male and the other a female.

Asexual generation is met with only in the *Microstomida*; it takes the form of transverse division accompanied by budding. The posterior third of the body becomes separated off by a septum running from the gut to the integument and an external furrow corresponding to this; this part of the body grows in length until it equals the anterior portion. By further repetition of this double procedure of separation and equalization there, chains of 4, then 8, 16, and 32 buds are formed, which remain attached (Fig. 9), and, although fresh mouth apertures (*m'*, *m''*, *m'''*) have been formed, are still in communication by the intestinal lumen; this becomes closed before or after the several buds break off from their connection with each other. Throughout the whole summer chains of zooids are met with; in autumn this asexual division probably ceases to occur; the several individuals become sexually mature, separate from each other, and lay eggs which remain quiescent during the winter and in the spring develop into fresh individuals reproducing asexually.

Development.—The study of the development of the Turbellarians is unfortunately not very far advanced, particularly among the small *Rhabdocœlida*, which are extremely difficult to investigate, and about which hardly any developmental facts are known. The larger freshwater *Tricladida* and the *Polycladida* on the contrary have been recently very fully investigated. The *Rhabdocœla* and the *Tricladida* appear to develop directly without any metamorphosis, while a great part of the *Polycladida* undergo a metamorphosis and pass through a larval condition, during which they are furnished with provisional ciliated processes (Fig. 10); the *Acœla* have also a free larval form; pelagic larvæ with a coat of long cilia apparently belonging to this group have been observed by Ulianin. The segmentation of the ovum is total, but unequal; an epibolic gastrula is formed and the aperture of invagination becomes the permanent mouth of the adult.

Systematic Arrangement and Mode of Life.—Order *Turbellaria.*—Platyhelminths with a ciliated integument, a mouth and pharynx, but no anus; with paired cerebral ganglia and two lateral nerve cords; sexual organs hermaphrodite; chiefly free-swimming.

Sub-order A. *Rhabdocœlida.*—Of small size; body cylindrical or depressed; without an intestine, or with a simple unbranched intestine; the female genital glands always compact, not follicular; genital apertures single or distinct.

Tribe I. *Acœla* (Fig. 1, *a*).—With a digestive parenchyma not differentiated into intestine and parenchyma proper; with no nervous system or excretory organs; sexual organs hermaphrodite, with follicular testes and paired ovaries; generally without a pharynx but having otoliths; all the

forms marine. Many quite flat, with the lateral margins bent down towards the ventral surface (*Convoluta*), frequently with brown or green parasitic algæ in the parenchyma.

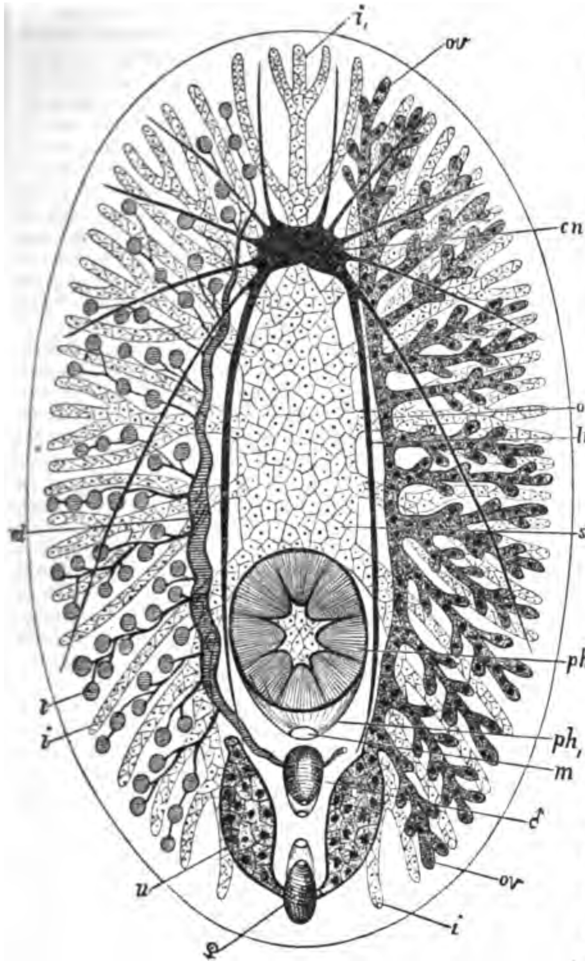

FIG. 8.—Plan of a Polycladid. *cn*, brain; *i*, intestinal branches; *i*₁. anterior unimpaired intestinal branch; *ln*, longitudinal nerve cord; *m*, mouth; *od*, oviduct; *ov*, ovarian follicle; *ph*, pharynx; *ph*₁, pharyngeal pouch; *st*, stomach; *t*, testicular follicle; *u*, uterus: *vd*. vas deferens: ♂, male copulatory organ, with the male aperture behind; ♀, female copulatory organ, with the female aperture before it. The eyes are omitted.

Tribe II. *Rhabdocœla* (Fig. 1, *b*).—Intestinal tract and parenchyma separate; nervous system and excretory organs present; with compact testes and female generative glands (ovaries or separated germarium and yelk glands); with a complicated pharynx, but generally without otoliths. Numerous forms, freshwater and marine; the genus *Prorhynchus* (two species) also in damp earth. The *Microstomida* (Fig. 9) propagate asexually.

Freshwater forms mostly belong to the families *Mesostomida* and *Vorticida*, some of which contain green parasitic algæ. Marine forms include representatives of these two families and of the *Proboscida* (with a tactile proboscis). Of the family *Vorticida*, the genera *Graffilla* and *Anoplodium* are parasitic, the former in Gastropods the latter in Echinoderms (Holothurians).

Tribe III. *Alloiocœla* (Fig. 1, *c*).—Intestinal tract and parenchyma separate; nervous system and excretory organs present; with follicular testes and compact female glands (as in the *Rhabdocœla*); pharynx similarly developed as a shorter or longer sac. One family (*Monotida*), with otoliths. All the species marine. with one exception, *Plagiostoma lemani*, which lives in the deep water of the Alpine lakes.

Sub-order B. *Dendrocœlida*.—Large forms with a flattened body, branched intestines, follicular testes and follicular yelk glands or ovaries; without otoliths.

Tribe I. *Tricladida*.—Body elongate; intestine with three main branches uniting to open into a cylindrical retractile pharynx; with follicular testes, two round germariums, and numerous yelk follicles, with a single sexual aperture. *Planaria, Dendrocœlum, Polycelis* (Fig. 1, *g*) are inhabitants of fresh water (with great power of reproduction). Terrestrial forms (Fig. 1, *e, f*) of leech-like shape, especially met with in the tropics (only two European species *Rhynchodemus terrestris* and *Geodesmus bilineatus*); marine forms *Gunda* (characterized by a metameric structure), *Bdelloura* (external parasite of *Limulus*).

Tribe II, *Polycladida* (Fig. 1, *d*).—Body leaf-like, thin, and broad, with numerous branched or retiform intestinal cœca which unite to form a central tube (stomach); with follicular testes and follicular ovaries, with two separated genital apertures, the male in front of the female; without (*Acotylea*) or with (*Cotylea*) a sucker situated behind the female generative opening. All marine.

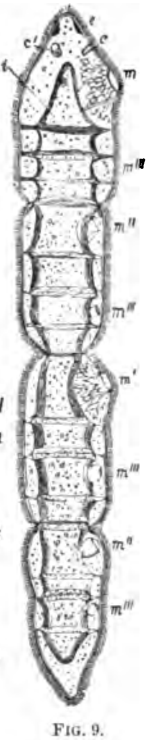

FIG. 9.

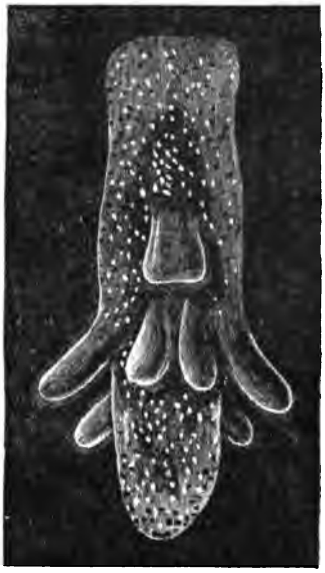

FIG. 10.

FIG. 9.—*Microstoma lineare*, Oe., undergoing division. There are 16 individuals, 8 with mouth apertures, showing the buds of the first (*m*), second (*m'*), third (*m''*), and fourth (*m'''*) generation. The fifth generation has not yet acquired a mouth aperture. *c*, ciliated grooves; *e*, eye spots; *i*, intestine.

FIG. 10.—Larva of *Yungia aurantica*, L. (*Polycladida*), with provisional ciliated processes (after A. Lang).

Literature.—The most recent works, which also contain a full account of what has gone before, are the following:—*Rhabdocœla*.—L. v. Graff, *Monographie der Turbellarien:* 1. *Rhabdocœlida*, Leipsic 1882, with 20 plates. *Marine and Freshwater Tricladida*.—A. Lang, "Der Bau von *Gunda segmentata* und die Verwandtschaft der Platyhelminthen mit Cœlenteraten und Hirudineen," in *Mitth. Zool. Stat. Neapel*, vol. iii., 1881; El. Metschnikoff, "Die Embryologie von *Planaria polychroa*, in *Zeitschr. f. wiss. Zool.*, vol. xxxviii., 1883; Isao Jijima, "Untersuchungen über den Bau und die Entwickelungsgeschichte der Süsswasser-Dendrocoelen," in *Zeitschr. f. wiss. Zool.*, vol. xl., 1884. *Land Planarians.*—H. N. Moseley, "On the Anatomy and Histology of the Land Planarians of Ceylon, with some account of their Habits, and with a Description of Two New Species, and with Notes on the Anatomy of some European Aquatic Species," in *Phil. Trans.* (London, 1874), and "Notes on the Structure of several Forms of Land Planarians, with a Description of Two New Genera and Several New Species, and a List of all Species at present known," in *Quart. Jour. Micr. Sci.*, vol. xlvii., 1877; J. v. Kennel, "Die in Deutschland gefundenen Landplanarien *Rhynchodemus terrestris* und *Geodesmus bilineatus*," in *Arbeit. Zool.-Zootom. Instit. Würzburg*, v., 1879. *Polycladida.*—A. Lang, "Die Polycladen," in *Fauna und Flora des Golfes von Neapel*, No. 11, 39 plates, Leipsic, 1884-85. (L. V. G.)

[For descriptions of North American Planarians see Leidy, Jos. Jour. Acad. Nat. Sci. Phil., 1855, and Proc. Acad. Nat. Sci. Phila., ix., 1858, p. 171–72; Girard, Chas., Proc. Bost. Soc. Nat. Hist., 1848–51, Proc. Acad. Nat. Sci. Phila., 1853, and in Stimpson's Synopsis of the Marine Invertebrata of Grand Menan, (Smithsonian Contrib. to Knowledge, 1853); also Silliman, W. A., in Zeitschrift für wissenschaftliche Zoologie, Band x. 21. Heft. I. 1884, p. 49–78.

Rhyncodesmus sylvaticus Leidy, is a land Planarian found in the United States.—AM. ED.]

PLANCK, GOTTLIEB JAKOB (1751–1833), theologian and church historian, was born at Nürtingen in Würtemberg, where his father was a notary, on November 15, 1751. He was educated for the Protestant ministry at Blaubeuren, Bebenhausen, and Tübingen, and from 1774 to 1784 held successive appointments as repetent, preacher, and professor in Tübingen and Stuttgart. In 1781 he published anonymously the first volume of his *Geschichte des Protestantischen Lehrbegriffs*; the second, also anonymous, appeared in 1783; and in 1784 he was chosen to succeed Walch at Göttingen. Here in the course of a long and useful professional career he enjoyed a large number of academical and ecclesiastical honors. His death took place on August 31, 1833.

The *Geschichte des Protestantischen Lehrbegriffs* was completed in 6 vols. in 1800 It was followed by an extensive *Geschichte der Kirchenverfassung*, in 5 vols. (1803–1809). Both are works of considerable importance, and are characterized by abundant learning and acuteness, the most conspicuous fault in the eyes of his least favorable critics being a tendency, which cannot be wholly denied, to "subjective pragmatism."

PLANTAGENET. This surname, distinctive of a line of kings who ruled in England for more than three hundred years, was first adopted by Geoffrey, count of Anjou, in reference to a sprig of broom (*planta genistæ*) which he is said to have worn in his bonnet. He is described by early writers as a very handsome man, but there was certainly nothing very striking in his character. He was the son of Fulk, count of Anjou, king of Jerusalem, who, before his departure for the Holy Land, placed him in possession of the counties of Anjou and Maine. This made him in the eyes of Henry I. of England, who was anxious to protect Normandy, an eligible husband for his widowed daughter, the empress Maud, whom he proposed to make his heiress, both in England and beyond sea. It was a purely political marriage, and the couple immediately afterwards had violent quarrels. Nor was either of them popular in England, where a female sovereign would at that time have been an innovation, and Geoffrey was disliked as a foreigner—although the same objection might have seemed to apply to Stephen of Blois, whose superior activity gained possession of the throne before Maud could make good her pretentions. In a long war with the usurper, though recognized as "lady of England" and virtual sovereign by one part of the country, she was only able in the end to secure the succession for her son. Stephen ended his days in peace, and the house of Plantagenet succeeded to the throne in the person of Henry II. by virtue of a compact.

Henry, the son of Geoffrey of Anjou and the empress Maud, was born at Le Mans in the year 1133, and was just twenty-one years of age when he attained the crown. But his youth had been well spent in preparation for it. When eight years old he was brought to England to be trained in arms. At sixteen he was knighted by his great-uncle David of Scotland. In 1151 his father put him in possession of Normandy, and, dying soon after, left him also the succession to Anjou. These advantages he improved next year by his marriage with Eleanor of Aquitaine, which, by adding Poitou and Guienne to his dominions, gave him the lordship over the whole western side of France, from north to south, with the exception of Britanny, which also some time afterwards came under his power.

Having thus, even before he was twenty, become master of so many fair provinces, he then sailed to England, and, though he did not dethrone Stephen, compelled him to acknowledge him as his successor. Next year he was king. It is a new era in the history of England as well as in the fortunes of his house. The country, which was lately so impatient of the rule of a foreigner—fearing, doubtless, that English interests would be sacrificed to those of Anjou—now yields an easy submission to the ruler of all western France, from Picardy to the Pyrenees. And, though Henry is in fact one of the greatest of Continental potentates, greater really than his feudal superior, the king of France, there is no great cause for anxiety. Henry devotes himself to the interests of his island kingdom, takes steps to secure the succession there to his issue, causing his eldest son even to be crowned king during his own lifetime, and is much more intent on the subjugation of Wales and Ireland and the recognition of his feudal superiority over Scotland than upon any extension of his responsibilities abroad. Personally a man of fiery temperament and strong passions, his patience as a politician is remarkable. Bit by bit he is building up a strong empire, and even keeping the pretensions of the church within definite and reasonable bounds. But a single angry word undoes the work of years. He is responsible for Becket's murder. He must do penance and make his peace with the church. He must humiliate himself before Becket's grave.

His dynastic policy seemed almost an equal failure, but was productive of wide and far-reaching consequences. His ungrateful sons rebelled against him, and when he heard that even John had joined the confederacy he felt that he had nothing more to live for. The eldest, Henry, whom he had been so anxious to make a king during his own life, sickened and died in France, after flagrant acts of ingratitude and impiety. Geoffrey, to whom he had secured the duchy of Britanny, soon followed his brother, and there remained but Richard and John, besides three daughters, who were all disposed of in marriage to Continental princes. As Richard, though he came to the crown, also died without legitimate issue, the male line was continued in the two sons of John, Henry III. and Richard, king of the Romans, and the issue of the latter became extinct in the next generation.

It is remarkable how the prosperity of England seemed to keep pace with the stability of the succession. The short reigns of Richard I. and John were times of peculiar misery, which was only brought to a climax by the war of the Great Charter and by the dauphin being called in to enforce it. Matters improved under Henry III., even during the minority; but he, too, had a war with his barons in the latter part of his reign. He, too, like his father, had but two sons who grew up to manhood; and, while the elder, Edward I., succeeded him on the throne and was the ancestor of all the following kings, the younger, Edmund Crouchback, became progenitor of the house of Lancaster by the marriage of his great-granddaughter Blanche, to John of Gaunt, fourth son of Edward III. Edward I. had three sons who came to man's estate; Edward II., only two, or more properly only one, for the second, John of Eltham, died in Scotland at the age of nineteen. Finally the time of Edward III. with his great family was the climax in the fortunes of the house of Plantagenet. Nor need we pursue the family history further, as the story of its descent after the days of Edward III. will be found sufficiently treated elsewhere (see LANCASTER, HOUSE OF, and YORK, HOUSE OF).

Of the alliances of this great dynasty the most important after the days of Henry II. were those of the house of Lancaster. Henry III. married his daughter Margaret to Alexander III. of Scotland, and another daughter to the duke of Britanny. Edward I. had for his sons-in-law Gilbert de Clare, earl of Gloucester, the duke of Brabant, and the earl of Holland. A daughter of Edward II. married a duke of Gueldres. But "the aspiring blood of Lancaster" spread itself over Europe by alliances with Castile and Portugal, Navarre and Denmark, Bavaria and other foreign states. It has reigned in Portugal to the present day, and it continued to reign in Spain till the end of the 17th century. (J. GA.)

PLANTAIN (Lat. *plantago*), a name given to plants with broad palm-like leaves. This is the case with certain species of *Plantago*, *Alisma*, and *Musa*, to all of which the term is popularly applied. Of the

Plantago little need be said here, the species being for the most part mere weeds, though one species, *P. lanceolata*, is eaten by cattle, and the seeds of another, *P. major*, are collected for the food of birds. Of far greater general importance is the genus *Musa*, to which belong the Plantain, and the BANANA (*q.v.*). These are gigantic herbs, now diffused by cultivation throughout the tropics of both hemispheres, and sending up from a short thick underground stem shoots with a number of very large leaves whose long thick leaf-stalks are wrapped one around another. The blades are usually oblong-obtuse, like the blade of an oar, with a very thick midrib from which diverge on each side numerous parallel densely arranged secondary ribs. The flowers are borne in huge pendulous spikes provided with large boat-shaped, often colored, bracts, in whose axils the whorls of flowers are produced ; the lower ones are usually female or hermaphrodite, those at the apex of the spike are male only. These flowers consist of a perianth of six divisions partly united below, sligthly two-lipped above, and inclosing five perfect and one imperfect stamen. The ovary is inferior and three-celled—ripening into a long oblong fruit filled with spongy pulp in which the numerous seeds are imbedded. The accumulation of starch and sugar in this pulp renders the fruit of vast importance as an article of diet in the tropics. Corenwinder, cited by Pavy, says that, while starchy matter forms more than 19 per cent. of the ripe fruit—there is also nearly 5 per cent. of nitrogenous matter, about double that of the potato. The plant requires but little attention, and the produce from a relatively small area is enormous ; hence it is one of the most valuable of all food-plants. After fruiting, the stem dies down, but provision for new growth is made by the production from the underground stock of numerous offsets. The number of varieties is very great, a circumstance which in itself testifies to the long period during which the plant has been cultivated. It is also the more remarkable in that perfect seeds are comparatively rarely produced, the inference being that the different forms have arisen from bud-variations or "sports." In spite of the vast number of varieties grown in the tropics of both hemispheres—varieties mostly dependent on diversities in the size, form, and flavor of the fruit—the general opinion among botanists is that they have all sprung from one species, the *Musa sapientum* of Brown. Were it otherwise, it is presumed that the varieties found in America would be different from the Asiatic ones, and these again from those found in the South Sea Islands, etc., but, as a matter of fact, there are no geographic limitations, the same varieties being found in different quarters of the globe. The varieties are arranged under two heads by Desvaux according to the size of their fruit—the bananas, with fruit 7-15 inches in length, and the fig bananas, with fruit from 1-6 inches long ; but these variations are not constant, and Schomburgk has recorded a case in which a spike of the fig banana bore numerous fruits proper to that variety, and in addition a large number of fruits like those of the Chinese dwarf-plantain, *Musa chinensis*, the Cavendish banana of gardens—a case analogous to, but even more remarkable than, the not infrequent occurrence of peaches and nectarines on the same branch. The plantain and the banana are sometimes spoken of as distinct. The former has a green stem and yellow angular fruit not fit for eating till cooked. The banana (*M. sapientum*) has the stem marked with purple spots, and a shorter more cylindric fruit which may be eaten without cooking, but the two run one into the other so that no absolute distinction can be drawn between them. The species have been found in a wild state in Chittagong and Khasia, in the Philippine Islands, in Siam, and in Ceylon, but nowhere truly wild on the American continent.

Musa sapientum.

Throughout tropical and subtropical Asia the plant has numerous and diverse native names; and it was mentioned by old Greek and Latin authors. On the other hand, there are no native names for the plant in Mexico, Peru, or Brazil. From such considerations as these Alphonse de Candolle, in his *Origine des Plantes Cultivées*, sums up the evidence by asserting the Asiatic origin of the plantain and its early introduction into America by the Spaniards or Portuguese. If it should turn out that the banana or the plantain existed in America before the discovery of that continent, then M. de Candolle would attribute that circumstance to some fortuitous introduction at no very remote date rather than to the simultaneous existence of the banana as an indigenous plant in both hemispheres.

It is not only for their fruit that these plants are valuable. The leaves are used for thatching, and the abundant fibre they contain forms a good substitute for hemp. *Musa textilis* is of special value from this point of view. The Abyssinian banana, *M. Ensete*, has dry capsular fruit, and very handsome foliage.

PLANTAIN-EATER. See TOURAKOO.

PLANTIN, CHRISTOPHE (1514-1589), born in a village near Tours (probably Saint-Avertin) in 1514, learned book-binding and book-selling at Caen, and, having married in that town, settled in 1549 as bookbinder in Antwerp, then the principal commercial town of the Netherlands, where he was soon known as the first in his profession. A bad wound in the arm, which unfitted him for this occupation, seems to have been the cause that first led him (about 1555) to apply himself to typography. The first known book printed in his office was *La Institutione di una fanciulla nata nobilmente*, by J. M. Bruto, with a French translation, and this was soon followed by many other works in French and Latin, which in point of execution rivalled the best printing of his time, while the masters in the art of engraving then flourishing in the Netherlands illustrated many of his editions. In 1562, Plantin himself being absent in Paris, his workmen printed an heretical pamphlet, which caused his movables to be seized and sold. It seems, however, that he recovered a great deal of the money, and in 1563 he associated himself with some friends to carry on his business on a larger scale. Among them were two grand-nephews of Dan. Bomberg, who furnished him with the fine Hebrew types of that renowned Venetian printer. He was now in a position to spare no expense in printing his books with all the care he deemed necessary; and his editions of the Bible in Hebrew, Latin, and Dutch, his *Corpus Juris*, Latin and Greek classics, and many other works produced at this period are renowned for their beautiful execution and accuracy. A much greater enterprise was planned by him in those years —the publication of a *Biblia Polyglotta*, which should fix the original text of Old and New Testaments on a scientific basis. In spite of clerical opposition he was supported by Philip II. king of Spain, who sent him the learned Benedictus Arius Montanus to take the leading part in the work of editorship. With his zealous help the work was finished in five years

(1569–73, 8 vols. fol.). Plantin earned much renown by it, but little profit, or rather less than none; but in compensation he received the privilege of printing all liturgical books for the states of King Philip, and the office of "prototypographus regius," which carried with it the oversight over all printers in the Netherlands, a charge of which Plantin seems to have acquitted himself indifferently. This need not surprise us, when we know that Plantin, though outwardly a faithful son of the church, was till his death the partisan of a mystical sect of heretics; and it is now proved that many of their books published without the name of a printer came from his presses together with the missals, breviaries, etc., for the Roman Catholic Church.

Besides the polyglott Bible, Plantin published in those years many other works of note, such as editions of St. Augustine and St. Jerome, the botanical works of Dodonæus, Clusius, and Lobelius, the description of the Netherlands by Guicciardini, etc. In 1575 his printing-office reckoned more than twenty presses and seventy-three workmen, besides a similar number that worked for the office at home. But soon there came bad times for Antwerp. In November, 1576, the town was plundered and in part burnt by the Spaniards, and Plantin had to pay an exorbitant ransom. A great many inhabitants of the once flourishing city emigrated, and Plantin also thought of settling elsewhere. He established a branch of his office in Paris; and when in 1583 the states of Holland sought a typographer for the newly erected university at Leyden, and invited him to occupy this place, he left his much reduced business in Antwerp to his sons-in-law, John Moerentorf (Moretus) and Francis van Ravelinghen (Raphelengius), and settled at Leyden. But he could not thrive, it seems, in Holland. When in 1585 Antwerp was taken by the Prince of Parma and affairs became there more settled, he left the office in Leyden to Raphelengius and returned to Antwerp, excusing himself for having served the states of the revolted provinces by the difficulties of his situation. In Antwerp he labored till his death on the 1st July, 1589. His son-in-law, John Moretus, and his descendants continued to print many works of note "in officina Plantiniana," but from the second half of the 17th century the house began to decline. It continued, however, in the possession of the Moretus family, which religiously left all the old things in the office untouched, and when in 1876 the town of Antwerp acquired the old buildings with all their contents for 1,200,000 francs, the authorities were able with little trouble to create one of the most remarkable museums in existence (Musée Plantin, opened 19th August, 1877).

See Max Rooses, *Christophe Plantin imprimeur Anversois*, Antwerp, 1882; Aug. de Backer and Ch. Ruelens, *Annales de l'imprimerie Plantinienne*, Brussels, 1865; Degeorge, *La Maison Plantin*, 2d ed., Brussels, 1878. (P. A. T.)

PLANTING. See ARBORICULTURE.

PLASENCIA, a city of Spain and an episcopal see, in the north of the province of Caceres (Estremadura), is pleasantly situated on the right bank of the Xerte or Jerte, a sub-tributary of the Tagus, and at the foot of the sierras of Bejar and Vera, continuations of the Guadarrama range. Industrially and commercially insignificant, the place has some interest for the artist and ecclesiologist on account of its fine walls, built in 1197 by Alphonso VIII. of Castile, and of its cathedral, begun in 1498, which is a favorable specimen of the ornate Gothic of its period, and also shows good examples of the workmanship of Berruguete, Aleman, and other artists. The population of the ayuntamiento was 7090 in 1877. The Hieronymite convent of Yuste, the scene of the last years of the emperor Charles V., lies about 24 miles to the westward, and is most conveniently reached from Plasencia.

PLASTER OF PARIS. See GYPSUM.

PLATA, LA. See ARGENTINE REPUBLIC.

PLATA, RIO DE LA. See PLATE RIVER, p. 198

PLATÆA, or PLATÆÆ, a celebrated city of ancient Greece, lay at the foot of the northern slope of Mount Cithæron in Bœotia, about 6½ miles by road south of Thebes, or a little over 5 geographical miles in a direct line. Its territory was separated from that of Thebes by the river Asopus. The Thebans claimed to have founded Platæa, but, however this may have been, Platæa was always at feud with its more powerful neighbor. In 519 B.C. the Platæans, being hard pressed by Thebes, applied for help to the Spartan king Cleomenes, who advised them to place themselves under the protection of Athens. They did so, and Athens and Platæa were thenceforward fast friends. It was perhaps on this occasion that the Platæans were granted that restricted citizenship of Athens which we know that they enjoyed at a later time. When Athens faced the Persians alone at Marathon, the Platæans to a man marched out to their help and shared in the victory (490 B.C.). From that day the names of Athens and Platæa were always associated in solemn prayers at Athens. Though dwellers in an inland town, and therefore ignorant of seamanship, the Platæans helped to man the Athenian ships at the sea fight with the Persians off Artemisium (480). In revenge the Persians burned Platæa. The great battle of Platæa, which finally secured the freedom of Greece against the Persians, was fought on the uneven and broken ground to the east and north of the town (September, 479). After the battle the Greeks declared the city and territory of Platæa to be independent and inviolable. The Platæans undertook to bring annual offerings of food and raiment to the graves of those who had fallen in the battle; and a festival of liberation (Eleutheria) was celebrated every fifth year. These offerings continued to be brought, and the festival to be held, as late as the 2d century of our era. With the spoils of the Persian wars the Platæans raised a temple of Athene the Warlike.[1] The Peloponnesian war began with an attempt of the Thebans to seize Platæa (431 B.C.). The attempt failed, but in 427, after a siege of about two years, the city was taken by the Peloponnesians and the garrison put to the sword. The bulk of the population had previously taken refuge in Athens. A year afterwards the Thebans razed the city to the ground, and built a large hospice close to the old temple of Hera, to whom they erected a new temple 100 feet long. In 421 the surviving Platæans received from the Athenians the town of Scione in Macedonia as a residence, but they had no doubt to quit it at the end of the war (404). When the peace of Antalcidas was concluded between Greece and Persia (387) Platæa was restored, but a few years afterwards it was surprised and destroyed, except the temples, by the Thebans (about 373). The Platæans were again received at Athens, where they were now admitted to full citizenship except that they were not eligible for the priesthood and the archonship. After the battle of Chæronea (338) Philip of Macedon brought back the Platæans as a counterpoise to the power of Thebes, but the walls were not fully restored till some years later. Alexander the Great, then monarch of Asia, contributed to rebuild them, in recognition, he declared, of the services which the Platæans had rendered against the Persians of old. With the loss of Greek freedom Platæa sank into insignificance. The inhabitants lived on the glories of the past, and were regarded as braggarts by the rest of the Bœotians. In the 6th century the walls were once more restored by Justinian.

The fullest description of ancient Platæa is that of Pausanias, who visited it in the 2d century. The great temple of Hera, he tells us, contained a statue of Rhea by Praxiteles; the temple of Athene the Warlike was adorned with an image of the goddess by Phidias and paintings by Polygnotus. Close to the city gates were the tombs of the Greeks who had fallen in the battle of Platæa, and an altar and image of Zeus the Liberator in white marble. The ruins of the ancient town lie about 500 yards east of the modern village of Kokhla. They occupy a slightly elevated plateau forming a rude triangle about two and a half miles in circumference, of which the apex to the south almost touches the great rocky slope of Cithæron, and the base to the north has a steep though short descent to the plain. The outer walls follow the edge of the plateau, but an inner cross-wall divides it into two unequal parts. The southern and higher part is probably as old as the Persian wars; the masonry of the northern part is more recent, and probably belongs to the age of Philip and Alexander. It is likely that these two parts were never included at the same time within the city walls, but that the southern was the ancient city, and that at one of the restorations (perhaps that of 387 B.C.) the northern and more spacious part of the plateau was preferred as the site. Within this northern half, and close to the northern wall, is a terrace on which may have stood the temple of Hera. The northwestern corner of the northern town is portioned off by a wall, and is conjectured to have been the acropolis of the newer city.

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[1] It was built, according to Plutarch (*Arist.* 20), after the battle of Platæa; according to Pausanias (ix. 4. 1), after the battle of Marathon.

See Dodwell's *Tour through Greece*, i. p. 274 *sq.*; Leake's *Travels in Northern Greece* vol. ii. chap. 16; and Bursian's *Geographie von Griechenland*, vol. i. p. 243 *sq.*

PLATE. The word *plate* (connected with the Greek πλατύς, flat, the late Latin *plata* = *lamina*, and the Spanish *plata*, silver) is usually employed to denote works in silver or gold which belong to any class other than those of personal ornaments or coins.[1]

On account of the ease with which it can be worked and the pure state in which it is generally found, it is probable that gold was the first metal used by man; and it is certain that, in some countries at least, he attained to the most marvellous skill in its manipulation at a time when the other arts were in a very elementary condition. As an instance of this we may mention a sword of the bronze age, found in a barrow near Stonehenge, and now in the museum at Devizes.[2] The hilt of this sword is covered with the most microscopically minute gold mosaic. A simple design is formed by fixing tesseræ, or rather pins, of red and yellow gold into the wooden core of the handle. Incredible as it may appear, there are more than two thousand of these gold tesseræ to the square inch. The use of silver appears to belong to a rather later period, probably because, though a widely spread metal in almost all parts of the world, it is usually found in a less pure state than gold, and requires some skill to smelt and refine it. Though both these precious metals were largely and skilfully used by prehistoric races, they were generally employed as personal ornaments or decorations for weapons. Except in Scandinavian countries but little that can be called "plate" has been discovered in the early barrows of the prehistoric period in western Europe. It will be convenient to consider the no less prehistoric gold and silver work recently found at Troy, Tiryns, and Mycenæ as forming a stage in the history of Greek art.

Ancient Egypt.—An enormous amount of the precious metals was annually brought as tribute to the Egyptian kings; according to Diodorus, who quotes the authority of Hecatæus, the yearly produce of the royal gold and silver mines amounted to thirty-two millions of minæ—that is, about 133 millions sterling of modern money. Though this estimate is probably an exaggeration, the amount must have been very great. The gold chiefly came from the mines in the Bishári desert, about eighteen days' journey southeast of Kum Ombos. These mines were constantly worked down to the time of the Arab caliphs, but now appear to be exhausted. It is not known where the silver came from. Gold appears to have been relatively more abundant than silver, and the difference in value between them was very much less than it is now. Tribute was paid to the Egyptian kings, not in coined money, which was then unknown, but in rings or ingots. Owing to the Egyptian practice of burying with their dead personal ornaments and jewellery, rather than other possessions less intimately connected with the person of the deceased, but few specimens of either gold or silver plate have survived to our times, whereas the amount of gold jewellery that has been discovered is very large, and shows the utmost amount of skill in working the precious metals. We can, however, form some notion of what the larger works, such as plates and vases in gold and silver, were like from the frequent representations of them in mural sculpture and paintings. In many cases they were extremely elaborate and fanciful in shape, formed with the bodies or heads of griffins, horses, and other animals real or imaginary. Others are simple and graceful in outline, enriched with delicate surface ornament of leaves, wave and guilloche patterns, hieroglyphs, or sacred animals. Fig. 1 shows a gold vase of the time of Thothmes III. (Dynasty XVIII., about 1500 B.C.), taken from a wall-painting in one of the tombs at Thebes. The figure on its side is the hieroglyph for "gold." Others appear to have been very large and massive, with human figures in silver or gold supporting a great bowl or crater of the same metal.

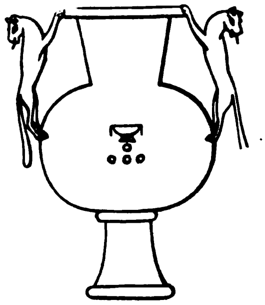
FIG. 1.—Gold Vase, from wall-paintings at Thebes.

In the language of the hieroglyphs silver is called "white gold," and gold is the generic name for money,—unlike most languages, in which silver usually has this special meaning,—a fact which points strongly to the priority of the use of gold. On the walls of one of the tombs at Beni Hassan there is an interesting representation of a gold- and silver-smith's workshop, showing the various processes employed—weighing, melting or soldering with the blow-pipe, refining the metal, and polishing the almost finished bowl or vase. In the time of Rameses III., about 1300 B.C., a clearly defined Assyrian influence appears in the decoration of some of the gold plate. A gold basket, represented in the tomb of this king at Thebes, has on its side a relief of the sacred tree between two beasts, the oldest of purely Aryan or Indo-European subjects, and quite foreign to Egypt.

The chief existing specimens of Egyptian plate are five silver *phialæ* or bowls, found at the ancient Thumuis in the Delta, and now in the Bulak Museum (Nos. 482 to 486 in the catalogue). These are modelled in the form of a lotus blossom, most graceful in design, but are apparently not earlier than the 5th century B.C. The Louvre possesses a fine gold patera, 6¼ inches across, with figures of fishes within a lotus border in repoussé work; an inscription on the rim shows it to have belonged to an officer of Thothmes III. (*Mém. Soc. Ant. de France*, xxiv. 1858).

Assyrian and Phœnician Plate.—Among the many treasures of early art found by General Cesnola in the tombs of Cyprus none are of more interest than a large number of Phœnician silver phialæ or saucer-like dishes, enriched with delicate repoussé and tooled reliefs, which in their design present many characteristics of Assyrian art mingled with a more or less strong Egyptian influence. A considerable number of bowls and phialæ found in Assyria itself are so exactly similar to these Cyprian ones, both in shape and ornamentation, that they cannot but be classed together as the production of the same people and the same age.

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[1] In mediæval English the term "a plate" was occasionally used in the sense of a silver vessel. A curious survival of this use of the word still exists at Queen's College, Oxford, where the servants may yet be heard asking at the buttery for so many "plates of beer," that is silver tankards.

[2] Hoare, *Ancient Wiltshire*, 1840.

The British Museum possesses a fine collection of these bowls, mostly found in the palace at Nimrûd. Though they are made of bronze, and only occasionally ornamented with a few silver studs, they are evidently the production of artists who were accustomed to work in the precious metals, some of them in fact being almost identical in form and design with the silver phialæ found at Curium and elsewhere in Cyprus. They are ornamented in a very delicate and minute manner, partly by incised lines, and partly by the repoussé process, finally completed by chasing. Their designs consist of a central geometrical pattern, with one or more concentric bands round it of figures of gods and men, with various animals and plants. In these bands there is a strange admixture of Assyrian and Egyptian style. The main motives belong to the former class, the principal groups being purely Assyrian—such as the sacred tree between the two attendant beasts, or the king engaged in combat and vanquishing a lion single-handed; while mingled with these are figures and groups purely Egyptian in style, such as the hawk-headed deity, or a king slaying a whole crowd of captives at one blow. Fig. 2 gives a silver dish from Curium containing examples of all the above mentioned subjects. Some of the designs are exceedingly beautiful, and are arranged with great decorative skill: a favorite composition is that of antelopes walking in a forest of tall papyrus plants, arranged in radiating lines, so as to suit the circular phiale, and yet treated with perfect grace and freedom. In addition to the numerous silver phialæ some were found, with similar decoration, made of pure gold. The Curium find alone is said to have included more than a thousand objects in gold and silver.

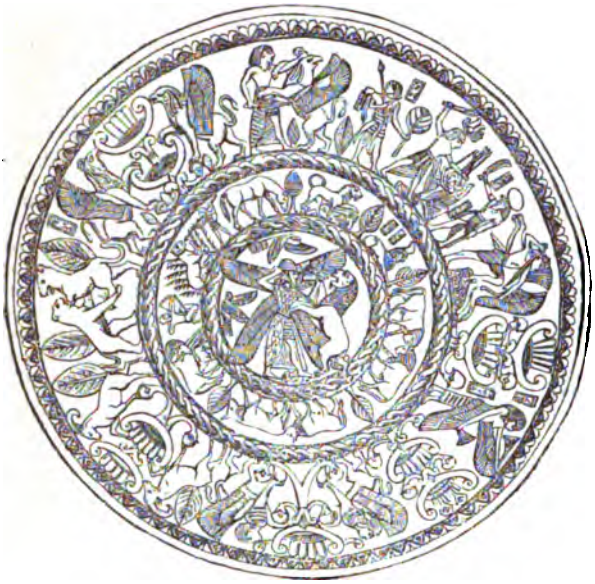

FIG. 2.—Silver Bowl, about 7 inches in diameter, found in a tomb in Cyprus, with repoussé reliefs of Egyptian and Assyrian style.

Etruscan Plate.—The Etruscan races of Italy were specially renowned for their skill in working all the metals, and above all in their gold work. Large quantities of the most exquisite gold jewellery have been found in Etruscan tombs, including, in addition to smaller objects, sceptres, wreaths of olive, and massive head-pieces. The Museo Kircheriano in Rome possesses a magnificent specimen of the last form of ornament; it is covered with nearly a hundred little statuettes of lions arranged in parallel rows.[1] Little, however, that can be classed under the head of plate has yet been found. A number of silver bowls found in Etruscan tombs have ornaments in the Egypto-Assyrian style, and were probably imported into Italy by the Phœnicians; some almost exactly resemble those found in Cyprus.

The British Museum (gold ornament room) possesses a fine specimen of early plate found at Agrigentum in Sicily. This is a gold phiale or bowl, about 5 inches across, with central boss or omphalos (φιάλη μεσόμφαλος) which seems once to have contained a large jewel. Round the inside of the bowl are six figures of oxen, repoussé in relief, and at one side a crescent, formed by punched dots. A delicate twisted moulding surrounds the edge; the workmanship of the whole is very skilful (see Fig. 3).

Hellenic Plate.—Discoveries made of late years on the plains of Troy, at Mycenæ, and at Camirus in Rhodes have brought to light a large quantity of gold and silver plate of very remote antiquity. These early specimens of plate are all very similar in character, graceful in shape, hammered, cast, and soldered with great skill, but, with the exception of weapons and ornaments, mostly devoid of surface decoration. The most remarkable find was that which Dr. Schliemann calls "Priam's treasure," including a large number of silver vases and bowls, with fine massive double-handled cups in gold, and a very curious spherical gold bottle. Fig. 4 shows a silver cup, with gold mounts, found in a tomb at Camirus in Rhodes, apparently a work of the same early date and class. Homer's poems are full of descriptions of rich works in both the precious metals (*Iliad*, xxiii. 741), showing that the taste for valuable pieces of plate was developed among the Greeks at a very early time—much more so probably than it was during the most flourishing period of Hellenic art, when the production of beautifully painted fictile vases seems to some extent to have superseded the more barbaric magnificence of gold and silver. During the 6th century B.C. the demand for works of this class, valuable not only for their material but for their workmanship, seems to have been very great under the last dynasty of Lydian kings, whose wealth in gold and silver has become proverbial. Crœsus especially encouraged the art, and paid enormous sums for silver vases and cups to the most renowned artists of his time, such as Glaucus and Theodorus the Samian.

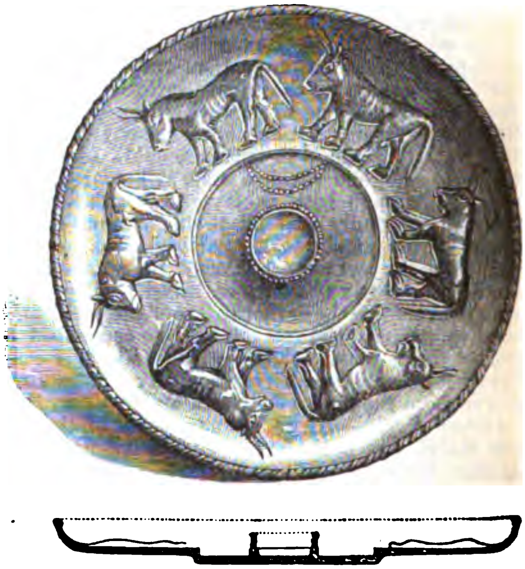

FIG. 3.—Archaic Gold Phiale, found at Agrigentum, now in the British Museum. It is shown in section below. It is 5 inches in diameter.

Pliny (*N. H.*, xxxiii.) gives a valuable account of the sources whence the Greeks and Romans derived their precious metals, their methods of refining, and the sculptors who were most celebrated for their skill in making articles of plate. Among the Greeks and Romans the greatest artists of the day did not disdain to practice this branch of art. The same sculptor who produced noble and colossal statues for the temples of the gods would at another time put forth his utmost skill and artistic talent in chasing and embossing some small silver cup or vase. In this way ancient pieces of plate ranked among the most perfect productions of art—very different from the custom of the 19th century, which leaves its plate to be executed by some dull mechanical craftsman, after the pompous designs supplied by a tradesman whose only standard of merit appears to be the pretentiousness of the design and the number of ounces of silver it contains.

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[1] Another, very similar, exists in the Vatican Mus. Gregor.

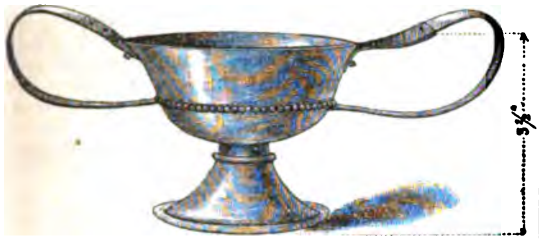

FIG. 4.—Silver Cantharus from Rhodes, with gold mounts. Possibly the form of the Homeric δέπας ἀμφικύπελλον.

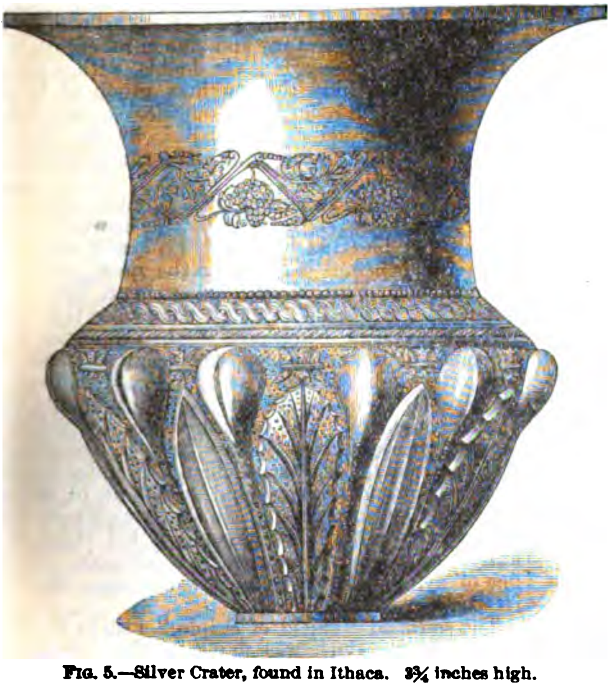

FIG. 5.—Silver Crater, found in Ithaca. 3¾ inches high.

In the best times of Greek art, the chief works in gold and silver seem to have been dedicated to religious purposes, and to have been seldom used for the ostentatious pomp of private individuals. Vessels for the use of the temples, tripods in gold or silver of the richest work, and statues of the gods were the chief objects on which the precious metals were lavished.[1]

The gold used by the Greeks probably came from Asia Minor or Egypt, while the mines of Laurium, in the mountains which form the promontory of Sunium in Attica, supplied an abundant amount of silver for many centuries.[2] According to Pliny, Phidias was the first sculptor who produced works of great merit in the precious metals; he mentions a number of other Greek artists who were celebrated for this class of work, but unluckily does not give their dates. The chief of these were Mentor and Mys (both of the 5th century, B.C.), Acragas, Boethus, the sculptors Myron and Stratonicus, as well as the well-known Praxiteles and Scopas. In Pliny's time many works in gold and silver by these artists still existed in Rhodes and elsewhere. Among later workers he specially mentions Zopyrus, who made two silver cups, embossed with the scene of the judgment of Orestes by the Areopagite court, and Pythias, who made a bowl with reliefs of Ulysses and Diomedes carrying off the Palladium. Enormous prices were given by wealthy Romans for ancient silver plate made by distinguished Greek artists; according to Pliny, more than £300 an ounce was paid for the last-mentioned cup.

Though a large quantity of later Græco-Roman plate still exists in various museums, the specimens of Greek silver-work of the best period are extremely rare, and mostly unimportant in point of size. In 1812 Dr. Lee discovered at Ithaca a very beautiful vase or cyathus 3¾ inches high (see Fig. 5) and a phiale or patera, 9½ inches across, both of silver, repoussé and chased, with very rich and graceful patterns of leaves and flowers—suggesting a slight tinge of Assyrian style.[3] These are probably not later than the 5th century B.C. A good many silver mirror-cases, with repoussé figure-subjects in high relief, have been found at various places; as, for instance, one with a beautiful seated figure of Aphrodite found at Tarentum and now in the British Museum.[4] The South Kensington Museum contains a most exquisite little silver vase found in the baths of Apollo at Vicarello in Italy (Fig. 6), enriched with a band in low relief of storks devouring serpents, executed with gem-like minuteness and finish—probably not later than the 3d century B.C. The British Museum has a little vase of similar form and almost equal beauty, though perhaps later in date; it is decorated with bands of vine branches in a graceful flowing pattern, and is partly gilt. The most important find of Greek silver plate, mingled with pieces of Roman or Græco-Roman work, was that discovered in the crypt of the temple of Mercury Augustus, at Villeret, near Bernay, in France (the ancient Canetum), in 1830.[5] It consists

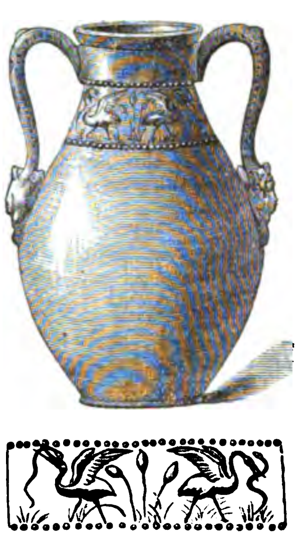

FIG. 6.—Greek Silver Vase, 5 inches high, c. 4th century B.C. The ornamental band is shown below in plano. (South Kensington Museum.)

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[1] The gold eagles on the sacred omphalos at Delphi were notable examples of this; see Pindar, *Pyth.* iv. 4.

[2] Boeckh, *Silver Mines of Laurium*, 1842.

[3] See *Archæologia*, xxxiii. 36–54.

[4] *Ib.*, xxxiv. 265–72.

[5] See Chabouillet, *Catalogue des Camées, etc., de la Bibliothèque Imperiale*, Paris, 1858, pp. 418–57; also Raoul Rochette, *Monuments d' Antiquité*, p. 272, and Lenormant, *Bull. dell' Inst. Arch.*, Rome, 1830.

of silver vessels and two silver statuettes, sixty-nine pieces in all, the gift of various donors to the temple. It is in itself a small museum of specimens of ancient plate, containing objects of great variety of date and workmanship, from fine Greek work of about 300 B.C. down to the coarser Roman production of the 2d or 3d century A.D. The shapes of the vessels composing this treasure are very numerous—ewers, bowls, pateræ, large ladle-shaped cups, and drinking cups with and without handles. Those of Greek workmanship are in slight relief, while some of the Roman wine-cups and bowls have heads and figures almost detached from the ground. Some of these latter much resemble some silver canthari found in Pompeii.[1] The dedicatory Roman inscriptions, in some cases, appear to be later additions, made by the various donors who presented these treasures to the temple.[2] It is interesting to note that two vases among the Bernay treasure have reliefs of the theft of the Palladium, like the celebrated cup by Pythias mentioned by Pliny; another subject described by him as decorating silver plate by Zopyrus, the judgment of Orestes, is represented on a fine cup found at Antium, apparently of Greek design, which is preserved in the Corsini Palace in Rome. These may possibly be copies from originals by those much-renowned artists.

Græco-Roman and Roman Plate.—Of what may be called Græco-Roman plate a much larger number of specimens still exist. Even during the 1st century the growing pomp and ostentation of the wealthy Romans led to an enormous demand for large and elaborate pieces of plate, while their good taste induced them to prefer the works of Greek *cœlatores*—a branch of art which even at that time showed but little signs of decay. It was no doubt the desire for objects which should combine intrinsic value with artistic merit, and also be of a more durable sort, that by slow degrees gave the death-blow to the art of vase painting. It is not always easy to distinguish the best works in silver of this Roman period from the more purely Greek works of an earlier time. They are often of the highest merit both in design and execution. The finest collection of these was found in 1869 at Hildesheim in Hanover, and is now in the Berlin Museum. They consist of a large number of cups, bowls, vases, dishes, and tripods, all of silver, some decorated with gilding and enriched in the most elaborate way with figure and scroll-work reliefs of the greatest beauty and finish; these, except one or two of very rude work, can hardly be later in date than the first century after Christ. The most remarkable is a cylix, inside which a geometrical Greek border in slight relief forms a frame for a seated figure of Athene—an "emblema" soldered on, in very high relief. The attitude of this figure, the folds of the drapery, and other details are arranged with extreme grace. Almost the only point which recalls the fact that this exquisite piece does not belong to the best period of Greek art is the very salient relief of the figure, whereas in earlier times the silver-worker was content with a more moderate amount of relief, and thus decorated the surface of his vessel without injuring its main contour. A large silver crater in the same set (Fig. 7) is free from this fault. It is covered outside with delicate floral scroll-work, growing in graceful curves all over the surface of the vessel, with very slight projection from the main surface—a perfect model in every way for the treatment of silver. Pliny specially mentions the custom of Roman generals and other officers travelling on military expeditions with magnificent services of plate; and it appears probable that this had been the case with the Hildesheim treasure; defeat or some other disaster may have forced the Roman owner to hide and relinquish the whole set[3].

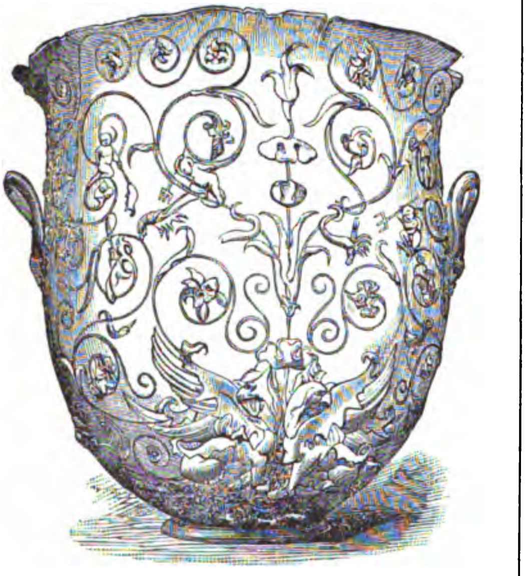

FIG. 7.—Silver Crater, 15½ inches high, from the Hildesheim find. (Berlin Museum.)

The museum at Naples contains a very large number of silver cups found in Pompeii, encrusted with figure-subjects or branches of ivy and vine in relief. In cases of this sort the cup is made double, with a smooth inner skin to hide the sinkings produced by the repoussé work in relief on the outside. Silver vessels ornamented in relief were called by the Romans *cœlata* or *aspera*, to distinguish them from plain ones, which were called *levia*.[4]

Among later specimens of Roman plate the most remarkable is the gold patera, nearly 10 inches in diameter, found at Rennes in 1777, and now in the Paris Bibliothèque—a work of the most marvellous delicacy and high finish—almost gem-like in its minuteness of detail. Though not earlier than about 210 A.D., a slight clumsiness in the proportion of its embossed figures is the only visible sign of decadence. The outer rim is set with sixteen fine gold coins—*aurei* of various members of the Antonine family from Hadrian to Geta. The central *enblema* or medallion represents the drinking contest between Bacchus and Hercules, and round this medallion is a band of repoussé figures showing the triumphal procession of Bacchus after winning the contest. He sits triumphant in his leopard-drawn car, while Hercules is led along, helplessly intoxicated. supported by bacchanals. A long line of nymphs, fauns, and satyrs complete the circular band.

The so-called "shield of Scipio," also in the Paris Bibliothèque, which was found in the Rhone near Avignon, is the finest example of Roman plate of the 4th century. It is not a shield, but a large silver patera, about 26 inches in diameter with a repoussé relief representing the restoration of Briseis to Achilles. The composition and general design are good, but the execution is feeble and rather coarse.

The British Museum possesses good specimens of Roman silver work in its last stage of decline. These are two large caskets or toilet boxes, with silver unguent vases, oblong *lances*, pateræ, ewers, spoons, and other objects, all found in Rome in 1793. The caskets are decorated in low relief with somewhat blunt repoussé figures and ornaments. The rim of one casket is incised with the following words—SECUNDE ET PROIECTA VIVATIS IN CHRISTO. One of the silver vases has the words PELEGRINA VTERE FELIX. The legend on the casket, and the ☧ which appears among the ornaments, show that it was made for a Roman lady, named Projecta, who was a Christian; her portrait, together with that of her husband Secundus, is on the centre of the lid in a medallion supported by two cupids. With the exception of a pair of small silver two-handled vases, undecorated, but of the purest Greek-like form, these various pieces of silver work probably date from the 5th century.[1]

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[1] Quaranta, *Quattordici Vasi d'Argento . . . Pompeei*, Naples, 1837.

[2] See a valuable paper on this subject in the *Journal of Hellenic Studies*, vol. iii. No. 1, by Dr. Walstein, who attributes part of this treasure to the Ephesian school of artists, and traces in some of the designs miniature reproductions of large works of Greek sculpture

[3] Darcel, *Trésor de Hildesheim*, 1870. The number of gold and silver statues in Rome was very great. In the inscription of Ancyra, Augustus records that he melted down no less than 80 silver statues of himself, and with the money thus obtained presented "golden gifts," to the temple of Apollo Palatinus. See *Mon. Ancyr.*, ed. Mommsen, 1883.

[4] For the various classical methods of working in silver and gold see METAL WORK.

Plate from the Crimea.—The finest collection of early gold and silver plate is that in the Musée de l'Ermitage at St. Petersburg, the result of many years' excavation in the tombs of the Cimmerian Bosphorus.[2] Most of these magnificent pieces of plate, both in style of workmanship and the character of their decoration, resemble the work of Greek artists; in some cases nothing but the costume of the figures embossed upon them shows that they were not produced in Athens.

The earliest in style is a massive gold phiale (φιάλη μεσόμφαλος) covered with the richest and most minute surface ornament. The motive of the design is taken from an open lotus flower; the petals form radiating lobes, and these petals are entirely covered with delicate scroll-work, surrounding Greek-like gorgons' heads, and other smaller heads, savage-looking and bearded. Though perhaps rather overloaded with ornament, this beautiful phiale, which shows strong traces of Phœnician or Assyrian influence, is a real masterpiece of decorative design. Of later date, probably 4th century B.C., is a small gold bottle, Hellenic in form, but ornamented with a band of non-Hellenic figures in relief—Scythian bowmen, as their dress clearly shows. The grandest piece of all is a large silver amphora, of about the same date, shaped like the Greek fictile amphoræ, and ornamented with a beautiful flowing pattern, of pure Hellenic honeysuckle form, mingled with birds and very highly projecting animals' heads. On the shoulder of the vase there is a band of Scythians and horses, executed with great spirit and refinement.[3] It is difficult to believe that this splendid vase, so graceful in outline, and so pure in its decoration, was not produced by some famous Athenian *toreutes*.

Oriental Plate.—Some very curious pieces of plate both in gold and silver have been found in northern India; these appear to be of native workmanship, but the subjects with which they are embossed, and the modelling of the figures, show that they were produced under late Roman influence, or in some cases possibly even Greek influence in a highly degraded state, handed down from the time of Alexander's Indian conquests.

Under the Sasanian kings of Persia (from the 3d to 6th centuries) very massive and richly decorated gold vases, bowls, and bottles were made (Fig. 8). Those which still exist show a curious mingling of ancient Assyrian art with that of Rome in its decline. Reliefs representing winged lions, or the sacred tree between its attendant beasts, alternate with subjects from Roman mythology, such as the rape of Ganymede; but all are treated alike with much originality, and in a highly decorative manner. The Paris Bibliothèque and the Vienna Museum contain some fine specimens.

The gold and silver work of Russia resembles in style that of Byzantium at an early period. Shrines and other magnificent pieces of plate in the treasury of the cathedral at Moscow (see Weltmann, *Le trésor de Moscou*, 1861), though executed at the end of the 15th century, are exactly similar in design to Byzantine work of the 11th or 12th century, and even since then but little change or development of style has taken place.

The caliphs of Baghdad, the Sultans of Egypt, and other Moslem rulers were once famed for their rich stores of plate, which was probably of extreme beauty both in design and workmanship. Little or nothing of this Moslem plate now remains, and it is only possible to judge of its style and magnificence from the fine works in brass and other less valuable metals which have survived to our time.

Early Mediæval Plate.—The Gothic, Gaulish, and other semi-barbarian peoples, who in the 6th century were masters of Spain, France, and parts of central Europe, produced great quantities of work in the precious metals, especially gold, often of great magnificence of design and not without some skill in workmanship. In 1837 a large number of pieces of very massive gold plate were found at Petrossa in Roumania; much of this find was unfortunately broken up and melted, but a considerable portion was saved, and is now in the museum at Bucharest. These magnificent objects are all of solid gold, and consist of large dishes, vases, ewers, baskets of open work, and personal ornaments (Fig. 9). Some of them show a strong Roman influence in their design, others are more purely barbaric in style. To the first of these classes belongs a very fine phiale or patera, 10 inches in diameter. In the centre is a seated statuette of a goddess, holding a cup, while all round, in high relief, are standing figures of various male and female deities, purely Roman in style. Though the execution is somewhat clumsy, there is much reminiscence of classical grace in the attitudes and drapery of these figures. A large basket and other pieces, made of square bars of gold arranged so as to form an open pattern of stiff geometrical design, have nothing in common with the vessels in which Roman influence is apparent, and can hardly be the work of the same school of goldsmiths.[4] The date of this Petrossa treasure is supposed to be the 6th century. The celebrated Gourdon gold cup and tray now preserved in Paris belong to about the same date. They are very rich and magnificent, quite free from any survival of

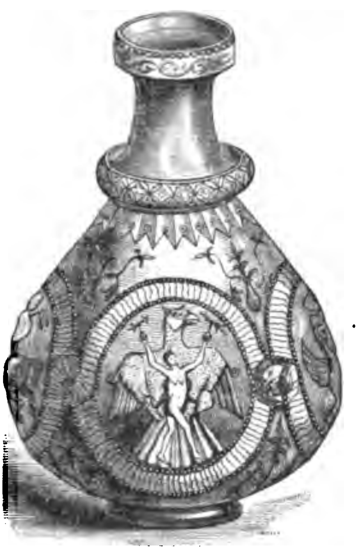

FIG. 8.

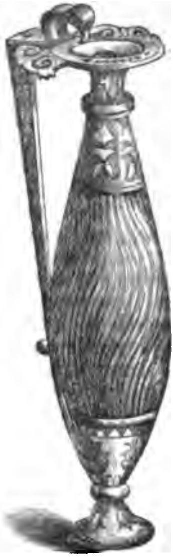

FIG. 9.

FIG. 8.—Sasanian Gold Bottle, about 10 inches high. In the Vienna Museum.

FIG. 9.—Gold Ewer, 15 inches high, from the Petrossa treasure.

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[1] Visconti, *Una Supellettile d'Argento*, Rome, 1825.

[2] See Stephani, *Antiquités du Bosphore Cimmérien*, 1854, and *Compte-rendu de la Commission Imperiale*, St. Petersburg, 1859, and still in progress.

[3] *Gaz. des B. Arts*, xxv. 19-39, 1882.

[4] Soden Smith, *Treasure of Petrossa*, 1869.

classic influence, and in style resemble the Merovingian gold work which was found in the tomb of Childeric I. The cup is three inches high, shaped like a miniature two-handled chalice; its companion oblong tray or plate has a large cross in high relief in the centre. They are elaborately ornamented with inlaid work of turquoises and garnets, and delicate filigree patterns in gold, soldered on.

In the 6th century Byzantium was the chief centre for the production of large and magnificent works in the precious metals. The religious fervor and the great wealth of Justinian and his successors filled the churches of Byzantium, not only with enormous quantities of gold and silver chalices, shrines and other smaller pieces of ecclesiastical plate, but even large altars, with tall pillared baldacchini over them, fonts, massive candelabra, statues and high screens, all made of the precious metals. The wealth and artistic splendor with which St. Peter's in Rome and St. Sophia in Constantinople were enriched is now almost inconceivable. To read the mere inventories of these treasures dazzles the imagination—such as that given in the *Liber Pontificalis* of Anastasius Bibliothecarius, which includes the long list of treasures given by Constantine to St. Peter's before he transferred his seat of empire to Byzantium (330), and the scarcely less wonderful list of gold and silver plate presented to the same basilica by Pope Symmachus (498–514).[1]

During the 7th century France and other Western countries were but little behind Italy and Byzantium in their production of massive works, both secular and religious, in the precious metals. St. Eloy, the French goldsmith bishop, made a number of most splendid shrines and other sacred furniture in beaten gold—among them large shrines for the relics of St. Denis, St. Geneviève and St. Martin, as well as gold thrones, plate and jewelry for the French kings Clothaire II. and Dagobert I. At this time every cathedral or abbey church in Germany, France and even England began to accumulate rich treasures of every kind in gold and silver, enriched with jewels and enamel; but few specimens, however, still exist of the work of this early period. The most notable are Charlemagne's regalia[2] and other treasures at Aix-la-Chapelle, a few preserved at St. Peter's in Rome, and the remarkable set of ecclesiastical utensils which still exist in the cathedral of Monza near Milan—the gift of Queen Theodelinda in the early part of the 7th century.[3]

The existing examples of magnificent early work in the precious metals mostly belong to a somewhat later period. The chief are the gold and silver altar in Sant' Ambrogio at Milan, of the 9th century; the "Pala d'Oro," or gold retable, in St. Mark's at Venice, begun in the 10th century (see METAL-WORK); and the gold altar frontal given by the emperor Henry II. and his wife Cunigunde, at the beginning of the 11th century, to the cathedral at Basel. The last is about 4 feet high by 6 feet long, repoussé in high relief, with figures of Christ, the three archangels and St. Benedict, standing under an arcade of round arches; it is now in the Cluny Museum in Paris.[4] A similar gold frontal, of equal splendor, was that made for the archbishop of Sens in 999. This was melted down by Louis XV. in 1760, but fortunately a drawing of it was preserved and is published by Du Sommerard (*Album*, 9th series, pl. xiii.).

A most valuable description of the various methods of work practiced by gold- and silver-smiths in the 11th and 12th centuries is given by the monk Theophilus in his *Diversarum Artium Schedula* (Hendrie's ed., 1847). He minutely describes every possible process that could be employed in making and ornamenting elaborate pieces of ecclesiastical plate—such as smelting, refining, hammering, chasing and repoussé work, soldering, casting (by the "cire perdu" process), wire-drawing, gilding with mercury amalgam and the application of niello, enamel and gems.

The silversmith of those days, as in classical times, was not only a thorough artist with a complete sense of beauty and fitness in his work, but he was also a craftsman of the most varied fertility of resource and made himself thoroughly responsible for every part of his work and every stage through which it passed—a most striking contrast to the modern subdivision of labor and eagerness to produce a show of neatness without regard to real excellence of work, which is the curse of all 19th-century handicrafts and one of the main reasons why our modern productions are in the main neither works of true art nor objects of real lasting utility.

Italian Plate.—Before the latter part of the 15th century large pieces of silver work were made more for ecclesiastical use than for the gratification of private luxury. The great silver shrine in Orvieto cathedral, made to contain the blood-stained corporal of the famous Bolsena miracle, is one of the chief of these. It is a very large and elaborate work in solid silver, made to imitate the west front of a cathedral, and decorated in the most sumptuous way with figures cast and chased in relief, and a wonderful series of miniature-like pictures embossed in low relief and covered with translucent enamels of various brilliant colors. This splendid piece of silver work was executed about 1338 by Ugolino da Siena and his pupils. The other most important pieces of silver work in Italy are the frontal and retable of St. James in the cathedral at Pistoia and the altar of San Giovanni at Florence (see METAL-WORK). On these two works were employed a whole series of the chief Tuscan artists of the 14th and 15th centuries, many of whom, though of great reputation in other branches of art, such as painting, sculpture on a large scale and architecture, did not disdain to devote their utmost skill and years of labor to work which we now as a rule consign to craftsmen of the very smallest capacity.

Among the distinguished names of Florentines who during the space of one century only, the 15th, worked in gold and silver, the following may be given to suggest the high rank which this class of work took among the arts: Brunelleschi, Ghiberti, Donatello, Luca della Robbia, the two Pollaiuoli, Verrocchio, Michelozzo, Ghirlandaio, Botticelli, Lorenzo di Credi, Baccio Baldini, and Francia. The cities of Italy which chiefly excelled in this religious and beautiful class of silver-work during the 14th and 15th centuries were Florence, Siena, Arezzo, Pisa and Pistoia.

Owing to the demoralization and increase of luxury which grew in Italy with such startling rapidity during the early years of the 16th century, the wealth and artistic skill which in the previous centuries had been mainly devoted to religious objects were diverted into a different channel and became for the most part absorbed in the production of magnificent pieces of plate—vases, ewers, dishes and the like—of large size and decorated in the most lavish way with the fanciful and over-luxuriant forms of ornament introduced by the already declining taste of the Renaissance. This demand created a new school of metal-workers, among whom Benvenuto Cellini (1500–1571) was perhaps the ablest and certainly the most prominent. His graphic and often shameless autobiography makes him one of the foremost and most vivid figures of this wonderful 16th century, in which the most bestial self-indulgence was mingled with the keenest enthusiasm for art. Cellini's work is always perfect in execution, but very unequal in merit of design; some of his silver pieces, such as the large salt-cellar made for Francis I., are much marred by an attempt to produce a massive grandeur of effect, on a scale and in a material quite unsuited to such ambitious and sculpturesque effects. Cellini's influence on the design of silver plate was very great, not only in Italy and France, where his life was spent, but also on the great silversmiths of Augsburg and Nuremberg, many of whose finest pieces are often attributed to Cellini.[1] During the 17th and even the 18th centuries fine pieces of plate were produced in Italy, many of them still retaining some of the grace and refinement of the earlier Renaissance.

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[1] See D'Agincourt, *Histoire de l'Art*, 1823.

[2] Bock, *Die Kleinodien des heil römischen Reiches*, 1864.

[3] *Arch. Jour.*, xlv. 8.

[4] *Archæologia*, xxx. 144–48.

Germany.—From very early times Germany was specially famed for its works in the precious metals, mostly, as in other countries, for ecclesiastical use. In the 15th century a large quantity of secular plate was produced, of very beautiful design and the most skilful workmanship. Tall covered cups or hanaps on slender stems, modelled with a series of bosses something like a pineapple and surmounted by a cleverly wrought flower, or beakers, cylindrical tankards with lids, enriched with delicate Gothic cresting or applied foliage, are the most beautiful in form and decoration. On the lids of these cups are frequently placed heraldic figures, holding shields with the owner's arms, modelled and cast with great spirit and finish. One celebrated silver beaker, of about 1400, now in the South Kensington Museum (Fig. 10), is ornamented with Gothic traceried windows filled in with translucent enamels.[2] Another,[3] rather later in date, preserved in the print room of the British Museum, is covered with figures and foliage in minute niello work, a most elaborate and splendid piece of plate.

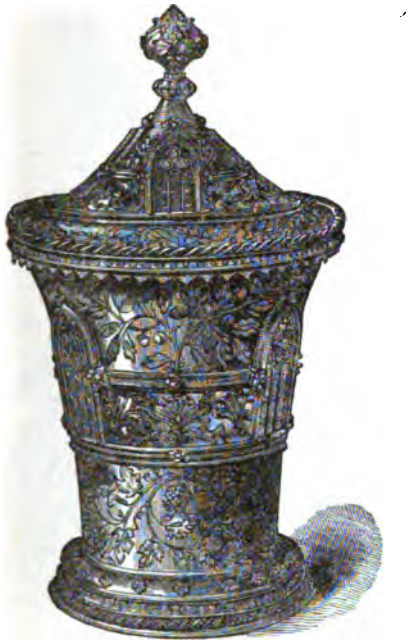

FIG. 10.—Silver Beaker, decorated with open work, filled in with translucent enamels. German or Flemish, of the 15th century. (S. K. M.)

During the first half of the 16th century Augsburg and Nuremberg, long celebrated for their silver work, developed a school of artists in plate whose productions are of the most unrivalled beauty, at once graceful in general form and decorated in slight relief with arabesques, strap-work, wreaths, and figure subjects arranged with the utmost good taste, and modelled and chased with the most perfect precision of touch. Though influenced by the contemporary silver-work of Italy, the works of Paul Flint, Wenzel Jamnitzer (1508–1585), and Theodor de Bry of Liége (1528–98) are free from the extravagance of outline and over-elaboration of detail which often disfigure the grand silver pieces of men like Cellini (see Fig. 11). In Germany the traditions of earlier Gothic art were less rapidly broken with; and many purely Gothic forms survived there till quite the end of the 16th century. In the first half of the 17th century the technical skill of the German silversmiths reached its highest point of perfection, but there was some falling off in their designs, which rapidly lost their purity of outline. Switzerland produced several silversmiths whose work is similar to that of this German school, especially their large plateaux and ewers, most richly and gracefully covered with ornament, all finished with almost gem-like minuteness. The principal among these artists was François Briot, all of whose productions are of extreme beauty. The majority of his existing works are not in silver, but in pewter, and thus by their absence of intrinsic value have escaped the melting pot (Fig. 12). Gaspar Enderlein was another workman of this school, whose productions cannot always be distinguished from those of Briot. Though born in Switzerland, these artists really belong to the great Augsburg and Nuremberg school.

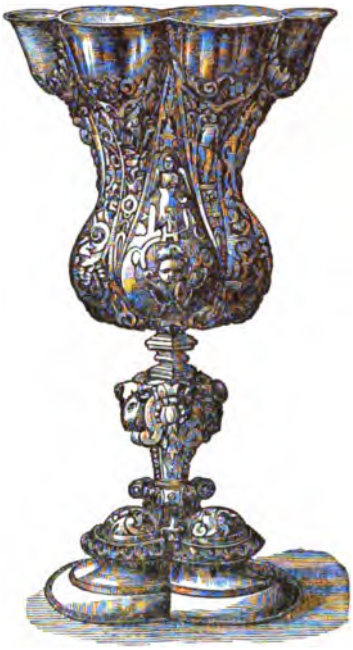

FIG. 11.—Silver Cup, 8¼ inches high, usually attributed to Jamnitzer, but more probably by Paul Flint. Made at Nuremberg about the middle of the 16th century. (S. K. M.)

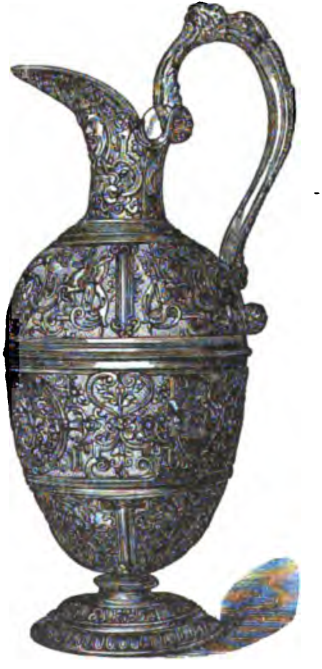

FIG. 12.—Ewer by François Briot, about 10 inches high. Middle of 16th century.

Many of the famous 15th and 16th century painters, such as Martin Schön, Israel von Mecken, and Holbein, used to supply the silver-workers with elaborate designs for plate. Virgil Solis of Nuremberg (1514–1562) was especially fertile in this sort of invention, and executed a large series of etchings of designs for vases, cups, ewers, tazze, and all sorts of plate.[1]

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[1] See the valuable work by Eugène Plon, *Ben. Cellini, sa vie, etc.*, Paris, 1883; also Cellini's own work, *Dell' Oreficeria*, 1568.

[2] Shaw, *Decorative Arts of the Middle Ages*, 1851.

[3] Shaw, *Dresses and Decorations of the Middle Ages*, 1858.

Spain.—Throughout the Middle Ages Spain was remarkable for its large and magnificent works in the precious metals. The cathedral of Gerona still possesses a most massive silver retable, made by a Valencian silversmith called Peter Bernec. The gold and silver altar-frontal, a work of the 11th century, was carried off from this cathedral by the French in the present century. Another very large and beautiful piece of silver work is the throne, Northern Gothic in style, made for King Martin of Aragon, about 1400, and now preserved in Barcelona cathedral. Till after 1500 little that is distinctively Spanish appears in the style of their silver work. At first Moorish influence, and then that of France and Germany, appear to have been paramount. It is not till the 16th century that a really Spanish school of art was developed; and the discovery of America with its rich stores of gold and silver gave an enormous impetus to this class of work.[2] The "custodia," or tabernacle for the host, in many of the Spanish cathedrals, is a large and massive object, decorated in a very gorgeous though somewhat debased style. In spite of the plundering of the French, even now no country is so rich in ecclesiastical plate as Spain.

England.—The Celtic races of both England and Ireland appear to have possessed great wealth in gold and silver, but especially the former. It seems, however, to have been mostly used in the manufacture of personal ornaments, such as torques, fibulæ, and the like. A magnificent suit of gold armor, repoussé with simple patterns of lines and dots, was found some years ago at Mold in Flintshire, and is now in the British Museum.[3] The amount of gold jewellery found in Ireland during the past century has been enormous; but, owing to the unfortunate law of "treasure-trove," by far the greater part was immediately melted down by the finders. Little of this period that can be called plate has been discovered in the British Isles,—unlike Denmark and other Scandinavian countries, where the excavation of tombs has in many cases yielded rich results in the way of massive cups, bowls, ladles, and horns of solid gold, mostly decorated, with simple designs of spirals, concentric circles or interlaced grotesques. Others are of silver, parcel-gilt, and some have figured subjects in low relief (Fig. 13). In like manner, during the Saxon period, though gold and silver jewellery was common, yet little plate appears to have been made, with the exception of shrines, altar-frontals, and vessels for ecclesiastical use, of which every important church in England must have possessed a magnificent stock. With regard to English secular plate, though but few early examples still exist, we know from various records, such as wills and inventories, that the 14th century was one in which every rich lord or burgher prided himself on his fine and massive collection of silver vessels; on festive occasions this was displayed, not only on the dinner-table, but also on sideboards, arranged with tiers of steps, one above the other, so as to show off to advantage the weighty silver vases, flagons, and dishes with which it was loaded. The central object on every rich man's table was the "nef"—a large silver casket, usually (as the name suggests) in the form of a ship, and arranged to contain the host's napkin, goblet, spoon, and knife, with an assortment of spices and salt. Great sums were often spent on this large and elaborate piece of plate, *e.g.*, one made for the duke of Anjou in the 14th century weighed 348 marks of gold. The English silversmiths of this period were highly skilled in their art, and produced objects of great beauty both in design and workmanship. One of the finest specimens of late 14th century plate which still exists is a silver cup belonging to the mayor and corporation of King's Lynn. It is graceful and chalice-like in form, skilfully chased, and decorated in a very rich and elaborate way with colored translucent enamels (Fig. 14) of ladies and youths, several with hawks on their wrists.[4] Silver salt-cellars were among the most elaborate pieces of plate produced during the 15th century. Several colleges at Oxford and Cambridge still possess fine specimens of these (Fig. 15); the favorite shape was a kind of hour-glass form richly ornamented with spiral fluting or bosses.

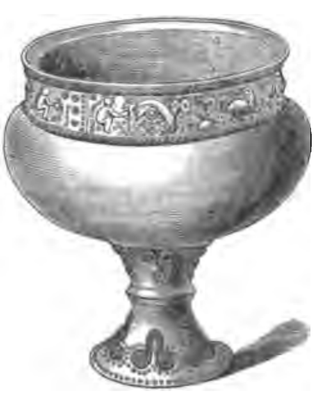

Fig. 13.—Silver Cup, 4¾ inches high, with embossed gold band; found in a grave in the east of Seeland (Denmark). This cup dates from the earlier part of the Iron Age.

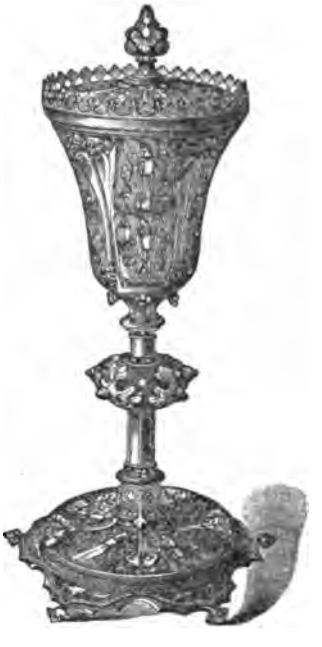

Fig. 14.

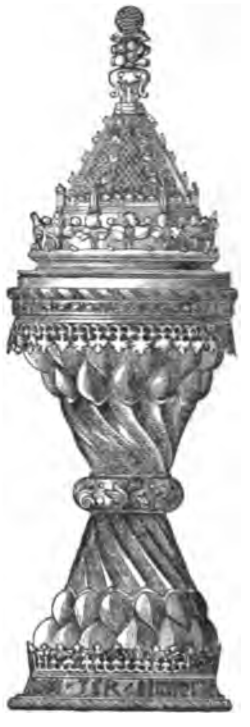

Fig. 15.

FIG. 14.—Silver Cup, with translucent enamels. Probably French work of the 14th century.

FIG. 15.—Silver-gilt Salt-cellar, 14½ inches high. Given to New College, Oxford, in 1493.

But few existing specimens of English plate are older than the beginning of the 15th century. Among the few that remain, the principal are two or three chalices—such as the two large gold ones found in the coffin of an archbishop of York, now used for holy communion in the cathedral, and a fine silver chalice from the church of Berwick St. James, Wilts, now in the British Museum. Both this and the York chalices are devoid of ornament, but, judging from their shape, appear to be of the 12th or 13th century.[1]

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[1] See twenty-one fac-similes of these rare etchings published by J. Pimell, London, 1862.

[2] See Riaño, *Industrial Arts in Spain*, 1879; and Davillier, *L'orfèvrerie en Espagne*, 1879.

[3] *Archæol.*, xxvi. 422.

[4] See Carter, *Specimens of Ancient Sculpture, etc.*, 1838.

It is interesting to note the various changes of form through which the ecclesiastical chalice passed from early Christian times till the 16th century. It was at first an ordinary secular cup (Fig. 16, A), with two handles, classical in form, and of large capacity, because the laity as well as the clergy received the wine. The double handles were of practical use in passing the cup round like a modern "loving cup." The first alteration was the omission of the handles, so that it took the form B, with large hemispherical bowl, a round foot, and a knop for security in holding it. For some centuries it appears to have been the custom for the priest to hold the chalice, while the communicant sucked the wine through a silver tube or "fistula." Some of the most magnificent early examples of this form of chalice have the bowl mounted in bands, set with jewels, and enriched with minute filigree work,—a design which appears to have been taken from those cups, such as the four magnificent examples in the treasury of St. Mark's at Venice, which have their bowl cut out of crystal, onyx, or some other precious stone.[2] The finest examples of this class are the Ardagh chalice, now in the Dublin Museum, and the chalice of St. Remigius, in Rheims cathedral; both are most magnificent specimens of the taste and skill of 11th-century goldsmiths. C shows the next form (12th and 13th centuries). The design is simpler; there is a distinct shaft, extending above and below the knop; and on the foot is marked a cross, not found in the earlier ones, to show which side the priest is to hold towards himself at celebration. The next alteration in the form of chalice, which occurred in the 14th century, was to make the foot not circular in plan but polygonal or lobed, so that the cup might not roll when laid on its side to drain, after it had been rinsed out. It thus took the shape D, and this form lasted in most countries till about 1500, and in England till the Reformation. In countries which did not adopt the Reformed faith the shape was altered, by the general growth of the Renaissance, into a form frequently like E. But in England the change was more complete; the bowl which in the previous two or three centuries had been slowly reduced in size, owing to the gradually introduced practice of refusing the wine to the laity, was suddenly made more capacious, and the form was altered to the shape F, in order that the Protestant "communion cup" might bear no resemblance to the old Catholic "massing chalice." This was ordered to be done in 1562, (see *Arch. Jour.* xxv. 44–53). The last form, G, shows the usual shape of sepulchral chalices, which, before the Reformation, were enclosed in the coffins of all ecclesiastics who had received priest's orders. These are without the knop, and were frequently made of pewter, tin or even wax, as they were not meant for use. In some few cases a real chalice was buried with some ecclesiastic of rank, but this was exceptional.

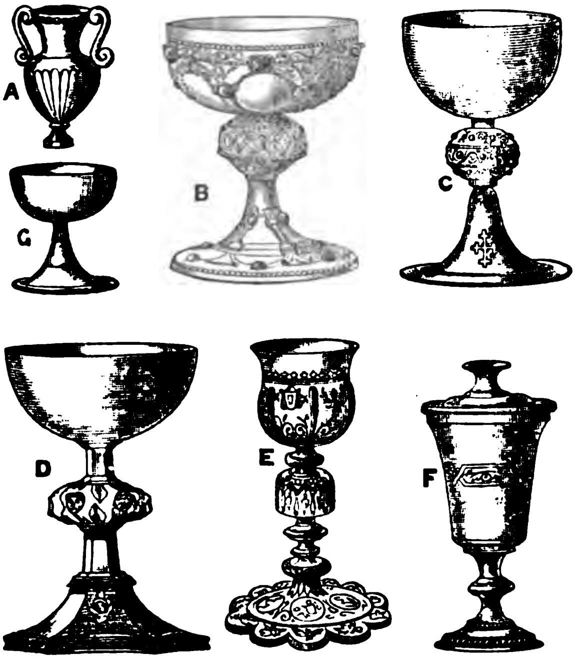

FIG. 16.—Various shapes of Chalices, showing development from the earliest forms.

Secular plate during the 15th and 16th centuries was very similar in style to that made in Germany, though the English silversmiths of the latter century never quite equalled the skill or artistic talent of the great Nuremberg and Augsburg silver-workers. In the 17th century, during the reigns of James I. and Charles I., many fine pieces of plate, especially tall hanaps and tankards, were made of very graceful form and decoration. The greater part of this, and all earlier plate, especially the fine collections belonging to the universities, were melted down during the Civil War. In Charles II.'s reign returning prosperity and the increase of luxury in England caused the production of many magnificent pieces of plate, often on a large scale, such as toilet services, wine-coolers, and even fire-dogs and tables. These are very florid in their ornament, and mostly have lost the beautiful forms of the century before (Fig. 17). In the early part of the 18th century the designs are mostly poor, and the decoration rather coarse, till the time of the classical revival which was brought about mainly by the discovery of the buried cities of Pompeii and Herculaneum. A quite different style of plate then came into vogue—semi-classical both in form and decoration, and often worked with great delicacy of treatment. A good deal of plate in this style was made under the influence of the brothers Adam (Fig. 18), distinguished architects in the second half of the 18th century. Of modern plate from the art point of view there is nothing to say; it is nearly always poor in design and feeble in execution.

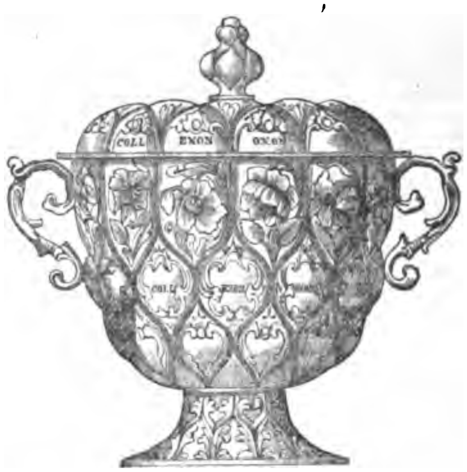

FIG. 17.—Covered Cup of solid gold, 6 inches high, circa 1660-70. Given to Exeter College, Oxford, by George Hall, Bishop of Chester.

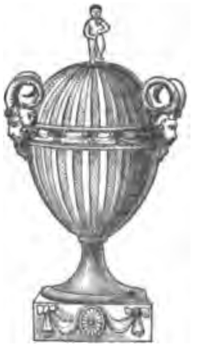

FIG. 18.—Silver Vase, 11 inches high, dated 1772. Designed by the brothers Adam. (S.K.M.)

The Assay of Gold and Silver Plate.—The primitive method of testing the purity of the metal was by marking a streak with it on the touch-stone, and comparing the color of the mark with that made by various pieces of gold or silver of known degrees of purity. Assay by cupellation is now employed for silver: a piece of the silver to be tested is melted with some lead in a cupel or bone-ash crucible; the lead is oxidized, and rapidly sinks into the bone-ash, carrying with it any other impurities which are present. The residue of pure silver is then weighed, and by its loss shows how much alloy it contained. Gold is now tested by an elaborate chemical process by which the trial bit is dissolved in acid, and then thrown down in the form of precipitate, which can be examined by a careful quantitative analysis. See ASSAYING, GOLD, and SILVER.

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[1] Among the most important existing specimens are the solid gold chalice and paten preserved at Corpus Christi College, Oxford, the gift of the founder, Bishop Fox. These have the year-mark K for 1507-8. See *Quart. Rev.* cxl. p. 353.

[2] See De Fleury, *La Messe*, Paris, 1882, in progress.

The standard of purity required in the time of Edward I. was, for gold, that it should be of the "Paris touch," *i. e.*, 19⅕ carats out of 24. Before then 22 carats was the standard. Silver was to be "of the sterling alloy," viz., 11 oz. 2 dwts. to the pound. Except for a time during the 16th century, this standard of silver has been kept up, and is still required by law.

Hall-marks on Silver.—In the 13th century the English Guild of Gold- and Silver-smiths had grown into great importance, and had acquired monopolies and many special privileges. In order to keep the standard up to the required purity the system of requiring each article to be stamped with certain marks was introduced by royal command. The first of these was the *King's mark*—a leopard's or lion's head crowned. This was introduced in 1300 by Edward I. (29 Edw. I. stat. 3. c. 30). The second, the *Maker's mark*, was added in 1363 (37 Edw. III. c. 7). This might be any badge or initial chosen by the master silversmith himself. The third was the *Year letter* or *Assayer's mark*; this was an alphabet, one letter being used for a year, counting from the day of the annual election of the warden of the Goldsmiths' Company. When one alphabet was exhausted, another with differently shaped letters was begun. The first of these series of year-letters commences in 1438. The earliest existing piece of plate which has the three marks complete is a spoon which was given by Henry VI. to Sir Ralph Pudsey; this has the year mark for 1445. Other marks, subsequently introduced, were the lion passant, first used in 1545; the lion's head erased, and a full-length figure of Britannia, used only between 1697 and 1720; and lastly the portrait of the reigning sovereign, which has been in use since 1784. In addition to these general hall marks, the plate made in various towns had from the year 1423 certain special provincial marks. The best work on hall-marked plate and the marks themselves, with the history of the Silversmiths' Company, is Cripps, *Old English Plate*, 1881. See also Cripps, *Old French Plate*, 1880.

The South Kensington Museum has a very fine illustrative collection of plate, from early mediæval times downwards. It also possesses a very valuable and large assortment of electrotype copies, including the Hildesheim and a part of the Petrossa treasures, as well as a number of the best specimens of college and corporation plate. The museum handbooks on this subject by J. H. Pollen and W. Cripps are extremely useful to the student. The same department has also published a most valuable *List of Works on Gold- and Silver-smiths' Works in the National Art Library*, 1882.

Modern Plate in the East.—Though little plate of real artistic merit is now made in Europe, in the East, among the Moslem and Hindu races, there still survives some real taste in design and skill in execution. Delhi, Benares, Lucknow, Cutch, and other places in India and Kashmir still produce a quantity of beautiful silver and gold work,—chiefly ewers, basins, rose-water sprinklers, salvers, coffee-pots, and the like. These are of graceful form, covered with rich repoussé work, or more often with very delicate chased patterns. Their style in the main is Moslem, but some combine an Arab form with native Indian surface decoration. This class of work is not a revival, but has been practiced and handed down by unbroken tradition, and with little or no change in style from the 16th century or even earlier.[1] The silversmiths of Persia, Damascus, and other Eastern places are still skilful, and retain some good traditions in their designs. They are, however, more occupied in the production of personal ornaments than in making larger works of silver or gold.

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PLATE, THE RIVER, or RIO DE LA PLATA ("River of Silver") in South America (see vol. ii. Plate xxv., and vol. iv. Plate xvii.), was at first known as Rio de

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[1] See Birdwood, *Industrial Arts of India*, 1880, p. 144.

Solis, after Juan Diaz de Solis, who discovered it in 1515, and lost his life on its banks. The present name, a double misnomer, was bestowed by Sebastian Cabot, who, ignorant that he was on the wrong side of the continent, thought he had reached a country of mineral wealth—a mistake (perpetuated also in the designation Argentine Republic) which may be said to have received a kind of poetic justification in the fact that the distant mines of Potosi lie within the drainage area of the La Plata system. Like Rio Grande do Sul and Rio de Janeiro on the Brazilian coast, this Rio is not a river but a vast estuary into which rivers discharge. At its narrowest it is 23 miles across, opposite Buenos Ayres 34 miles, and opposite Montevideo 63 miles. By some writers the conventional limit between estuary and ocean is drawn from Montevideo, where the water is still fresh enough to be drunk; but others go farther out and take the line 150 miles across from Maldonado to Cabo San Antonio. In the former case the length of the estuary is 125 miles. At one time it must evidently have extended 200 miles farther inland to Diamante, at the bend of the Paraná; and nature is steadily and rapidly at work prolonging the rivers proper at the expense of the estuary. At low water the average depth may be taken at 18 feet, and shoals and sandbanks are abundant, especially in the upper end. Nearly the whole expanse between Buenos Ayres and Martin Garcia Island is between 3 and 6 feet deep, and a great portion is even shallower. In the shallower portions the bottom consists of a very fine hard-grained sand, in the deeper portions of a sticky ooze. The tidal movement is so disguised by the more obvious effects of wind that Mr. Révy found people who had lived all their lives on the banks ready to deny its existence. But at Buenos Ayres the normal neap-tide is 5 feet 3 inches above ordinary low water, and the spring tides vary from 6 to more than 10 feet. The region being one of "storms and extraordinary electric disturbance," with the pampero at one time blowing hard from the land and at another a sea wind driving the ocean before it, the ordinary levels and currents are often violently disturbed. The general slope of the surface may even be reversed, and the main current of estuary and river run up stream for a hundred miles or more. It has been estimated that the volume of water poured into the Rio de la Plata exceeds the aggregate discharge of all the rivers of Europe put together. Nor need this be matter of surprise when the enormous extent and the character of the drainage area are taken into account. The headwaters of the Rio Blanco (a feeder of the Pilcomayo sub-system) rise only 125 miles from the coast of the Pacific, in 68° 10′ W. long, and those of the Rio Grande are not more than 70 miles from the coast of the Atlantic, in 44° W. long.; the basin thus extends east and west over twenty-four degrees of longitude, or 1500 miles, and the direct distance from the northmost source to the mouth of the Paraná is about as great. A considerable proportion of this vast area lies within the tropics, and receives an abundant rainfall, which, owing to the character of the strata, is largely carried off by the surface drainage. As an instance of the effect of this rainfall on even the secondary tributaries, Mr. Bigg-Wither's experience may be cited: at Jatahy on the Tibagy he was detained from the 2d to the 25th of July by the river, after nine days of incessant downpour, rising 33 feet at a place where it was 200 yards wide, and pouring along a volume of 90,000 cubit feet per second, or twenty-five times its low-water volume (see *Journ. Roy. Geogr. Soc.*, 1876).

The three great rivers of the La Plata system are the Paraná, its equal affluent the Paraguay, and the Uruguay—the second being the most important as a waterway, and the first the most interesting from its physical features.[1] As the general course of the Paraná and the Paraguay, both of which rise in Brazil, has already been sketched in the article on that country (vol. iv. p. 200), it simply remains to direct attention to a few points of interest. In regard to the great "Seven Falls" of the Paraná, we have still no better account than that of Azara in the 18th century; but the Hundred Cataracts, or Victoria Falls of the Curityba or Y-guazu, have been described in detail by the members of the first Germano-Argentine colonial land surveying expedition to Misiones in 1883 (see *Verhandl. d. Ges. f. Erdkunde zu Berlin*, vol. x. pp. 357–364). For combined beauty and grandeur of scenery they claim to rank among the foremost cataracts in the world. About 6 or 7 miles higher up the river is 3 miles broad; it gradually narrows until, after passing through a perfect labyrinth of islands (King Albert Archipelago), it pours, not in a single mass, but in numerous streams, over a horse-shoe edge of rock into a gorge 120 to 150 feet deep. Niederlein divides the falls into three groups—a northern or Brazilian, a central or insular, and a southern or Argentine, to which he has attached respectively the names of the Emperor Dom Pedro, the Emperor William, and General Roca. The river continues for some distance shut in by overhanging cliffs; and a large number of secondary cataracts (Bosetti Falls, Prince Bismarck Falls, etc.) are formed by tributary streams, and add to the bewildering beauty of the scene.

The watersheds between the northeastern headwaters of the Paraguay system and the southern affluents of the Amazons are so low and narrow that in some instances canoes have been conveyed overland from the one to the other. Interest has recently been concentrated on the exploration of the Pilcomayo, a right-hand tributary which joins the Paraguay proper in 25° 20′ S. lat. Though its sources have long been known, all attempts to trace it downward from Bolivia or upward from the Argentine Republic had been foiled by the hostility of the Indians. At length, on April 27, 1882, Dr. Crevaux, the great French explorer of South American rivers, was slain with all his party by the Tobas at a place called Ipanticapu. General interest was thus aroused; and the task in which Dr. Crevaux perished has since been practically accomplished by Dr. Thouar, his fellow-countryman, who, leaving the San Francisco mission-station on 10th September, 1883, reached the mouth of the river on 10th November, though he had not been able to keep close to its course in the lower section of the journey. The Pilcomayo rises in Vilcapujia (a mountain 13,500 feet high to the E. of Lago Poopo), and passes between the Cordillera of Livichuco and the Cordillera de los Frailes, a few miles to the north of Potosi. It cuts through the last range of the Andes in 21° 16′ 50″ S. lat. and 63° 25′ W. long., and enters the plains of the Gran Chaco at a height of 1456 feet above sea-level (J. B. Minchin[2]). It is soon after joined by the Pilaga, which brings down the waters of the Rio Blanco and other streams from the mountains. Till in its southeastern course, it reaches 22° S. lat., the river has a very regular course, flowing at the rate of 6500 feet per hour over a sandy bed 600 to 700 feet wide, unimpeded by rocks or trees, and enclosed by steep banks 15 to 20 feet high, above which the country stretches out in pasture-covered plains. Farther down the banks increase in height to from 20 to 45 feet, and embrace a channel or valley 5500 feet or more in breadth, though the actual river does not exceed 150 or 200 feet. At the point called Cabello Muerto, 24° 20′ S. lat., commence the marshy plains of the lower course, in which the banks hardly rise above the level of the water, and a whole series of lagoons lie at a distance of a mile or two on the left hand. So flat is the country, and so tortuous the river that when Mr. Robinson, in 1873, ascended for 150 miles, he never lost sight of the white houses of Asuncion.[3]

About 150 miles below the mouth of the Pilcomayo the Paraguay is joined by another Andean river, the Rio Vermejo or Y-pyta, whose red waters, pouring into the dark clear water of the main stream, are sufficient to tinge the whole current downwards to the confluence of the Paraná. "From the junction of its headstreams down to the Paraguay, the Vermejo does not receive a single affluent; its breadth varies from 70 to 250 yards, its depth from 5 to 16 feet; and the current appears to average 1½ miles an hour" (Keith Johnston). Its navigability was shown about 1780 by the Franciscan missionaries Murillo and Lapa descending the whole way in a canoe, but it was not till 1874 that, under Don Natalio Boldan, the regular navigation was undertaken.

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[1] The word Paraná, meaning simply *river*, appears, it is to be remembered, alone or in composition again and again throughout South America. See Lallemant, in *Zeitschr. für Erdk.*, Berlin, 1863, p. 156.

[2] "Eastern Bolivia, etc.," in *Proc. Roy. Geo. Soc.*, 1881.

[3] See Thouar's account in *L'Exploration*, 1884; and map of the Pilcomayo, in *Bol. Inst Geogr. Argentino*, 1882.

At their confluence the Paraguay has a width of half a mile, the Paraná of 3 miles. The united river continues for 686 miles, first in a south-southwest, then in a south, and finally in a southeast direction before it reaches the head of the La Plata estuary. Down to Diamante, or for 433 miles, its left bank is at intervals formed by lines of bold bluffs from 100 to 200 feet high, on which several of the more important towns are built; but the channel often breaks up so as to enclose extensive islands. The worst reach in this respect is the 45 miles below Goya, a little town in 29° 7′ S. lat. At Diamante begins the enormous delta (some 5000 or 6000 square miles) which is traversed by countless and changing channels, and presents nothing else, even if viewed from the masthead of the steamer, but a boundless labyrinth of islands clothed with exuberant vegetation. The two chief lines of navigation through this deltaic region are the Paraná de las Palmas (so called by Cabot, in 1526, but now showing comparatively few palms among its ceibas, willows, and poplars) and the Paraná Guazu. The former has its mouth about 24 miles north of Buenos Ayres, the latter joining the estuary of the Uruguay 22 miles farther north, in 34° N. lat. and 58° 24′ 30″ W. long.

The third great confluent of the La Plata system, the Uruguay, is quite unlike the other two. Instead of having a fairly steady and continuous flow, it appears sometimes as an insignificant torrent and at other times as a magnificent river. It has its headwaters in the Serra Geral, and for several hundred miles continues to flow west through Brazil (forming the northern boundary of Rio Grande do Sul province), as if it meant, like the Curityba, to carry its waters to the Paraná; but about 54° W. long. it is turned aside by the mountain range of Misiones, and flows southwest and south almost parallel with the Paraná. It has a total length of 950 miles, and a drainage area of 200,000 square miles.

In the matter of annual rise and fall the three rivers differ considerably. The Paraguay is regular, reaching its lowest stage in the end of February, and its highest about the end of June, and showing an average difference of level not exceeding 15 feet. The ordinary flow at Asuncion is between 97,400 and 99,950 cubic feet per second. Above the junction of the Paraguay the Paraná appears to have numerous and rapid risings at irregular intervals, but to reach its maximum in December. Below the junction it has much the same movement as the Paraguay, having high water in summer, gradually shrinking through September, October and December, flooding in January, and continuing high and steady till June. The Uruguay rises about the middle of January (at Salto sometimes 22 feet above low water); again in April, to continue in flood for two months (30 feet at Salto); and for the third time, and with great regularity, in September or October, to last a whole month, and reach 40 to 50 feet above low water. Occasionally the flood level of the Paraná is maintained throughout a whole year, or even two years in succession; and at intervals, as in 1858 and 1868, the water rises so high that the whole delta is submerged. The highest floods on record stood 24 feet above ordinary low-water mark at Rosario, or 12 feet above ordinary high water. As a system of waterways the La Plata rivers are but partially developed. Steamers, mainly Brazilian, ascend from Buenos Ayres by the Paraná, Paraguay and Cuyabá, a total distance of 2146 miles, to the town of Cuyabá in Brazil; and the Pilcomayo and the Vermejo, the Apa, the Jejuy, and the Tebiquary are all more or less navigable. The Paraná affords a free passage for 280 miles above the confluence to the Seven Falls, except during low water, when the rapids of Apipe interfere; and, according to Bigg-Wither, the Upper Paraná and its tributaries the Tibagy, Paranapanéma, Tiete, Ibahy, etc., furnish 1290 miles of navigable stream, of which 510 could be at once utilized by steamers of light draught, while the remainder would require a certain outlay in the way of improvements. Vessels drawing 4½ feet of water can always ascend the Uruguay to Salto (200 miles), and during six months they can cross the Salto Chico, or Lesser Fall, a mile higher up; but the Salto Grande, 8 miles farther, stops all progress except during six weeks in October and September. The whole system may be estimated to give upwards of 5000 miles of waterway, of which 3500 are accessible from the sea, without counting the secondary deltaic channels.

See T. J. Page, U.S.N., *La Plata*, 1859 (the surveys of the "Waterwitch"); Burton, *Battle-fields of Paraguay*, 1870; Bigg-Wither, *Pioneering in South Brazil*, 1878; J. J. Revy, *Hydraulics of Great Rivers: the Paraná, the Uruguay, and the La Plata Estuary*, 1874 (a series of elaborate investigations and measurements of great value); and other works mentioned under PARAGUAY.

(H. A. W.)

PLATEAU, JOSEPH ANTOINE FERDINAND, was born at Brussels in 1801, and died in 1883 at Ghent, where he had been professor of physics from 1835. He was a pupil and friend of Quetelet, who had much influence on the early part of his career. The more original investigations of Plateau refer chiefly to portions of one or other of two branches of science—physiological optics and molecular forces. His doctoral thesis (Liége, 1829) had for its subject "Impressions produced by Light on the Organs of Vision"; and it was succeeded by numerous memoirs, some of much value, on the persistence of visual impressions, subjective impressions of color, irradiation, etc. Among other results of his studies was the invention of the philosophical toy known as the "thaumatrope." We owe to him also something much more important, the process of studying the motion of a vibrating body by looking at it through equidistant radial slits in a revolving disk. In 1829 he imprudently gazed at the midday sun for 20 seconds, with the view of studying the after effects. The result was blindness for some days, succeeded by a temporary recovery; but for the next fourteen years his sight gradually deteriorated, and in 1843 he became permanently blind. This calamity did not interrupt his scientific activity. Aided by his wife and son, and afterwards by his son-in-law Van der Mensbrugghe, he continued to the end of his life his researches on vision—directing the course of the experiments which they made for him, and interpreting the bearing of the results. He also published a valuable analytical catalogue of all the more important memoirs which had been written, from the earliest times to the end of the 18th century, on his favorite theme of subjective visual phenomena. But even more extraordinary were this blind man's investigations about molecular forces, embracing hundreds of novel experiments whose results he saw only with others' eyes. These form the subject of his great work *Statique expérimentale et théorique des Liquides soumis aux seules Forces moleculaires* (2 vols., 1873), which is a valuable contribution to our knowledge of the phenomena usually called capillary. To avoid, as far as possible, complications due to gravity, Plateau employed either films formed of a solution of soap with glycerin, or masses of oil suspended in a mixture of alcohol and water of the same density as the oil. See CAPILLARY ACTION.

PLATED WARE. The plating or coating of one metal or alloy with another is extensively practiced in metal working. In some cases the coating metal is a valuable protector from oxidation, etc., of the underlying metal; in other cases the properties and advantages of two metals—such as strength and lustre—are combined in one object; and more frequently a cheap and inferior body by a superficial coating gets the appearance of a more valuable and important metal. The art of plating was originally applied to the production of imitation silver plate, whence the term "plating." The original method of silver plating consisted in attaching, by a kind of autogenous soldering, thin plates of silver to the opposite surfaces of a prepared ingot of copper alloy or of German silver. The silver plates were firmly wired to the ingot and submitted to a soldering temperature in a plating furnace, in which the surfaces became firmly united. Subsequently the ingot was rolled down to a sheet in which the relative thickness of the metals was maintained, and from such sheets "silver plated" articles were fashioned. This method of plating may be regarded as now extinct, being superseded by electroplating (see ELECTRO-METALLURGY, vol. viii. p. 108).

Recently, however, cooking vessels, etc., of iron plated in an analogous manner with nickel have come into use (see NICKEL, vol. xvii. p. 500). The plating or casing of iron with brass is extensively practiced in the manufacture of stair-rods, curtain and picture rods, and "cased" tubing for upholstery purposes generally; and in the manufacture of pipes for conveying water the body of lead is frequently lined with a coating of pure tin. The gilding of metals is a process analogous to plating, as are also the galvanizing of iron and the manufacture of tin and terne plates. For these see IRON, vol. xiii. p. 367.

PLATEN-HALLERMUND, AUGUST, GRAF VON (1796-1835), German poet, was born at Ansbach on October 24, 1796, and died at Syracuse on December 5, 1835. His principal publications were *Lyrische Blätter* (1821), *Sonette aus Venedig* (1825), an historical fragment entitled *Geschichten des Königreichs Neapel* 1414-43 (1833), and a poem in nine cantos, *Die Abbasiden* (1835). He wrote also a number of dramas, of which may be mentioned *Der gläserne Pantoffel* and *Die Liga von Cambrai*. See vol. x. p. 487.

PLATINUM AND THE PLATINUM METALS.

The metals platinum (Pt), palladium (Pd), rhodium (Rh), iridium (Ir), ruthenium (Ru), and osmium (Os) are united into a family by a striking similarity in chemical characters and by their association in natural occurrence. A rather rare ore, called platinum ore or polyxene, is almost the only native material which is available for their extraction; it contains them all in the reguline form. *Traces* of platinum are found in almost all native gold.

As early as the first half of the 16th century it appears to have been noticed that the gold ore in the Spanish mines of Darien includes grains of a white metal endowed with the qualities of a noble metal and yet distinctly different from silver; but the fact remained unknown in Europe because the Spanish Government, having found out that the new metal lent itself most admirably for the adulteration of gold, prohibited its exportation. Only from about the middle of last century did the metal begin to find its way to Europe and to become known there, at first as a curiosity, under its Spanish name of "platina del Pinto" (the little silver from the river Pinto). Its chemical individuality and qualities were established by the successive labors of Scheffer (1752), Marggraft (1757), Bergmann (1777), and others. An amateur, Count von Sickingen, it appears, was the first who succeeded in working the metal (1772); the first platinum crucible was produced by Achard (1784). Achard's mode of rendering the native metal amenable to mechanical working was founded upon the fact that it forms a readily fusible alloy with arsenic, from which the latter can be driven off again by intense heating. This method was worked industrially for a time, but subsequently superseded by another superior process, which is usually credited to Wollaston, because it was he who, after having wrought it as a rich source of revenue for years, published it in 1828. But as early as 1800 Knight of London had published all that is essential in the process; and Messrs. Johnson, Matthey & Co. inform the writer that Wollaston obtained the secrets of both the refining and the compressing of the spongy into compact metal from a relative of theirs, Thomas Cock, who, they are convinced, is the true inventor. Undisputed merits of Wollaston's are his discoveries of palladium (1803) and rhodium (1804). About the same time iridium and osmium were discovered by Smithson Tennant.

Platinum ore well deserves its cognomen of "polyxene," because it is a most complex mixture of mineralogical species, including (1) a number of heavy reguline species designated as platinum, osmiridium, iron-platinum, platiniridium, iridium, palladium (also gold), and (2) a number of non-metallic species, notably chrome-iron ore, magnetic oxide of iron, zircone, corundum, and occasionally also diamond. The reguline components always form detached granules, which are generally small, but occasionally assume considerable dimensions. The Demidoff museum contains a a native platinum lump weighing 21 pounds troy. The ore, as already stated, was discovered first in South America; it is found there chiefly in the provinces of Choco and Barbacoas, New Granada, and also in Brazil. It occurs besides in San Domingo, in California, at the Rogue river in Oregon, in Canada, and in the island of Borneo. But the richest deposits are those of the Ural Mountains; these were discovered about 1823, and have been wrought by the Russian Government since about 1828. Part at least of the Ural ore, as Daubrée showed, was embedded originally with chrome-iron in a serpentine derived from olivine. The very variable percentages of the several components range approximately as follows:—platinum, 60 to 87; other polyxene metals 3 to 7; gold up to 2 and more; iron 4 to 12; copper 0 to 4; non-metallic gangue 1 to 3.

Platinum, though a noble metal chemically, has too modest an appearance to lend itself much to the jeweller's purposes. The Russian Government used, for a while, to strike platinum coins, but soon came to give up the practice on account of the immense fluctuations in the commercial value of the metal. Almost all the platinum produced now-a-days is made into chemical utensils. Platinum, in fact, is the metal of the chemist. "Without platinum crucibles, which share the infusibility of porcelain with the chemical inertness of gold ones the composition of most minerals could not have been ascertained" (Liebig), and chemistry generally could not have come up to its present level. In industrial chemistry platinum is used chiefly for the construction of those stills for the concentration of oil of vitriol, which, although a single one costs a fortune, are cheaper in the long run than glass retorts.

The technical extraction of platinum from its ore is to the present day effected everywhere by some modification or other of the so-called "Wollaston" process. Heraeus of Hanau operates as follows. The ore is digested within glass retorts in aqua regia diluted with three times its weight of water, an over-pressure of some 12 inches of water being established within the retorts to accelerate the process, which always takes several days. The whole of the osmiridium, along with more or less of other polyxene metals. and the "sand" (corundum, chrome-iron, etc.) remain undissolved, as a heavy black deposit; the platinum, palladium, part of the rhodium, and more or less of the other three polyxene metals pass into solution, the platinum, iridium and palladium as tetrachlorides. From the clarified solution the whole (almost) of the platinum can be precipitated as $PtCl_6(NH_4)_2$ by addition of a large excess of sal-ammoniac; and this simple process used to be adopted formerly. But the precipitate then includes much chloro-iridiate of ammonium $IrCl_6(NH_4)_2$ and other impurities. Heraeus, therefore, first evaporates to dryness and heats the residue to 125° C. for a sufficient time, to reduce the palladic and iridic chlorides to the lower stages of $PdCl_2$ and Ir_2Cl_6, which form soluble double salts with sal-ammoniac. The heated residue is dissolved in water acidulated with hydrochloric acid, the solution filtered, and mixed with hot concentrated solution of sal-ammoniac, when a (relatively) pure chloroplatinate comes down as a yellow precipitate (the iridium compound is dark-red), which is washed, first with saturated sal-ammoniac solution, then with dilute hydrochloric acid. The precipitate needs only be exposed to a dull red heat to be converted into "spongy platinum," *i. e.*, metallic platinum in the form of a gray porous mass. As platinum is infusible even at the highest temperature producible in a wind-furnace, the spongy metal cannot be fused together into a regulus like an ordinary metal; but it shares with wrought iron the rare quality of assuming a high degree of softness and viscosity at a strong red heat; and, consequently, the sponge, after a preliminary compression by purely mechanical means, needs only be exposed to a strong heat to "frit" into a coherent mass; and this mass, by repeated forging at a white heat is readily made into a perfectly homogeneous compact bar, which, as the metal is very ductile, is easily rolled out into sheet or drawn into wire. In the former form more especially it goes into the workshop to be made into utensils.

This process of welding at the time of Achard (who used it first) and of Knight was a necessary make-shift; but it is singular that it was retained long after the invention of the oxyhydrogen blast (see vol. xviii. p. 108), by means of which platinum can be fused as easily as lead can in an ordinary fire. With the oxyhydrogen-blowpipe Hare, as early as 1847, fused 970 grammes (upwards of two pounds) of platinum into one regulus. Yet platinum manufacturers did not utilize this obvious process until Deville and Debray, in 1859, again demonstrated its practicability. Their furnace is of the simplest description. Two flat pieces of quicklime, scooped out so as to represent two cupels, are placed one upon the other so that they enclose a flat space similar in form to two superimposed soup-plates. The lower cupel has a notch cut out of its side to serve as a spout for pouring out the liquefied metal, the upper and shallower one is pierced with a central slightly conical round hole through which the (platinum) nozzle of the blow-pipe enters, so that the flame flattens itself out on the introduced metal. By means of this simple contrivance Deville and Debray had no difficulty in fusing as much as twelve kilogrammes of platinum into one regulus; and Messrs. Johnson, Matthey, & Co. of London now think nothing of fusing up as much as 1000 ounces of metal in one operation. A regulus made under Mr. Geo. Matthey's superintendence for the metric commission in Paris in 1874 weighed one quarter of a ton.

The shaping of compact platinum is effected pretty much in the same way as that of gold or silver; only the difficulties are less because platinum, unlike the two ordinary noble metals, is susceptible of "welding"; *i. e.*, two pieces of the metal, at a white heat, can be united into one by a stroke of the hammer. Soldering is rarely necessary; it used to be effected (and still is occasionally) by means of gold as a connecting medium and an ordinary blow-pipe. But platinum workers, following the lead of Messrs. Johnson, Matthey, & Co., have long learned to unite two platinum seams by the "autogenic" process—the local fusing of the two contiguous parts in the oxyhydrogen flame.

For the preparation of chemically pure platinum Schneider's process is the one most easily executed and explained. The commercial metal is dissolved in aqua regia and the excess of nitric acid removed by evaporation to a syrup in a water-bath. The residue is redissolved in water and boiled for a long time with a large excess of potash-free caustic soda. If care be taken to maintain a strong alkaline reaction, all the foreign polyxene chlorides are reduced to lower forms than that of tetrachloride; while only the platinum itself retains this state of combination. The hypochlorite formed is then reduced to (NaCl) by addition of a little alcohol to the boiling alkaline liquid, which is now allowed to cool and acidified strongly with hydrochloric acid so as to redissolve any hydrated platinic oxide which may have been precipitated by the first instalments of acid. The liquid at last is filtered, and precipitated by sal-ammoniac to obtain a *pure* chloroplatinate ($PtCl_6(NH_4)_2$), which on ignition, of course, yields an equally pure spongy metal.

Pure compact platinum is a tin-white metal about as soft as pure copper and nearly (but not quite) equal in plasticity to gold. The specific gravity of the fused metal is 21.48 to 21.50 at 17.6° C. (Deville and Debray). The breaking strain is 34.1 kilos for hard-drawn and 23.5 kilos for annealed wires; the modulus of elasticity 15,518 (kilogramme and milimetre as units; by Werthum's experiments on annealed welded wire). Unit length of the (fused) metal expands by 0.000907 from 0° to 100° C. (Fizeau). The specific conductivity for heat at 12° C. is 8.4, for electricity at 0° C. 16.4 (silver=100). The statement regarding electricity refers to the annealed metal. The fusing point, according to recent determination by Violle, is 1779 C.; the same experimenter finds for the true specific heat $\delta Q/\delta t = 0.0317 + 0.000012t$ (centigrade scale). When platinum is heated beyond its fusing point, it soon begins to volatilize. The fused metal, like silver, absorbs oxygen, and consequently "spits" on freezing. At a red heat the then viscid metal, as Graham has shown, "occludes" hydrogen gas; *i.e.*, it dissolves the gas (just as, for instance, liquid water would), which explains the fact previously discovered by Deville that a platinum tube, although it may be perfectly gas-tight in the cold, at a red heat allows hydrogen (but not, for instance, oxygen, nitrogen, or carbonic acid) to pass through its walls. According to Graham the quantity of gas occluded is independent of the surface of the metal operated on, but proportional to its weight. No gas is taken up in the cold; but the gas occluded at a red heat, though extractable at that temperature by means of an absolute vacuum as producible by a Sprengel pump (see MERCURIAL AIR PUMP, vol. xvi. p. 35), is retained on cooling and cannot be thus liberated at the ordinary temperature. The volume of hydrogen absorbed by unit-volume of metal at a red heat under one atmosphere's pressure was found, in the case of fused metal, to vary from 0.13 to 0.21 volume measured cold; in the case of merely welded metal, from 2.34 to 3.8 volumes (compare *Palladium* below). Oxygen gas, though absorbed by the liquid, is not occluded by the solid metal at any temperature, but when brought in contact with it at moderate temperatures suffers considerable condensation at its surface. The thin condensed film of oxygen exhibits a high degree of chemical activity; a perfectly clean piece of platinum foil, when immersed in a mixture of hydrogen or ammonia or other combustible gas and air, begins to glow and starts a process of slow combustion or there may be an explosion. The spongy metal of course exhibits a very high degree of activity; a jet of hydrogen gas, when made to strike against a layer of spongy platinum causes it to glow and takes fire. This is the principle of the (now defunct) Döbereiner lamp. But the most striking effects are produced by a peculiar kind of very finely divided platinum, which was discovered by Liebig and called by him platinum black on account of its resemblance to lamp-black. A particularly active "black" is produced by dropping platinum chloride solution into a boiling mixture of three volumes of glycerin and two of caustic potash of 1.08 specific gravity. Platinum black, according to Liebig, absorbs 800 times its volume of oxygen from the air, and in virtue thereof is a most active oxidizing agent, which, in general, acts "catalytically" because the black, after having given up its oxygen to the oxidizable substance present, at once takes up a fresh supply from the atmosphere. For examples see FERMENTATION, vol. ix. pp. 83–87.

Platinum Alloys.

Platinum alloys of almost any kind are easily produced synthetically; and, as a rule, a temperature little if at all above the fusing point of the more fusible component suffices to start the union. We will begin with the cases in which the metal combines with another member of its own family. *Iridium.*—In the heat of an oxyhydrogen flame the two metals unite permanently in all proportions. The alloy has pretty much the appearance of platinum, but it is less fusible, harder, more elastic, specifically heavier, and less readily attacked by aqua regia,—all these qualities increasing as the percentage of iridium increases. The 19 per cent. alloy was produced for the first time by G. Matthey. It has the hardness and elasticity of soft steel (modulus of elasticity=22,000 for millimetre and kilogramme), and is hardly attacked by aqua regia. Alloys richer in iridium are difficult to work. The 10 per cent. alloy on the other hand still retains enough of the virtues referred to, to be far superior to platinum itself—perhaps we might say, to any other solid—as a material for standard measures of length or weight. In 1870 Messrs. Johnson, Matthey & Co. exhibited a standard metre made of this alloy, and it gave such unqualified satisfaction that the international metric committee which sat in Paris some years ago adopted it for the construction of their standards. *Rhodium.*—An alloy of 30 per cent. of this metal and 70 of platinum is absolutely proof against aqua regia, but is very expensive. Deville and Debray once elaborated an igneous process for producing, directly from the ore, a triple alloy of platinum, iridium, and rhodium, which is quite workable and, besides being more highly infusible than platinum, is almost proof against aqua regia. Crucibles made of this alloy used to be sold in Paris and elsewhere at moderate prices; but they are now no longer to be had. *Gold.*—This metal unites with platinum in all proportions, forming grayish-yellow or grayish-white alloys. A graduated series of these alloys was recommended by Schertel and Ehrhard as a means for defining certain ranges of high temperatures. According to their experiments, while the fusing point for gold was 1075° C., and for platinum 1775°, it was 1130° for 10 per cent. of platinum, 1190° for 20, 1255° for 30, 1320° for 40, 1385° for 50, 1460° for 60, 1535° for 70, 1610° for 80, and 1690° for 90 per cent. *Silver* and platinum unite readily in any proportion, but the alloys are in general liable to "liquation" (see METALS, vol. xvi. p. 73). Now platinum is as proof against nitric acid as gold; and yet these alloys cannot, like gold-silver, be parted by means of nitric acid; because, if the alloy is rich enough in silver to be at all attacked by the acid, part at least of the platinum passes into solution along with the silver. But concentrated oil of vitriol effects a sharp separation; the platinum remains. A considerable variety of alloys of platinum with other noble metals are used in mechanical dentistry. The following examples may be quoted: 66.7 per cent. of gold and 33 of platinum; platinum 50, silver 25, palladium 25; platinum 41.7, gold 25, palladium 33.3.

Of the great variety of alloys of platinum with base metals which have been recommended as substitutes for noble metals or otherwise we select the following:

	Platinum.	Silver.	Copper.	Tin.	Brass.	Nickel.
1	19	0	1	0	0	0
2	1	0	26	0	0	0
3	2	1	5	0	2	1
4	1	0	0	10	0	100
5	1	2	0	20	0	100
6	0.5	0	0	15	0	100
7	20	0	0	20	0	100
8	5 to 10	0	0	0	120	60

(1) Known to jewellers and dentists as hard platinum; (2) a rose-colored fine-grained ductile alloy; (3) introduced by Bolzani in Paris as an imitation gold; (4 to 7) platinum bronzes, recommended—(4) for knife and fork handles, (5) for bells, (6) for articles *de luxe*, (7) for telescopes; (8) not subject to oxidation.

Platinum Compounds.

Platinum is not changed by air, water, or steam at any temperature. It is proof against the action of all ordinary single acids, including hydrofluoric, in the heat or cold. Aqua regia (a mixture of hydrochloric and nitric acids) dissolves it slowly as chloroplatinic acid $PtCl_6H_2$. The metal is not attacked by even very strong boiling caustic potash or soda ley, nor is it changed by fusion with carbonate of soda or potash. Carbonate of lithia, and the hydrates of potash, soda and baryta, however, when fused in platinum vessels, attack them strongly, with formation of compounds of PtO_2 with the respective bases. According to recent experiments by the writer, none of these reactions go on in the absence of air; hence, for instance, a fusion with caustic baryta or potash can safely be carried out in a platinum crucible if the latter is protected by an atmosphere of hydrogen or nitrogen. Fused hepar (alkaline sulphide) dissolves platinum at a red heat; so does fused cyanide of potassium, especially if mixed with caustic potash.

Chloroplatinic Acid.—The solution of the metal in aqua regia is evaporated down repeatedly in a water bath with hydrochloric acid to destroy the excess of nitric acid and the very concentrated solution allowed to stand, when the acid gradually separates out in brown-red deliquescent crystals of the composition $PtCl_6H_2+6H_2O$, which are abundantly soluble in water, and also easily in even strong alcohol. The aqueous solution, if free of iridium and platinous chlorides, is of a rich but clear yellow color free of any tinge of brown. The "chloride of platinum" solution of the analyst is an aqueous solution of this acid. When the solution is mixed with those of certain chlorides, the 2HCl are displaced by their equivalent of metallic chloride, and metallic "chloroplatinates" are produced. Of these the potassium (rubidium and cæsium) and the ammonium salts are most easily prepared,—by addition of the respective chlorides to a moderately strong solution of chloroplatinic acid; they come down almost completely as pale yellow crystalline precipitates, little soluble in cold water and very nearly insoluble in alcohol. The sodium salt $PtCl_6Na_2+6H_2O$ and the lithium salt $PtCl_6Li_2+6H_2O$ are readily soluble in water and in aqueous alcohol (the Li_2-compound dissolves even in absolute alcohol); hence "chloride of platinum" is used for the separation of K, NH_4, Rb, Cs from Na and Li. On the other hand chloride of potassium or ammonium may serve as a precipitant for platinum, but in this case a large excess of a concentrated solution of the precipitant must be used to bring the solubility of the chloroplatinate precipitate to its minimum. Gold, copper, iron, and many other metals not belonging to the polyxene group, if present, remain dissolved. Real *platinic chloride*, $PtCl_4$, can be produced from the acid $PtCl_6H_2$ only by precipitating from its solution the chlorine of the 2HCl by the exact equivalent of nitrate of silver. The filtrate when evaporated (cold) over vitriol deposits red cyrstals of the composition $PtCl_4+5H_2O$. When chloroplatinic acid is heated to 300° C., it loses its 2HCl and half the chlorine of its $PtCl_4$ and *platinous chloride*, $PtCl_2$, remains as a dull green powder, insoluble in water but soluble in aqueous hydrochloric acid. Either chloride when heated to redness leaves spongy metal. The hydrochloric solution of platinous chloride, when evaporated with one of chloride of potassium to a sufficiently small volume, deposits rose-colored crystals of a double salt $PtCl_2+2KCl=PtCl_4K_2$. From a solution of this double salt *platinous hydrate*, $Pt(OH)_2$, is obtained, by boiling it with the calculated quantity of caustic soda, as a black precipitate which, when gently heated, becomes anhydrous. *Platinic hydrate*, $Pt(OH)_4$, is obtained by boiling chloroplatinic acid solution with excess of caustic soda, and then acidifying with acetic acid, as an almost white precipitate, $Pt(OH)_4+2H_2O$, which loses its $2H_2O$ at 100° C. and becomes brown; at a certain higher temperature it loses all its water and assumes the form of the black anhydride PtO_2. Both oxides are bases in so far as their hydrates combine with a limited number of acids; towards strong bases they behave as feeble acids. Only a few of the salts of the acid PtO_2 have been investigated. Either oxide when heated to redness breaks up into oxygen and metal.

Platin-Ammonium Compounds.—In this very numerous family of bodies a *compound radical* containing platinum and some ammonia residue plays the part of a basilous metal. The first member was discovered by Magnus in 1828. By adding ammonia to a hydrochloric solution of platinous chloride, he obtained a green precipitate of the composition $PtCl_2N_2H_6$, which soon became known as "Magnus's green salt," and served as a starting point for subsequent investigations.

Platinocyanides.—These were discovered by L. Gmelin, who obtained the potassium salt $Pt(NC)_4K_2$ by fusing the metal with prussiate of potash. Martius's method is more convenient: chloroplatinate of ammonia is heated in a strong mixed solution of caustic potash and cyanide of potassium as long as ammonia is going off. The solution on cooling deposits crystals containing $3H_2O$ of water, which appear yellow in transmitted and blue in reflected light. From the potash salt numerous other platinocyanides can be made by double decomposition; and a very interesting series is derived from these by the addition of chlorine or bromine. All these bodies are distinguished by their magnificent fluorescence.

The Polyxene Metals Generally.

The metals all exist in the three forms of "black," "sponge," and compact regulus. The colors of the compact metals are shades of white, except in the case of osmium, which forms blue crystals. Platinum, palladium, and rhodium are ductile; the rest break under the hammer.[1] In regard to specific gravity they arrange themselves into two groups as shown by the following table, which at the same time gives the atomic weights (those of Pt and Ir according to Seubert) and the formulæ of the most stable chlorides:—

Name.	Atomic weight. O = 16.	Specific Gravity.	Chlorides.
Platinum....	Pt = 194.8	21.50	$PtCl_2$; $PtCl_4$.
Iridium......	Ir = 193.0	22.38	Ir_2Cl_6.
Osmium......	Os = 195	22.48	(?)
Palladium[2]..	Pd = 106.6	11.4	$PdCl_2$.
Rhodium.....	Rh = 104.3	12.1	Rh_2Cl_6.
Ruthenium[2]	Ru = 103.8	12.26	Ru_2Cl_6+xRCl.

The order of fusibility is as follows:—Pd, Pt, Ir, Rh, Ru, Os. Palladium almost fuses in the strongest heat of a wind furnace, but like the four metals following requires an oxyhydrogen flame for its real fusion; osmium has never been fused at all; but it volatilizes abundantly at the highest temperature producible by the oxyhydrogen blast.

Action of Air.—Platinum and palladium do not oxidize at any temperature; rhodium also does not oxidize by itself, but when cupelled with lead it remains as monoxide RhO. Compact iridium does not oxidize appreciably even in the heat; but the finely-divided metal, at some temperature below 800°C., suffers gradual conversion into Ir_2O_3, which when heated more strongly begins to dissociate at 800°, and is completely reduced at 1000°C. Ruthenium draws a film of oxide in even cold air; at a red heat it passes into Ru_2O_3, which retains its oxygen at a white heat. Osmium (the finely-divided metal), when heated in air to about 400°C., takes fire and burns into vapor of tetroxide, OsO_4. This and the analogous ruthenium compound are the only volatile oxides of the group.

Water.—None of our metals seem to decompose water or steam at any temperature.

Hydrochloric Acids acts slowly on palladium in the presence of air; otherwise there is no action in any case.

Hot Nitric Acid dissolves palladium as nitrate $Pd(NO_3)_2$, and converts finely divided osmium into tetroxide vapor. Compact osmium, and platinum, iridium, and rhodium in any form, are not attacked by the acid.

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[1] It still remains to be seen how far this latter statement holds for the absolutely pure metals. Mr. George Matthey has succeeded in producing iridium wire, which could be bent into a loop without breaking.

[2] [Sp. gr. of Palladium, 12. and Ruthenium 11.4. See vol. v. p. 465, see also p. 204 of this article.—AM. ED.]

Aqua Regia, in the heat, dissolves palladium (very readily) and platinum (somewhat more slowly) as $MeCl_6H_2$; only the palladium compound is very unstable, being completely reduced to dichloride, $PdCl_2$, by mere evaporation over a water-bath. Iridium black, or iridium alloyed with much platinum, dissolves slowly as $IrCl_6H_2$, readily reducible (by, for instance, addition of alcohol, or evaporation to dryness and heating of the residue to about 150°C.) to Ir_2Cl_6. Compact iridium, like ruthenium or rhodium, is hardly attacked even by the hot acid; rhodium exhibits the highest degree of stability. Native osmiridium is not touched by aqua regia. Osmium, in the heat at least, becomes tetroxide.

Free Chlorine combines directly with all polyxene metals at suitable temperatures. As a disintegrator it is useful chiefly for the manipulation of osmiridium and other such platinum-ore components as refuse to dissolve in aqua regia. The action of the gas is greatly facilitated by the presence of fixed alkaline chloride.

Polyxene Oxides and Salts.

Monoxides have been produced from platinum, palladium, ruthenium, and osmium. PtO and PdO are decided, the other two are very feeble bases.

Sesquioxides, Me_2O_3, have been got from rhodium, iridium, ruthenium, and osmium. All are basic.

Binoxides, MeO_2, exist from all the metals except rhodium. PdO_2, like PtO_2 (see above), is basic or feebly acid; IrO_2 is a feeble base; RuO_2 and OsO_2 are neutral.

Tetròxides, MeO_4, are formed by osmium and ruthenium only. Both OsO_4 and RuO_4 are easily fusible and very volatile solids. Their vapors have a most powerful smell and are most dangerously poisonous.

Trioxides and *Heptoxides* do not exist as substances; but the groups RuO_3, OsO_3, and R_2O_7 unite with alkalies into soluble salts analogous to chromates and permanganates in their constitution respectively. The oxides MeO, Me_2O_3, MeO_2 are as a rule preparable by evaporating a solution of the respective chloride or potassio- etc. chloride to dryness with excess of carbonate of soda, heating the residue to dull redness, and removing the alkaline chloride and excess of carbonate by lixiviation with water. The oxides remain as very dark colored powders insoluble in acids. The corresponding hydrates are precipitated from the solutions of the chlorides or potassio- etc. chlorides, on addition of excess of caustic potash or soda and heating. These hydrates of the oxides are soluble in certain aqueous acids with formation of salts, and in this limited sense only the "oxides" can be said to be "bases."

Salts.—Of these the most characteristic and the best known are compounds of certain of their chlorides with alkaline chlorides.

1. The compounds $MeCl_6R_2$ (chloroplatinates and analogues), formed by all polyxene metals, except rhodium, are all crystalline salts, more or less soluble in water but as a rule insoluble or nearly so in alcohol. The acids $MeCl_6H_2$, in which Me is not platinum, exist only as unstable solution, which by the action of excess of caustic soda in the heat, if not by the action of a gentle heat alone, are all reduced to lower chlorides; only the platinum compound possesses a higher degree of stability.

2. Chlorides, $MeCl_2$, and potassio- etc. chlorides, $MeCl_4R_2$, exist only in the platinum and palladium series.

3. Hexachlorides, Me_2Cl_6, and compounds thereof with other chlorides are formed only by rhodium, iridium, and ruthenium.

Preparation of the Rarer Polyxene Metals.

For this the residues obtained in the industrial extraction of platinum from the ore form the natural raw material. These residues are two in number,—(1) that part of the ore which resisted the action of aqua regia (we will call it the osmiridium residue), and (2) the filtrate from the chloroplatinate of ammonia.

1. Part of the osmiridium in the first residue consists of scales or grains so hard that they cannot be powdered even in a steel mortar. They must be reduced to a fine powder, which is best done by fusing them up with eight to ten parts of zinc and then driving off the "solvent" in a wind-furnace. The osmiridium remains as a dark friable mass, which is easily powdered and incorporated with the originally sifted-off part. The disintegration of the residue may then be effected, according to Wöhler, by mixing it with its own weight of common salt and exposing the mixture to a current of chlorine at a dull red heat within a combustion tube. If the chlorine is moist much of the osmium goes off as vapor of tetroxide, which must be collected in solution of caustic potash. After complete chlorination the contents of the tube are treated with water, when as a rule some undisintegrated osmiridium remains which is filtered off. The solution is mixed with nitric acid and distilled as long as any osmic tetroxide vapors are going off, which are readily recognized by their powerful pungent smell, and of course must be carefully collected in caustic potash lye. The residual liquor (which contains the iridium as $IrCl_6Na_2$) is supersaturated with carbonate of soda, and evaporated to dryness, the residue kept at a dull red heat and then lixiviated with water. Alkaliferous oxide of iridium, Ir_2O_3, remains as a blue-black powder, which needs only be heated in hydrogen to be reduced to metal, from which the alkali is now easily removed by washing with water. Such iridium is always contaminated with more or less osmium, ruthenium, rhodium, and platinum, to remove which the crude metal is fused up with ten parts of lead, and the alloy treated with dilute nitric acid to dissolve the bulk of the lead, when the polyxene metals remain in the shape of a black powder. From this the platinum is extracted by prolonged treatment with dilute aqua regia, and from the residue the rhodium by fusion with bisulphate of potash and subsequent treatment with water, which dissolves away the sulphate of rhodium formed. The residue now left is fused in a gold crucible with ten parts of caustic and three of nitrate of potash, when the ruthenium and osmium assume the form of soluble MeO_3K_2O salts, which are extracted with water and thus removed. What remains is an alkaliferous (blue) sesquioxide of iridium, which as a rule still retains some iron, ruthenium, and traces of gold and silica (G. Matthey). For the final purification of the metal and the recovering of the ruthenium and rhodium see G. Matthey's memoir (*Chem. Soc. Journ.*, 1879, Abstr., p. 772) and chemical handbooks.

The osmium, as already stated, is obtained at an early stage of the process in the shape of a solution of its volatile tetroxide in caustic potash. This solution is mixed with a little alcohol to bring the osmium into the state of osmite, $K_2O + xOsO_2$, which is insoluble in alcohol. This precipitate is digested in sal-ammoniac, to convert it into a yellow compound of the composition $2NH_4Cl + OsO_2(NH_3)_2$, which latter needs only be heated in hydrogen to be converted into finely divided metallic osmium.

2. The second residue consists of a solution of a variety of polyxene chlorides in sal-ammoniac. This liquor is kept in contact with metallic iron, when the dissolved polyxene metals, and any gold or copper present, come down as a black heavy precipitate. This precipitate includes all the palladium and part of the rhodium as principal components. Bunsen has worked out an exhaustive method for the extracting of all its polyxene metals in pure forms; but it is too complicated to be reproduced here.[1] The customary method for extracting the palladium is to treat the metallic precipitate with aqua regia, which dissolves the palladium and platinum along with some of the iridium and rhodium, to filter, evaporate the residue to a syrup (for bringing the palladium into the form of $PdCl_2$), redissolve and precipitate the palladium by addition of the exact quantity of mercuric cyanide as cyanide $Pd(NC)_2$. This cyanide needs only be ignited strongly to leave a residue of metal. But this metal includes at least part of the copper of the original material. To remove it and other impurities, the crude metal is dissolved in hydrochloric acid with the help of free chlorine, and the solution next evaporated to dryness to reduce the $PdCl_6H_2$ to $PdCl_2$. The chloride is redissolved, the solution mixed with enough of ammonia to redissolve the precipitate first produced, and hydrochloric acid gas is now passed into the solution. Yellow palladiochloride of ammonium, $PdCl_4(NH_4)_2$, is precipitated, while copper and iron remain dissolved. After removal of the mother liquor the double salt is ignited and thus converted into palladium-sponge, which is easily fused up in the oxyhydrogen flame and thus brought into the form of regulus.

Notes on Palladium, Osmium, and Osmiridium.

Palladium, a silver-white metal of great ductility, is much used, notwithstanding its high price, in mechanical dentistry and occasionally also for the graduated limbs of theodolites and other instruments, because, unlike silver, it remains bright in sulphuretted hydrogen.

Of all the properties of this metal the most remarkable is its extraordinary power of "occluding" hydrogen. According to Graham (to whom we owe almost all our knowledge on the subject) the compact metal when immersed in *cold* hydrogen gas takes up none or at most very little of it; but at higher temperatures very considerable occlusions take place. A certain specimen of foil was found to occlude 526 volumes of the gas at 245° C., and 643 at 90° to 97° C., measured at 17.5° to 18° and one atmosphere's pressure, per unit-volume of metal. The hydrogen, as in the case of platinum, is retained on cooling, and from the cold compound cannot be extracted by means of an absolute vacuum, which re-extracts the gas at a red heat.

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[1] *Jahresb. d. Chemie*, 1868, p. 280; *Ann. d. Chemie*, vol. cxlvi. 265.

Far more striking results can be obtained by using palladium as a negative pole in the electrolysis of (acidulated) water. The coefficient of occlusion then assumes very high values; in Graham's hands it attained its maximum when the palladium was produced electrolytically from a 1.6 per cent. solution of its chloride, and thus hydrogenized while itself in the nascent state. The galvanically deposited sheet was found to contain 982 volumes of hydrogen (measured cold) per unit volume of original metal, corresponding approximately to the formula Pd_4H_3 for the compound. When palladium unites with (nascent or free) hydrogen it suffers a very appreciable expansion which on the removal of the hydrogen is followed by a contraction beyond the original volume of the plain metal. This can be most beautifully illustrated by electrolysing water in an apparatus in which the negative electrode consists of a long strip of palladium-foil of which one side is covered over with varnish or electrolytically deposited platinum. The hydrogen goes in at the bare side of the electrode; this side consequently expands more strongly than the other and the originally straight strip of metal becomes curved. When the current is reversed, hydrogen bubbles at once rise from what is now the negative pole, but the oxygen due at the palladium plate is for a time taken up by the hydrogen occluded there; this hydrogen is gradually consumed, and as it diminishes the plate unbends more and more completely and at last gets bent over in the opposite sense. Palladium by being hydrogenized does not lose any of its metallic properties, but (in the case of complete saturation) its density sinks from 12.38 to 11.79, its tenacity to 82 per cent. of its original value, its electric conductivity in the ratio of 8.1 to 5.9.

Graham views hydrogenized palladium as a true alloy, containing its hydrogen in the form of a metal "hydrogenium." He found that certain palladium alloys take up hydrogen as readily (though less abundantly) as the pure metal does with corresponding expansion, but when dehydrogenized shrink back into exactly their original volume. He calculated that the density of hydrogenium lies somewhere about the value of 0.733 (water = 1),—which of course means only that the weight of the occluded hydrogen, measured by the weight of a volume of water equal to the expansion observed is = 0.733. Dewar arrived at 0.620 as being probably nearer the truth, and for the specific heat of hydrogenium found values from 3.79 to 5.88.

Osmium.—According to Deville and Debray, powdery osmium is most readily obtained by mixing the vapor of the tetroxide with that gas ($CO + CO_2$) which is prepared by the decomposition of oxalic acid with oil of vitriol, and passing the mixture through a red-hot porcelain tube. The powdery metal readily fuses up with 3 or 4 parts of tin into a homogeneous alloy. When this alloy is treated with hydrochloric acid most of the tin dissolves, and the rest of it can be driven off by heating the residue in HCl gas. There remains ultimately pure osmium in the form of blue crystals endowed with a gray to violet reflex, which are hard enough to scratch glass. Their specific gravity is 22.48, so that osmium, besides being the most infusible of metals, is the heaviest of all known bodies.

Osmiridium.—Native osmiridium forms crystalline plate-shaped grains, distinguished by an extraordinary degree of hardness, which certainly exceeds that of hard-tempered steel. Most of the grains are very minute; the larger ones are utilized for making the so-called "diamond points" of gold pens. Osmiridium would lend itself for endless other applications if it were possible to unite the native dust into large compact masses. From a series of articles in the *Chemical News* (Jan. 2, 9, and 16, 1885), by Nelson W. Perry, it would appear that this problem has been solved, in a sense. John Holland, an American pen-maker, starting from the long-known fact that platinum metals readily unite with phosphorus into relatively easily fusible alloys, succeeded in producing a phosphorized osmiridium which can be cast (and pressed while liquid) into thin continuous slabs even harder than the native substance, and susceptible of being wrought into drills, knife-edges, etc.

Statistics.

The production of platinum-ore in Russia was 2327 kilogrammes [5130.68 ℔] in 1862, 492 [1082.4 ℔] in 1863, 397 [893.4 ℔] in 1864, 2273 [5000.6 ℔] in 1865, 1768 [3889.6 ℔] in 1867, and 2050 [4510 ℔] in 1871,—a total in those six years of 9307 [20,475.4 ℔]. The average production of platinum metal, from 1828 to 1845, amounted to 2623.8 kilogrammes [5772.4 ℔] per annum. In 1870 it was only 2005.8 kilos [4412.8 ℔], of which about 80 per cent. came from the Ural Mountains.[4]

The manufacture of platinum utensils is in the hands of a very few firms, of which that of Messrs. Johnson, Matthey & Co. of London is generally understood to be the most important. Even the total amount of metal which passes through these works in the aggregate is difficult of ascertainment, the more so as some of them at least are discounting large reserves of old metal, including more or less of the obsolete coins. According to an approximate estimate which a very competent authority has kindly furnished, the consumption during the last five years fell little short of 100,000 ℔ troy,[5] of which from 75 to 80 per cent are believed to have passed through the hands of London manufacturers.

The price of the metal during the last ten or twelve years has ranged from four to eight times that of silver. It is very high at present (1885) in consequence of the constantly increasing demand for platinum utensils. (W. D.)

PLATO.

PLATO, the Athenian philosopher and father of idealism, was born 427 B.C., and lived to the age of eighty. His literary activity may be roughly said to have extended over the first half of the 4th century B.C. His father's name was Ariston, and his mother's family, which claimed descent from Solon, included Critias, one of the thirty tyrants, and other Athenian notables. That throughout his early manhood he was the devoted friend of Socrates, that in middle life he taught those who resorted to him in the grove named of Academus, near the Cephisus, and there founded the first great philosophical school, that (with alleged interruptions) he continued to preside over the Academy until his death, are matters of established fact. It is said by Aristotle that he was at one time intimate with Cratylus the Heraclitean. Beyond this we have no authentic record of his outward life. That his name was at first Aristocles, and was changed to Plato because of the breadth of his shoulders or of his style or of his forehead, that he wrestled well,[1] that he wrote poetry[2] which he burnt on hearing Socrates, that he fought in three great battles[3], that he had a thin voice, that (as is told of other Greek philosophers) he travelled to Cyrene and conversed with priests in Egypt, are statements of Diogenes Laertius, which rest on more or less uncertain tradition. The express assertion—which this author attributes to Hermodorus—that after the death of Socrates Plato and other Socratics took refuge with Euclides in Megara, has a somewhat stronger claim to authenticity. But the fact cannot be regarded as certain, still less the elaborate inferences which have been drawn from it. The romantic legend of Plato's journeys to Sicily, and of his relations there with the younger Dionysius and the princely but unfortunate Dion, had attained some degree of consistency before the age of Cicero, and at an unknown but probably early time were worked up into the so-called *Epistles* of Plato, now all but universally discredited. Nor is there sufficient ground for supposing, as some have done, that an authentic tradition is perceptible behind the myth. For the details of the story the reader is referred to Grote,[6] who believed in the genuineness of the *Epistles*.

It is more important than any further balancing of uncertainties to observe the intellectual tendencies of the preceding generation (*c.* 430–400 B.C.).

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[1] See *Laws*, vii. 814 c.

[2] Some epigrams in the *Anthology* are attributed to him.

[3] This is told on the authority of Aristoxenus. But Plato cannot have been at Delium.

[4] From Kamarsch and Heeren's *Technisches Würterbuch*.

[5] Equal to 7464 kilogrammes [16,420.8 ℔] per annum, which is 3.7 times the amount given above for 1870.

[6] *History of Greece*, c. lxxxiv., *Plato*, vol. i. c. iii.

Antecedent tendencies.

The later years of the Peloponnesian War witnessed much mental disturbance and restlessness at Athens. Thoughtful minds looked forward with apprehension and backwards with regret, while even the most thoughtless were stirred into superficial activity. More than at any time since the age of Clisthenes, the city was divided, and a man's foes were often men of his own tribe or deme. Athenian politics were more factious and less significant than ever. Contention in the law-courts and rivalries in the assembly had for many men a more absorbing interest than questions of peace and war. Hereditary traditions had relaxed their hold, and political principles were not yet formulated. Yet there was not less scope on this account for personal ambition, while the progress of democracy, the necessity of conciliating the people, and the apportionment of public offices by lot had a distracting and, to reflecting persons, often a discouraging effect. For those amongst whom Plato was brought up this effect was aggravated by the sequel of the oligarchical revolution, while, on the other hand, for some years after the restoration of the democracy, a new stimulus had been imparted, which, though of short duration, was universally felt.

The events and circumstances thus briefly summarized appear in two ways to have encouraged the diffusion of ideas. The ambitious seem to have welcomed them as a means of influence, while those who turned from public life were the more stimulated to speculative disputation. However this may have been, it is manifest that before the beginning of the fourth century B.C. the intellectual atmosphere was already charged with a new force, which although essentially one may be differently described, according to the mode of its development, as (1) rhetorical and (2) theoretical and "sophistical." This last word indicates the channel through which the current influences were mostly derived. A new want, in the shape both of interested and of disinterested curiosity, had insensibly created a new profession. Men of various fatherlands, some native Athenians, but more from other parts of Hellas, had set themselves to supplement the deficiencies of ordinary education, and to train men for the requirements of civic life. More or less consciously they based their teachings on the philosophical dogmas of an earlier time, when the speculations of Xenophanes, Heraclitus, or Parmenides had interested only a few "wise men." Those great thoughts were now to be expounded, so that "even cobblers might understand."[1] The self-appointed teachers found a rich field and abundant harvest among the wealthier youth, to the chagrin of the old-fashioned Athenian, who sighed with Aristophanes for the good old days when men knew less and listened to their elders and obeyed the customs of their fathers. And such distrust was not wholly unfounded. For, amidst much that was graceful and improving, these novel questionings had an influence that, besides being unsettling, was aimless and unreal. A later criticism may discern in them the two great tendencies of naturalism and humanism. But it may be doubted if the sophist was himself aware of the direction of his own thoughts. For, although Prodicus or Hippias could debate a thesis and moralize with effect, they do not appear to have been capable of speculative reasoning. What passed for such was often either verbal quibbling or the pushing to an extreme of some isolated abstract notion. That *prudens quæstio* which is *dimidium scientiæ* had not yet been put. And yet the hour for putting it concerning human life was fully come. For the sea on which men were drifting was profoundly troubled, and would not sink back into its former calm. Conservative reaction was not less hopeless than the dreams of theorists were mischievously wild. In random talk, with gay, irresponsible energy, the youth were debating problems which have exercised great minds in Europe through all after time.

Socrates.

Men's thoughts had begun to be thus disturbed and eager when Socrates arose. To understand him is the most necessary preliminary to the study of Plato. In our first authentic knowledge of him he is a man in mature life, attracting the attention of his fellow-citizens no less by his courage as a soldier than by his strange-familiar presence in the Athenian agora. Like the cicada of the trees by the Ilissus, his voice was never silent—except when checked by his divine monitor, or when wrapt, as he sometimes was for hours, in a catalepsy of reverie (see SOCRATES). When he appeared in the market-place about midday, ready to single out his man for questioning, he had already spent some hours in the wrestling-schools, conversing with the youth. This was not, as it appeared to his contemporaries, mere idleness or mental dissipation (ἀδολεσχία), but the exercise of his self-chosen profession. There is no reason to doubt the general truth of the assertion which Plato attributes to him in the *Apologia*. He felt a divine vocation to examine himself by questioning other men. Gifted with an iron frame, and having trained himself to have fewer wants than a soldier or a slave, he could devote all his time to this one object, without engaging in remunerative business, or setting hours apart for recreation, since he was indefatigable alike in body and mind. He was really doing for the Athenians, whether they would or no, what the sophist professed to do for his adherents, and what such men as Protagoras and Prodicus had actually done in part. One obvious difference was that he would take no fee. But there was another and more deep-lying difference, which distinguished him not only from the contemporary sophists but from the thinkers of the previous age. This was the Socratic attitude of inquiry.

The skeptical movement had confused men's notions as to the value of ethical ideas.[2] "If 'right' is one thing in Athens and another at Sparta, why strive to follow right rather than expediency? The laws put restraint on Nature, which is prior to them. Then why submit to law?" And the ingenuities of rhetoric had stirred much unmeaning disputation. Every case seemed capable of being argued in opposite ways. Even on the great question of the ultimate constitution of things, the conflicting theories of absolute immutability and eternal change appeared to be equally irrefragable and equally untenable.

Now Socrates first of all maintained imperturbably the simple habits of an ordinary Athenian citizen, observing scrupulously even minute religious customs, entering also unreservedly into the lightest pastimes of his associates, while the plain and strenuous tenor of his own peculiar life remained unaffected. But into all he carried the same irrepressible, insatiable spirit of search, to which nothing human was alien or uninteresting. Taking men and women as he found them, and conversing casually, as it appeared, on the topic which chanced to interest his hearer, he had not gone far before he had unmasked some vain pretence, cut folly to the quick, or raised some doubt of wide significance. And, though he often ended with negation, his negative achievements had a positive aim. For there underlay the process, even when most ironical, the conviction, not less profound because implicit, that in spite of false appearances, in spite of error, there are realities not undiscoverable, and whatsoever is real is good. His hearers had been confused by contradictory voices,—one crying "All is motion," another "All is rest"; one "The absolute is unattainable," another "The relative alone is real"; some upholding a vague sentiment of traditional right, while some declared for arbitrary convention and some for the "law of nature." Some held that virtue was spontaneous, some that it was due to training, and some paradoxically denied that either vice or falsehood had any meaning. The faith of Socrates, whether instinctive or inspired, remained untroubled by these jarring tones. He did not ask—"Is virtue a reality?" or "Is goodness a delusion?" But with perfect confidence that there was an answer, he asked himself and others "What is it?" (τί ἐστί); or, more particularly, as Xenophon testifies, "What is a state? What is a statesman? What is just? What is unjust? What is government? What is it to be a ruler of men?" In this form of question, however simple, the originality of Socrates is typified; and by means of it he laid the first stone, not only of the fabric of ethical philosophy, but of scientific method. The secret of his success lay in the combination of a deep sense of human ignorance with a confidence not less deep in the power of reason.

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[1] *Theæt.*, 180 D.

[2] See Caird, *Hegel*, p. 168.

The first result, and, as the Platonic Socrates declares, the only result he had obtained, was the consciousness of knowing nothing. But he who knows that he knows nothing is disposed to seek, and only those who seek will find. And the seeking mind attains, if not to knowledge, yet to a new standard of knowing. So long as results are contradictory, so long as negative instances are successfully applied, the searcher may make progress but is still to seek. For the aim of inquiry is the universal.

Human life and experience the sphere of search; truth and good, regarded as identical, the end of it; universality the test of reality, conversation the method, rational thought the means,—these are the chief notes of the dialectic of Socrates. Applying the native strength of his intelligence directly to the facts of life, he revealed their significance in countless ways, by unthought-of generalizations, by strange analogies, combining what men had not combined, distinguishing what they had not distinguished,—but always with the single aim of rousing them to the search after eternal truth and good.

The spirit which led on towards this unseen goal was not less practical than speculative. Socrates desired not only that men might know, but that they might know and do. Utility is the watchword no less of the Socratic than of the Baconian induction. But Socrates never doubted that if men once know they will also do. His own conscious conviction of the unity of truth and good he believed to be unconsciously the basis of all men's actions. They erred, he thought, from not seeing the good, and not because they would not follow it if seen. This is expressed in the Socratic *dicta*, "Vice is ignorance," "Virtue is knowledge." Men therefore must be brought to see the good and true, and that they may see it they must first be made aware that they do not see.

This lifelong work of Socrates, in which the germs of ethics, psychology, and logic were contained,—after it had been sealed by the death in which he characteristically at once obeyed his countrymen and convinced them of error,—was idealized, developed, dramatized—first embodied and then extended beyond its original scope—in the writings of Plato, which may be described as the literary outcome of the profound impression made by Socrates upon his greatest follower.

These writings (in pursuance of the importance given by Socrates to conversation) are all cast in the form of imaginary dialogue. But in those which are presumably the latest in order of composition this imaginative form interferes but little with the direct expression of the philosopher's own thoughts. The many-colored veil at first inseparable from the features is gradually worn thinner, and at last becomes almost imperceptible.

Little more will be attempted in the following pages than to give a general outline of these immortal works in the order which is on the whole most probable, omitting those whose claim to authenticity is weakest, and passing lightly over some which, although genuine, are less important than the rest, or have less to do with the main current of Plato's thought.

The dialogues.

The Platonic dialogues are not merely the embodiment of the mind of Socrates and of the reflections of Plato. They are the portraiture of the highest intellectual life of Hellas in the time of Plato,—a life but distantly related to military and political events, and scarcely interrupted by them. Athens appears as the centre of the excitable Hellenic mind, profoundly stirred by the arrival of great sophists,[1] and keenly alive to the questions of Socrates, although in the pages of Plato, even more than in reality, he only "whispers with a few striplings in a corner." For, in the Platonic grouping, the agora, which was the chief scene of action for the real Socrates, retires into the background, and he is principally seen consorting with his chosen companions, who are also friends of Plato, and with the acquaintances whom he makes through them. The scene is narrowed (for the Academy was remote from the bustle of resort, and Plato judged the Hellenic world securely from the vantage-ground of partial retirement)—but the figures are distinct and full of life. In reading the dialogues, we not only breathe the most refined intellectual atmosphere, but are also present witnesses of the urbanity, the freedom, the playfulness, the generous warmth of the "best society" in Athens. For Plato has a numerous repertory of *dramatis personæ*, who stand in various relations to his chief character—the impetuous Chærephon, Apollodorus the inseparable weak brother, old Crito the true-hearted, Phædo the beloved disciple, Simmias and Cebes, who have been with Philolaus, the graceful and ingenious Phædrus, the petulant Philebus, Theætetus of the philosophic nature, who is cut off in his prime, and the incorrigible Alcibiades; then Plato's own kinsmen—Glaucon the irrepressible in politics, in quarrel, and in love, Adimantus, solid and grave, Critias in his phase of amateur philosopher, and not as what he afterwards became, Charmides, not in fiery manhood, but in his first bloom of diffident youth; and many others who appear as mere acquaintances, but have an interest of their own—the accomplished Agathon, the gay Aristophanes, Eryximachus the all-worthy physician, Meno, light of spirit, Callias, entertainer of sophists, Callicles the wilful man of the world, Cephalus the aged father of Lysias, and Nicias the honored soldier. All these appear, not as some of them do on the page of history, in sanguinary contention or fierce rivalry, but as peaceful Athenians, in momentary contact with Socrates, whose electric touch now benumbs and now exhilarates, and sometimes goads to frenzy of love or anger. Still more distantly related to him, as it were standing in an outer circle, are the imposing forms of Gorgias and Protagoras, surrounded with the lesser lights of Hippias, Prodicus, and Polus. Thrasymachus, Euthydemus, Dionysodorus hang round like comic masks, adding piquancy to the design. The adversaries Anytus and Meletus are allowed to appear for a moment, but soon vanish. The older philosophers, though Socrates turned away from them, also make their entrance on the Platonic stage. Parmenides with his magnificent depth is made to converse with the imaginary Socrates, who is still quite young. A stranger from Elea plays an important part in some later dialogues, and Timæus the Pythagorean is introduced discoursing of the creation of the world. In these dialogues Socrates is mostly silent; in the *Philebus* he has lost himself in Plato; and in the twelve books of the *Laws*, where an unnamed Athenian is the chief speaker, even the Platonic Socrates finally disappears.

Now, in evolving his philosophy from the Socratic basis, Plato works along three main lines,—the ethical and political, the metaphysical or scientific, and the mystical. All three are often intimately blended, as in the close of *Rep.*, bk. vi., and even where one element is uppermost the others are not wholly suppressed. But this distinction, like that sometimes made in modern philosophy between the good, the true, and the beautiful, is one which, if not unduly pressed, may be usefully borne in mind. Having noted this once for all, we pass to the more detailed consideration of the several dialogues.

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[1] It had been part of the policy of Pericles to draw distinguished foreigners to Athens.

I. *Laches*, *Charmides*, *Lysis*.—In this first group Socrates is dealing tentatively with single ethical notions. The result in each case is a confession of ignorance, but the subject has been so handled as to point the way to more fruitful discussions in the future. And suggestions are casually thrown out which anticipate some of the most far-reaching of Plato's subsequent contemplations.

Laches.

The *Laches* is a vigorous sketch, in which the characters of the soldier, the aged citizen, and the prudent general are well preserved; and Socrates is seen conversing with his elders, although with reference to the treatment of the young. The question raised is the definition of courage; and the humor of the piece consists in showing that three men, all of whom are unquestionably brave, are unable to give an account of bravery, or to decide whether courage is an animal instinct or a mental accomplishment.

Charmides.

Similarly, in the dialogue which bears his name, the temperate Charmides, of whom all testify that (as Aristophanes has it[1]) he "fills up the gracious mould of modesty," is hopelessly embarrassed when challenged by the Socratic method to put in words his conception of the modesty or temperance which he possesses, and which, as Socrates assures him, is a priceless gift. The *Charmides* contains some hints of Platonic notions, such as that of knowledge as self-consciousness, and of virtue as "doing one's own business."

Lysis.

The graceful little dialogue which bears the name of *Lysis* ends, like the two former, with a confession of failure. Socrates, Lysis, and Menexenus are all friends, and think highly of friendship, yet after many efforts they are unable to tell "what friendship is." Yet some of the suggestions which are here laid aside are afterwards allowed to reappear. The notion that "what is neither good nor evil loves the good because of the presence of evil" is expanded and emphasized in the *Symposium*. And the conception of an ideal object of friendship, an *αὐτὸ φίλον* (though rejected as in the criticism of Aristotle by the characteristic *reductio ad infinitum*), is destined to have a wider scope in the history of Platonism.

II. *Protagoras*, *Io*, *Meno*.—The previous dialogues have marked the distinction between unconscious and conscious morality, and have also brought out the Socratic tendency to identify virtue with the knowledge of good. Now, the more strongly it is felt that knowledge is inseparable from virtue the more strange and doubtful appears such unconscious excellence as that of Laches, Charmides, or Lysis. Hence arises the further paradox of Socrates,—"Virtue is not taught, and that which is commonly regarded as virtue springs up spontaneously or is received unconsciously by a kind of inspiration."

Protagoras.

Protagoras, in the dialogue named after him, is the professor of popular, unscientific, self-complacent excellence; while Socrates appears in his life-long search after the ideal knowledge of the best. The two men are naturally at cross purposes. Protagoras contends that virtue is taught by himself and others more or less successfully, and is not one but many. Socrates disputes the possibility of teaching virtue (since all men equally profess it, and even statesmen fail to give it to their sons), but affirms that, if it can be taught, virtue is not many, but one. The discussion, as in the former dialogues, ends inconclusively. But in the course of it Plato vividly sets forth the natural opposition between the empiric and scientific points of view, between a conventional and an intellectual standard. He does full justice to the thesis of Protagoras, and it is not to be supposed that he was contented to remain in the attitude which he has here attributed to Socrates. In his ideal state, where the earlier training of the best citizens is a refinement on the actual Hellenic education, he has to some extent reconciled the conceptions which are here dramatically opposed.

The preparations for the encounter and the description of it include many life-like touches, such as the eagerness of the young Athenian gentleman to hear the sophist, though he would be ashamed to be thought a sophist himself; the confusion into which the house of Callias has been thrown by the crowd of strangers and by the self-importance of rival professors; the graceful dignity of the man who has been forty years a teacher, the graphic description of the whole scene, the characteristic speeches of Prodicus and Hippias (from which some critics have elicited a theory of their doctrines), and the continued irony with which Socrates bears them all in hand and soothes the great man after disconcerting him.

In the argument there are two points which chiefly deserve notice. (1) Protagoras, in accordance with his relative view of things (which Plato afterwards criticized in the *Theætetus*), claims not to give men principles but to improve them in those virtues which Providence has given in some measure to all civilized men. (2) Socrates in postulating a scientific principle, which he expressly reserves for future consideration, would have it tested by the power of calculating the amount of pleasure. Grote dwells with some complacency on the "utilitarianism" of Socrates in the *Protagoras*. And it is true that a principle of utility is here opposed to conventional sentiment. But this opposition is intended to prepare the way for the wider and deeper contrast between an arbitrary and a scientific standard or between impressions and conceptions or ideas. And when Plato (in the *Gorgias* and *Philebus*) endeavors to define the art of measurement, which is here anticipated, it is not wonderful that differences here unthought of should come into view, or that the pleasant should be again contradistinguished from the good. In all three dialogues he is equally asserting the supremacy of reason.

Inspiration.

On the first vision of that transcendental knowledge[2] which is to be the key at once to truth and good, philosophy is apt to lose her balance, and to look with scorn upon the "trivial round, the common task," and the respectable commonplaces of "ordinary thinking." Yet, as Socrates is reminded by Protagoras, this unconscious wisdom also has a value. And Plato, who, when most ideal, ever strives to keep touch with experience, is fully convinced of the reality of this lower truth, of this unphilosophic virtue. But he is long puzzled how to conceive of it. For, if knowledge is all in all, what are we to make of wisdom and goodness in those who do not know? Protagoras had boldly spoken of honor and right as a direct gift from Zeus, and Socrates, in the *Io* and *Meno*, is represented as adopting an hypothesis of inspiration in order to account for these unaccredited graces of the soul.

Io.

Socrates has observed that rhapsodists and even poets have no definite knowledge of the things which they so powerfully represent (comp. *Apol.*, 22; *Phæd.*, 245 A; *Rep.*, iii. 398 A). He brings the rhapsode Io to admit this, and to conclude that he is the inspired medium of a magnetic influence. The muse is the chief magnet, and the poet is the first of a series of magnetic rings. Then follow the rhapsode and the actor, who are rings of inferior power, and the last ring is the hearer or spectator.

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[1] *Nub.*, 995, τῆς αἰδοῦς μέλλεις τἄγαλμ' ἀναπλῆσαι.

[2] *Phæd.*, 82 B; *Rep.*, x. 619 C.

Meno.

The *Meno* raises again the more serious question, Can virtue be taught? Socrates here states explicitly the paradox with which the *Protagoras* ended. "Virtue is knowledge; therefore virtue can be taught. But virtue is not taught. Therefore (in the highest sense) there can be no virtue." And he repeats several of his former reasons, that Athenian statesmen failed to teach their sons, and that the education given by sophists is unsatisfying. (The sophists are here denounced by Anytus, who is angered by Socrates's ironical praise of them.) But the paradox is softened in two ways: (1) the absence of knowledge does not preclude inquiry, and (2), though virtue cannot be taught, yet there is a sense in which virtue exists.

1. Meno begins in gayety of heart to define virtue, but is soon "benumbed" by the "torpedo" shock of Socrates, and asks "How can one inquire about that which he does not know?" Socrates meets this "eristic" difficulty with the doctrine of reminiscence (ἀνάμνησις). All knowledge is latent in the mind from birth, and through kindred (or association) of ideas much may be recovered, if only a beginning is made. Pindar and other poets have said that the soul is immortal and that she has passed through many previous states.[1] And Socrates now gives a practical illustration of the truth that knowledge is evolved from ignorance. He elicits, from a Greek slave of Meno's, the demonstration of a geometrical theorem.[2] About the middle of the process he turns to Meno and observes that the slave (who has made a false start) is now becoming conscious of ignorance. He then gradually draws from the man, by leading questions, the positive proof.

2. Though virtue is not yet defined, it may be affirmed "hypothetically" that, if virtue is knowledge, virtue can be taught. And experience leads us to admit two phases of virtue—the one a mode of life based on scientific principle, which hitherto is an ideal only: the other sporadic, springing of itself, yet of divine origin, relying upon true opinion, which it is, however, unable to make fast through demonstration of the cause or reason. But, if there were a virtuous man who could teach virtue, he would stand amongst his fellows like Tiresias amongst the shades.[3]

This mystical account of ordinary morality is in keeping with the semi-mythical defence of the process of inquiry—that all knowledge is implicit in the mind from birth.

III. *Euthyphro*, *Apologia*, *Crito*, *Phædo*.—There is no ground for supposing that these four dialogues were written consecutively, or that they belong strictly to the same period of Plato's industry. But they are linked together for the reader by their common reference to the trial and death of Socrates; no one of them has been proved to be in the author's earliest or latest manner; and they may therefore fitly end the series of dialogues in which the personal traits of the historic Socrates are most apparent, and Plato's own peculiar doctrines are as yet but partially disclosed.

Euthyphro.

The little dialogue known by the name of *Euthyphro* might have been classed with the *Laches*, *Charmides* and *Lysis*, as dealing inconclusively with a single notion. But, although slight and tentative in form, it has an undertone of deeper significance, in keeping with the gravity of the occasion. Plato implies that Socrates had thought more deeply on the nature of piety than his accusers had, and also that his piety was of a higher mood than that of ordinary religious men.

Euthyphro is a soothsayer, well-disposed to Socrates, but not one of his particular friends. They meet at the door of the king archon, whither Socrates has been summoned for the "precognition" (ἀνάκρισις) preliminary to his trial. Both men are interested in cases of alleged impiety. For Euthyphro's business is to impeach his father, who has inadvertently caused the death of a criminal laborer. The prophet feels the duty of purging the stain of blood to be more imperative the nearer home. Socrates is struck by the strong opinion thus evinced respecting the nature of piety, and detains Euthyphro at the entrance of the court, that he may learn from so clear an authority "what piety is," and so be fortified against Meletus. He leads his respondent from point to point, until the doubt is raised whether God loves holiness because it is holy, or it is holy because loved by God. Does God will what is righteous, or is that righteous which is willed by God? Here they find themselves wandering round and round. Socrates proves himself an involuntary Dædalus who makes opinions move, while he seeks for one which he can "bind fast with reason."

"The holy is a portion of the just." But what portion? "Due service of the gods by prayer and sacrifice." But how does this affect the gods? "It pleases them." Again we are found to be reasoning in a circle.

> "Thus far has Socrates proceeded in placing religion on a moral foundation. He is seeking to realize the harmony of religion and morality, which the great poets Æschylus, Sophocles, and Pindar had unconsciously anticipated, and which is the universal want of all men. To this the soothsayer adds the ceremonial element, 'attending upon the gods.' When further interrogated by Socrates as to the nature of this 'attention to the gods,' he replies that piety is an affair of business, a science of giving and asking and the like. Socrates points out the anthropomorphism of these notions. But when we expect him to go on and show that the true service of the gods is the service of the spirit and co-operation with them in all things true and good, he stops short; this was a lesson which the soothsayer could not have been made to understand, and which every one must learn for himself."[4]

Apology.

In Plato's *Apology* the fate of Socrates is no longer the subject of mere allusions, such as the rage of Anytus at the end of the *Meno*, and the scene and occasion of the *Euthyphro*. He is now seen face to face with his accusers, and with his countrymen who are condemning him to death.

What most aggravated his danger (after life-long impunity) is thus stated by Mr. James Riddell, in the introduction to his edition of the dialogue: "The ἐπιείκεια" (clemency) "of the restored people did not last long, and was naturally succeeded by a sensitive and fanatical zeal for their revived political institutions. Inquiry into the foundations of civil society was obviously rather perilous for the inquirer at such a time. Socrates knew the full extent of his danger. But, according to Xenophon (*Mem.*, iv. c. 8, § 14), he prepared no defence, alleging that his whole life had been a preparation for that hour."

The tone of the Platonic *Apology* is in full accordance with that saying; but it is too elaborate a work of art to be taken literally as a report of what was actually said. Professor Jowett well compares it to "those speeches of Thucydides, in which he has embodied his conception of the lofty character and policy of the great Pericles." Yet "it is significant that Plato is said to have been present at the defence, as he is also said to have been absent at the last scene of the *Phædo*. Some of the topics may have been actually used by Socrates, and the recollection of his very words may have rung in the ears of his disciple."

The Platonic *Apology* is in three parts: (1) before conviction, (2) after conviction and before sentence, (3) after the sentence.

1. Socrates cares not for acquittal. But he does care to explain his life. And he selects those aspects of it which there is hope of making his audience understand. That he partly succeeded in this is shown by the large number of those (220 out of 500) who voted for his acquittal.

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[1] The origin of this traditional belief is very obscure. The Greeks themselves were apt to associate it with Pythagoras and with the "Orphic" mysteries.

[2] *Eucl.*, i. 47 (the case where the triangle is isosceles).

[3] Hom., *Odyss.*, x. 495, Οἴῳ πεπνῦσθαι, ταὶ δὲ σκιαὶ ἀΐσσουσιν.

[4] Jowett.

a. His answer to Meletus, as least important, is reserved for the middle of his speech. He addresses himself first to "other accusers,"—comic poets and the rest, who have prejudiced his reputation by falsely identifying him with the physical philosophers and the sophists. But what then is the strange pursuit which has given to Socrates the name of wise? It is the practice of cross-examining, to which he was first impelled by the oracle at Delphi, and which he has followed ever since as a religious mission. The god said "Socrates is wise," when he was conscious of no wisdom great or small. So he went in search of some one wiser than himself, but could find none, though he found many who had conceit of wisdom. And he inferred that the god must mean "He is wisest who, like Socrates, is most aware of his own ignorance." This unceasing quest has left him in great poverty, and has made him enemies, who are represented by Anytus, Meletus, and Lycon. And their enmity is further embittered by the pleasure which young men take in seeing pretence unmasked, and in imitating the process of refutation. Hence has arisen the false charge that Socrates is a corrupter of youth.

b. Here he turns to Meletus. "If I corrupt the youth, who does them good?" *Mel.* "The laws, the judges, the audience, the Athenians generally" (comp. *Protagoras* and *Meno*). "Strange, that here only should be one to corrupt and many to improve; or that any one should be so infatuated as to wish to have bad neighbors." *Mel.* "Socrates is an atheist. He believes the sun to be a stone." "You are accusing Anaxagoras. I have said that I know nothing of such theories. And you accuse me of introducing novel notions about divine things. How can I believe in divine things (δαιμόνια) and not in divine beings (δαίμονες)? and how in divine beings, if not in gods who are their authors?"

c. That is a sufficient answer for his present accuser. He returns to the general long-standing defamation, which may well be his death, as slander has often been and again will be the death of many a man.

Yet if spared he will continue the same course of life, in spite of the danger. As at Potidæa and Delium he faced death where the Athenians posted him, so now he will remain at the post where he is stationed by the god. For to fear death is to assume pretended knowledge.

One thing is certain. A worse man can not harm a better. But if the Athenians kill Socrates, they will harm themselves. For they will lose the stimulus of his exhortations; and his poverty is a sufficient witness that he was sincere. Not that he would engage in politics. If he had done that he would have perished long before,[1] as he nearly did for his independent vote after the battle of Arginusæ, and for disobeying the murderous command of the thirty tyrants.

But have not Socrates's disciples, Alcibiades, Critias, Charmides, proved bad citizens? He has no disciples. Any one, bad or good, may come and hear him, and the talk which is his life-work is not unamusing. But why are no witnesses brought to substantiate this charge? There are elder friends of his companions who would be angry if he had used his influence for harm. But these men's confidence in Socrates is unshaken.

He will not appeal *ad misericordiam*. That would be a disgrace for one who (rightly or not) has been reputed wise, and to admit such an appeal in any case is a violation of the juror's oath.

Socrates has told the Athenians the whole truth, so far as a mixed audience of them could receive it. Elaboration and subtlety could have no place in addressing the Heliastic court, nor could that universal truth towards which he was leading men be made intelligible to a new audience while the clepsydra was running. But his tone and attitude must have made a strong appeal to the better nature of his hearers. With Meletus he "played rather than fought," but he has shown clearly that he has no fear of death, that he chooses to obey God rather than man, and that for very love of the Athenians he will not be swayed by their desires.

2. One convicted on a capital charge had the right of pleading before sentence in mitigation of the penalty proposed by his accuser. Socrates was convicted by fewer votes than he himself anticipated. The indictment of Meletus was ineffectual, and if it had not been for the speeches of Anytus and Lycon the defendant would have been triumphantly acquitted. Could he but have conversed with his judges more than once, he might have removed their prejudices. In no spirit of bravado, therefore, but in simple justice to himself, he meets the claim of Meletus that he shall be punished with death by the counter claim that he shall be maintained in the prytaneum as a public benefactor. He can not ask that death, which may be a good, shall be commuted for imprisonment or exile, which are certainly evils. A fine would be no evil; but he has no money; he can offer a mina. Here Plato and others interpose, and with their friendly help he offers thirty minæ.

3. He is sentenced to death, and the public business of the court is ended. But while the record is being entered and the magistrates are thus occupied, Socrates is imagined as addressing (*a*) the majority and (*b*) the minority in the court.

a. To those who have condemned him he speaks in a prophetic tone. "For the sake of depriving an old man of the last dregs of life, they have given Athens a bad name. He would not run away, and so death has overtaken him. But his accusers are overtaken by unrighteousness, and must reap the fruits of it.

"Nor will the Athenians find the desired relief. Other reprovers, whom Socrates has hitherto restrained, will now arise, not in a friendly but in a hostile spirit. The only way for the citizens to escape reproof is to reform their lives."

b. To the minority, who would have acquitted him, he speaks with gentle solemnity. "Let them know to their comfort that the divine voice has not once checked him throughout that day. This indicates that death is not an evil. And reason shows that death is either a long untroubled sleep, or removal to a better world, where are no unjust judges.

"No evil can happen to a good man either in life or after death. Wherefore Socrates will not be angry with his condemners, who have done him no harm, although they meant him anything but good. He will only ask of them to do to the sons of Socrates as Socrates has done to them."

Crito.

Is the love of truth consistent with civic duties? Is the philosopher a good citizen? are questions which are sure to arise where the truth involves practical improvement. In the *Apology* Socrates appears as an intrepid reformer; the *Crito* gives an impressive picture of him as a loyal and law-abiding Athenian.

Execution had been delayed during the annual mission to Delos (during which no one could be put to death). But the returning vessel had just been reported as descried from Sunium. At early dawn Crito, the oldest friend of Socrates, obtained access to his cell, and found him sleeping peacefully. Presently he awoke, and Crito told him of the approach of the fatal ship. Socrates replies by telling his dream.—A fair form stood over him and said,

> "The third day hence to Phthia shalt thou come."

And it would seem that the day after to-morrow will really be the day for going home.

Crito then reveals his plan for an escape. And Socrates argues the question in the old familiar way. "Crito's zeal is excellent, and most men would think his object right. But the few who think soundly say that it is wrong to return evil for evil. The laws of Athens (through the fault of men) are doing Socrates harm. But ought he therefore to infringe the law? Might not the laws of his country plead with him and say: 'You owe to us your birth and breeding; and when grown up you voluntarily submitted to us. For you might have gone elsewhere. But you preferred us to all other laws, and have been the most constant resident in Athens. Even at the last you accepted death rather than exile. If you now break your covenant, you will ruin your friends and will be rejected by all well-ordered cities. You might be received in Thessaly, but could only live there by cringing to foreigners for food. Where in that case will be your talk about virtue? You would not take your sons thither. And your friends would be equally kind to them if you were dead.'

"Think not of life and children first and of justice afterwards, but think of justice first, that you may be justified in the world below." Crito admits these arguments to be unanswerable.

Phædo.

The *Meno* referred to the immortality and pre-existence of the soul as a traditional doctrine, and it was there associated with the possibility of inquiry. In the *Phædo* Plato undertakes to substantiate this belief and base it anew, by narrating the last hours of Socrates, who is represented as calmly discussing the question with his friends when his own death was immediately at hand. The argument turns chiefly on the eternity of knowledge, and is far from satisfying. For, granting that eternity of knowledge involves eternity of mind, does the eternity of mind assure continued being to the individual?[1] Yet no unprejudiced reader of the *Phædo* can doubt that Plato, at the time of writing it, sincerely believed in a conscious personal existence after death. The words of Socrates, when he declares his hope of going to be with other friends, are absolutely unambiguous, and his reply to Crito's question, "How shall we bury you?" has a convincing force beyond all dialectic: "I cannot persuade Crito that I here am Socrates—I who am now reasoning and ordering discourse. He imagines Socrates to be that other, whom he will see by and by, a corpse." This and similar touches not only stamp the *Phædo* as a marvel of art, but are indisputable evidences of the writer's profound belief. They may be inventions, but they have nothing "mythical" about them, any more than the charge of Socrates to his friends, that they would best fulfil his wishes by attending to their own lives.

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[1] Comp. *Gorg.*, 521; *Rep.*, vi. 496.

The narrative, to be appreciated, must be read in full. But a short abstract of the argument may be given here.

1. Death is merely the separation of soul and body. And this is the very consummation at which philosophy aims. The body hinders thought. The mind attains to truth by retiring into herself. Through no bodily sense does she perceive justice, beauty, goodness, and other ideas. The philosopher has a life-long quarrel with bodily desires, and he should welcome the release of his soul. Thus he alone can have true courage, even as temperance and all the virtues are real in him alone.

But does the soul exist after death?

a. An old tradition tells of many successive births, the soul departing to Hades and returning again, so that the living are born from the dead. And if the dead had no existence, this could not be, since from nothing nothing can arise. Moreover, experience shows that opposite states come from their opposites, and that such a process is always reciprocal. Death certainly succeeds to life. Then life must succeed to death. And that which undergoes these changes must exist through all. If the dead came from the living, and not the living from the dead, the universe would ultimately be consumed in death.

This presumption is confirmed by the doctrine (here attributed to Socrates, comp. *Meno*) that knowledge comes through recollection. What is recollected must be previously known. Now we have never since birth had intuition of the absolute equality of which (through association) we are reminded by the sight of things approximately equal. And we cannot have seen it at the moment of birth, for at what other moment can we have forgotten it? Therefore, if ideals be not vain, our souls must have existed before birth, and according to the doctrine of opposites above stated, will have continued existence after death.

b. To charm away the fears of the "child within," Socrates adds, as further considerations:

(1) The soul is uncompounded, incorporeal, invisible, and therefore indissoluble and immutable.

(2) The soul commands, the body serves; therefore the soul is akin to the divine.

(3) Yet even the body holds together long after death, and the bones are all but indestructible.

The soul, if pure, departs to the invisible world, but, if tainted by communion with the body, she lingers hovering near the earth, and is afterwards born into the likeness of some lower form. That which true philosophy has purified alone rises ultimately to the gods. This lesson is impressively applied.

2. A pause ensues; and Simmias and Cebes are invited to express their doubts. For, as the swan dies singing, Socrates would die discoursing.

a. Simmias desires not to rest short of demonstration, though he is willing to make the highest attainable probability the guide of life.

If the soul is the harmony of the body, what becomes of her "when the lute is broken"?

b. Cebes compares the body to a garment which the soul keeps weaving at. The garment in which the weaver dies outlasts him. So the soul may have woven and worn many bodies in one lifetime, yet may perish and leave a body behind. Or even supposing her to have many lives, does even this hypothesis exempt her from ultimate decay?

Socrates warns his friends against losing faith in inquiry. Theories, like men, are disappointing; yet we should be neither misanthropists nor misologists. Then he answers his two friends.

(*a*) (1) The soul is acknowledged to be prior to the body. But no harmony is prior to the elements which are harmonized.

(2) The soul has virtue and vice, *i.e.*, harmony and discord. Is there harmony of harmony? Comp. *Rep.*, x. 609.

(3) All soul is equally soul, but all harmony is not equally harmonious.

(4) If the soul were the harmony of the body, they would be agreed; but, as has been already shown, they are perpetually quarrelling.

(5) The soul is not conditioned by the bodily elements, but has the power of controlling them.

(*b*) Cebes has raised the wide question whether the soul is independent of generation and corruption. Socrates owns that he himself (*i.e.*, Plato?) had once been fascinated by natural philosophy, and had sought to give a physical account of everything. Then hearing out of Anaxagoras that mind was the disposer of all, he had hoped to learn not only how things were, but also why. But he found Anaxagoras forsaking his own first principle and jumbling causes with conditions. ("The cause why Socrates sits here is not a certain disposition of joints and sinews, but that he has thought best to undergo his sentence,—else the joints and sinews would have been ere this, by Crito's advice, on the way to Thessaly.") Physical science never thinks of a power which orders everything for good, but expects to find another Atlas to sustain the world more strong and lasting than the reason of the best.

Socrates had turned from such philosophers and found for himself a way, not to gaze directly on the universal reason, but to seek an image of it in the world of mind, wherein are reflected the ideas, as, for example, the idea of beauty, through partaking of which beautiful things are beautiful. Assuming the existence of the ideas, he felt his way from hypothesis to hypothesis.

Now the participation of objects in ideas is in some cases essential and inseparable. Snow is essentially cold, fire hot, three odd, two even. And things thus essentially opposite are exclusive of each other's attributes. (When it was said above that opposites come from opposites, not opposite things were meant, but opposite states or conditions of one thing.) Snow cannot admit heat, nor fire cold; for they are inseparable vehicles of heat and cold respectively. The soul is the inseparable vehicle of life, and therefore, by parity of reasoning, the soul cannot admit of death, but is immortal and imperishable.

3. What follows is in the true sense *mythological*, and is admitted by Socrates to be uncertain.—"Howbeit, since the soul is proved to be immortal, men ought to charm their spirits with such tales."—

The earth, a globe self-balanced in the midst of space, has many mansions for the soul,[2] some higher and brighter, some lower and darker than our present habitation. We who dwell about the Mediterranean Sea are like frogs at the bottom of a pool. In some higher place, under the true heaven, our souls may dwell hereafter, and see not only colors and forms in their ideal purity but truth and justice as they are.

In the *Phædo*, more than elsewhere, Plato preaches withdrawal from the world. The Delian solemnity is to Socrates and his friends a period of "retreat," in which their eyes are turned from earthly things to dwell on the eternal. The theory of ideas here assumes its most transcendental aspect, and it is from portions of this dialogue and of the *Phædrus* and *Timæus* that the popular conception of Platonism has been principally derived. But to understand Plato rightly it is not enough to study isolated passages which happen to charm the imagination; nor should single expressions be interpreted without regard to the manner in which he presents the truth elsewhere.

It has already been shown (1) that Socratic inquiry implied a standard of truth and good, undiscovered but endlessly discoverable, and to be approached inductively; and (2) that in Plato this implicit assumption becomes explicit, in the identification of virtue with knowledge (*Lach.*, *Charm.*) as an art of measurement (*Protag.*), and in the vision (towards the end of the *Lysis*) of an absolute object of desire. The Socratic "self-knowledge" has been developed (*Charm.*) into a science of mind or consciousness, apart from which no physical studies can be fruitful. (3) Co-ordinate with these theoretical tendencies there has appeared in Plato the determination not to break with experience. —The bearing of these remarks on the further progress of Plato's thoughts will appear in the sequel. Meanwhile, in the *Phædo*, a long step is made in the direction of pure idealism. The ordinary virtue, which in the *Protagoras* and *Meno* was questioned but not condemned, is here rejected as unreal, and the task proposed to the philosopher is less to understand the world than to escape from it. The universal has assumed the form of the ideal, which is supposed, as elsewhere in Plato, to include mathematical as well as moral notions. The only function of perception is to awaken in us some reminiscence of this ideal. By following the clue thus given, and by searching for clearer images of truth in the world of mind, we may hope to be emancipated from sensation, and to lay hold upon the sole object of pure reason.

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[1] In the *Timæus* immortality is made to rest on the goodwill of God, because "only an evil being would wish to dissolve that which is harmonious and happy" (*Tim.*, 41 A).

[2] Comp. Milton, *Il Penseroso*, 88-92—

"To unsphere
The spirit of Plato, to unfold
What worlds or what vast regions hold
The immortal mind that hath forsook
Her mansion in this fleshly nook."

It is obvious that when he wrote the *Phædo* Plato conceived of universals as objective entities rather than as forms of thought. The notion of "ideal colors" (though occurring in the myth) is an indication of his ontological mood.

Yet even here the *εἴδη* are not consistently hypostatized. The notion of "what is best" has a distinctly practical side, and the "knowledge through reminiscence" is in one aspect a process of reflection on experience, turning on the laws of association.[1] It is also said that objects "partake" of the ideas, and some concrete natures are regarded as embodiments or vehicles of some of them. Still, if taken as a whole, notwithstanding the scientific attitude of Socrates, the *Phædo* is rather a meditation than an inquiry—a study of the soul as self-existent, and of the mind and truth as co-eternal.

IV. *Symposium*, *Phædrus*, *Cratylus.*—Socrates is again imagined as in the fullness of life. But the real Socrates is becoming more and more inextricably blended with Platonic thought and fancy. In the *Apology* there is a distinct echo of the voice of Socrates; the *Phædo* gives many personal traits of him; but the dialogues which are now to follow are replete with original invention, based in part, no doubt, on personal recollections.

Symposium.

The *Symposium* admits both of comparison and of contrast with the *Phædo*. Both dialogues are mystical, both are spiritual, but the spirituality in either is of a different order. That is here immanent which was there transcendent; the beautiful takes the place of the good. The world is not now to be annihilated, but rather transfigured, until particular objects are lost in universal light. Instead of flying from the region of growth and decay, the mind, through intercourse with beauty, is now the active cause of production. Yet the life of contemplation is still the highest life, and philosophy the truest *μουσική*.

The leading conception of the *Symposium* has been anticipated in the *Lysis*, where it was said that "the indifferent loves the good, because of the presence of evil."

The banqueters (including Socrates), who are met to celebrate the tragic victory of Agathon, happen not to be disposed for hard drinking. They send away the flute-girl and entertain each other with the praise of Love.

Phædrus tells how Love inspires to honorable deeds, and how Alcestis and Achilles died for Love.

Pausanias rhetorically distinguishes the earthly from the heavenly Love.

The physician Eryximachus, admitting the distinction, yet holds that Love pervades all nature, and that art consists in following the higher Love in each particular sphere. So Empedocles had spoken of Love as overcoming previous discord. For opposites cannot, as Heraclitus fancied, coexist.

Aristophanes, in a comic myth, describes the origin of Love as an imperfect creature's longing for completion. The original double human beings were growing impious, and Zeus split them in twain, ever since which act the bereaved halves wander in search of one another.

Agathon speaks, or rather sings, of Love and his works. He is the youngest, not the eldest of gods, living and moving delicately wherever bloom is and in the hearts of men—the author of all virtue and of all good works, obeyed by gods, fair and causing all things fair, making men to be of one mind at feasts—pilot, defender, saviour, in whose footsteps all should follow, chanting strains of love.

Socrates will not attempt to rival the poet, and begins by stipulating that he may tell the truth. He accepts the distinction between Love and his works, but points out that, since desire implies want, and the desire of Love is toward beauty, Love, as wanting beauty, is not beautiful. So much being established in the Socratic manner, he proceeds to unfold the mystery once revealed to him by Diotima, the Mantinean wise woman.

Love is neither beautiful nor ugly, neither wise nor foolish, neither god nor mortal. Between gods and mortals is the world of mediating spirits (*τὸ δαιμόνιον*). And Love is a great spirit, child of Resource (the son of Prudence) and Poverty the beggar maid, who conceived him at the birthday feast of Aphrodite. He is far from living "delicately," but is ragged and shoeless, always in difficulties, yet always brimming with invention, a mighty hunter after wisdom and all things fair; sometimes "all full with feasting" on them, the next moment "clean starved" for lack; never absolutely knowing nor quite ignorant. That is to say, he is a "philosopher." For knowledge is the most beautiful thing, and love is of the beautiful.

But what does love desire of the beautiful? The possession is enough. But there is one kind of love—called "being in love"—which desires beauty for a peculiar end. The lover is seeking, not his "other half," but possession of the beautiful and *birth in beauty*.

For there is a season of puberty both in body and mind, when human nature longs to create, and it cannot save in presence of beauty. This yearning is the earnest of immortality. Even in the bird's devotion to its mate and to its young there is a craving after continued being. In individual lives there is a flux, not only of the body, but in the mind. Nay, the sciences themselves also come and go (here the contrast to the *Phædo* is at its height). But in mortal things the shadow of continuity is succession.

The love of fame is a somewhat brighter image of immortality than the love of offspring. Creative souls would bring into being not children of their body, but good deeds. And such a one is readiest to fall in love with a fair mind in a fair body, and then is filled with enthusiasm and begets noble thoughts. Homer, Hesiod, Lycurgus, Solon, were such genial minds. But they stopped at the threshold (comp. *Prot.*, *Meno*), and saw not the higher mysteries, which are reserved for those who rise from noble actions, institutions, laws, to universal beauty. The true order is to advance from one to all fair forms then to fair practices, fair thoughts, and lastly to the single thought of absolute beauty. In that communion only, beholding beauty with the eye of the mind, one shall bring forth realities and become the friend of God and be immortal, if mortal man may.

Alcibiades here breaks in and is vociferously welcomed. He is crowning Agathon, when, on perceiving Socrates, he declares that he will crown him too. Then he announces himself king of the feast, and insists upon hard drinking (though this will make no difference to Socrates).

Eryximachus demands from the newcomer a speech in praise of love. But Alcibiades will praise no one else when Socrates is near. And with the freedom of one who is deep in wine he proceeds with his strange encomium of "this Marsyas."

"In face and outward bearing he is like a Satyr or Silenus, and by his voice he charms more powerfully than they do by their pipings. The eloquence of Pericles has no effect in comparison with his. His words alone move Alcibiades to shame, and fascinate him until he stops his ears and runs from him."—"I often wish him dead. Yet that would break my heart. He brings me to my wit's end."—"And, as carved Sileni are made to encase images of gods, so this Silenus-mask entreasures things divine. He affects ignorance and susceptibility to beauty. Thus he mocks mankind. But he cares nothing for outward shows, and his temperance (*σωφροσύνη*) is wonderful."

To prove this Alcibiades reveals his own heart-secret. (He is not ashamed to speak it amongst others who have felt the pang which Socrates inflicts.) And he makes it abundantly manifest that in their widely-rumored intercourse (comp. *Protag.* init.) Socrates had never cared for anything but what was best for his younger friend. Alcibiades then relates as an eyewitness the endurance shown by Socrates at Potidæa, his strange persistence in solitary meditation,—standing absorbed in thought for a day and a night together,—and his intrepid conduct in the retreat from Delium (comp. *Laches*). "The talk of Socrates is of pack-asses and cobblers, and he is ever saying the same things in the same words; but one who lifts the mask and looks within will find that no other words have meaning." Alcibiades ends by warning his companions against the wiles of Socrates.

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[1] Comp. *Theæt.*, 184-186.

Some raillery follows, and they are invaded by another band of revellers, who compel them to drink still more deeply. The soberly inclined (led by Eryximachus) slink off, and Aristodemus, the reporter of the scene, only remembers further that when he awoke at cock-crow Socrates was still conversing with Agathon and Aristophanes, and showing them that tragedy and comedy were essentially one. He talked them both asleep, and at daybreak went about his usual business.

The philosopher of the *Symposium* is in the world and yet not of it, apparently yielding but really overcoming. In the *Phædo* the soul was exhorted to "live upon her servant's loss," as in Shakspeare's most religious sonnet; this dialogue tells of a "soul within sense" in the spirit of some more recent poetry. By force of imagination rather than of reason, the reconciliation of becoming (*γένεσις*) with being (*οὐσία*), of the temporal with the eternal, is anticipated. But through the bright haze of fancy and behind the mask of irony, Socrates still appears the same strong, pure, upright, and beneficent human being as in the *Apology*, *Crito*, and *Phædo*.

Phædrus.

The impassioned contemplation of the beautiful is again imagined as the beginning of philosophy. But the "limitless ocean of beauty" is replaced by a world of supramundane forms, beheld by unembodied souls, and remembered here on earth through enthusiasm, proceeding by dialectic from multiform impressions to one rational conception, and distinguishing the "lines and veins" of truth. The *Phædrus* records Plato's highest "hour of insight," when he willed the various tasks hereafter to be fulfilled. In it he soars to a pitch of contemplation from whence he takes a comprehensive and keen-eyed survey of the country to be explored, marking off the blind alleys and paths that lead astray, laying down the main lines and chief branches, and taking note of the erroneous wanderings of others. Reversing the vulgar adage, he flies that he may creep.

The transcendent aspiration of the *Phædo* and the mystic glow of the *Symposium* are here combined with the notion of a scientific process. No longer asking, as in the *Protagoras*, Is virtue one or many? Plato rises to the conception of a scientific one and many, to be contemplated through dialectic,—no barren abstraction, but a method of classification according to nature.

This method is to be applied especially to psychology, not merely with a speculative, but also with a practical aim. For the "birth in beauty" of the *Symposium* is here developed into an art of education, of which the true rhetoric is but the means, and true statesmanship an accidental outcome.

Like all imaginative critics, Plato falls to some extent under the influence of that which he criticises. The art of rhetoric which he so often travestied had a lasting effect upon his style. Readers of his latest works are often reminded of the mock grandiloquence of the *Phædrus*. But in this dialogue the poetical side of his genius is at the height. Not only can he express or imitate anything, and produce any effect at will, but he is standing behind his creation and disposing it with the most perfect mastery, preserving unity amidst profuse variety, and giving harmony to a wildness bordering on the grotesque.

The person of Socrates is here deliberately modified. He no longer (as in the *Symposium*) teaches positive wisdom under the pretence of repeating what he has heard, but is himself caught by an exceptional inspiration, which is accounted for by the unusual circumstance of his finding himself in the country and alone with Phædrus. He has been hitherto a stranger to the woods and fields, which would tempt him away from studying himself through intercourse with men. But by the promise of discourse—especially of talk with Phædrus—he may be drawn anywhither.

Phædrus has been charmed by a discourse of Lysias, which after some coy excuses he consents to read.

It is a frigid erotic diatribe, in which one not in love pleads for preference over the lover. Socrates hints at criticism, and is challeged to produce something better on the same theme.

1. Distinguishing desire from true opinion, he defines love as desire prevailing against truth, and then expatiates on the harmful tendencies of love as so defined. But he becomes alarmed at his own unwonted eloquence, and is about to remove, when the "divine token" warns him that he must first recite a "palinode" in praise of love. For no divine power can be the cause of evil.

2. Love is madness; but there is a noble madness, as is shown by soothsayers (called *μάντεις* from *μαίνομαι*). And of the higher madness there are four kinds.

To explain this it is necessary to understand psychology. The soul is self-existent and self-moving, and therefore eternal. And her form is like a pair of winged steeds with their charioteer. In divine souls both steeds are good, but in human souls one of them is bad. Now before entering the body the soul lost her wings, which in her unembodied state were nourished by beauty, wisdom, goodness, and all that is divine. For at the festival of souls, in which they visit the heaven that is above the heavens, the unruly steed caused the charioteer to see imperfectly. So the soul cast her feathers and fell down and passed into the human form. And, according to the comparative clearness or dimness of that first vision, her earthly lot is varied from that of a philosopher or artist down through nine grades (including woman) to that of a tyrant. On her conduct in this state of probation depends her condition when again born into the world. And only in ten thousand years can she return to her pristine state, except through a life of philosophy (comp. *Phædo*) or of pure and noble love (comp. *Symposium*).

The mind of the philosopher alone has wings. He is ever being initiated into perfect mysteries, and his soul alone becomes complete. But the vulgar deem him mad and rebuke him; they do not see that he is inspired.

This divine madness (the fourth kind of those above mentioned) is kindled through the renewed vision of beauty. For wisdom is not seen; her loveliness would have been transporting if she had a visible form. The struggle of the higher passion with the lower is then described with extraordinary vividness, under the image of the two steeds. When the higher impulse triumphs, the issue is a philosophic friendship, at once passionate and absolutely pure.

3. From his "palinode" Socrates returns to Lysias, who is advised to leave speech-writing for philosophy.

a. Phædrus remarks that the speech-writer is despised by the politician. Socrates replies that speech-writing and politics are one concern. The real difference is between those who base their teaching on philosophy and those who are content with rules of art. For example, if the first speech of Socrates is compared with that of Lysias, the one is found to distinguish and define, the other not; the one observes order in discourse, the other "begins where he should end," and his utterance is like a disordered chain. A speech should be an organic whole, a "creature having hands and feet." So in the "palinode" there was a classification of the kinds of madness, which led the way to "a possibly true though partly erring myth."

This approximation to truth in the midst of much that was playful was due to the observance of two principles, generalization and division (*συναγωγή*, *διαίρεσις*). Whoever sees the one and many in nature, him Socrates follows and walks in his footsteps, as if he were a god.

In comparison of dialectic, as thus conceived, the frigid rules of Lysias, Thrasymachus, Theodorus, Evenus, Tisias, Gorgias, Polus, and Protagoras are futile and absurd.

b. Another condition of teaching (or true rhetoric) is the science of mind. Whether the soul be one or many, complex or multiform, and if multiform what are its parts and kinds, are questions which the teacher must have already solved. And he must likewise have classified all arguments and know them in their various applicability to divers souls. An art of speaking that should fulfil this condition is non-existent. Yet how can even verisimilitude be attained without knowledge of truth?

c. The art of writing is kindred to the art of speech. But Socrates maintains that oral teaching through the living contact of mind with mind has many advantages over written composition, which is, comparatively speaking, a dead thing. Men may write for amusement or to record the intercourse that has been. But the serious occupation of the true thinker and teacher is the communication of truth through vital converse with others like-minded,—the creation of "thoughts that breathe" in spirits conscious of their value.

In conclusion, a friendly hint is given to Isocrates that he may do better than Lysias if he will but turn his attention to philosophy.

The *Phædrus* anticipates much that Plato afterwards slowly elaborated, and retains some things which he at last eliminated. (1) The presence of movement or impulse in the highest region is an aspect of truth which reappears in the *Sophistes* and other later dialogues. It has been thought strange that it should be found so early as in the *Phædrus*. But does not this remark imply an unwarrantable assumption, viz., that Plato's idealism took its departure from the being of Parmenides? Is it not rather the fact that his own theory was formulated before the Megarian ascendency led him to examine the Eleatic doctrine, and that it was by a tendency from the first inherent in Platonism that that doctrine was modified in his final teaching? (2) The outlines of method which are thrown out at white heat in the *Phædrus* are a preparation for the more sober treatment of the ideas in the dialectical dialogues. In these, however, the conception of classification is somewhat altered through contact with Eleaticism. (3) The *Phædrus* aims, not merely at realizing universals, but at grasping them in and through particulars. This is an ideal of knowledge which was "lost as soon as seen," but one which in some of his latest dialogues, such as the *Politicus* and *Philebus*, Plato again endeavors to work out. (4) The *Phædrus* contains the elements of that true psychology into which the ontological theory of the ideas is gradually transmuted in Plato's more advanced writings, when the difficulties of his ideal doctrine in its cruder forms have been clearly felt and understood. (5) Plato here appears as a professor of education, preferring oral intercourse to authorship. In this paradox he at once exalts the work of Socrates and avows his own vocation as a teacher. The passage throws an interesting light upon the form of dialogue in which his works are cast. But it is not to be supposed that he remained long unconscious of the influence he was destined to wield by writing. In undertaking a great task like the *Republic*, he practically receded from the untenable view asserted here; and in the *Laws* he recommends his longest and most prosaic work as a suitable basis for the education of the future. (6) It must always appear strange, even to those most familiar with the conditions of Hellenic life, that in portraying the idealizing power of passionate love Plato should have taken his departure from unnatural feeling.

On this subject he has sung his own "palinode" in the *Laws*, which he intended as his final legacy to mankind.[1] Not that he ceased to exalt genius and originality above mere talent, or to demand for philosophy the service of the heart as well as the head, nor yet that friendship was less valued by him in later years. All this remained unchanged. And in the *Republic* the passion of love is still distantly referred to as the symbol of ideal aspiration. But a time came when he had learned to frown on the aberration of feeling which in the *Symposium* and *Phædrus* he appears to regard as the legitimate stimulus of intellectual enthusiasm. And already in the *Theætetus* not love but wonder is described as the only beginning of philosophy.

While calling attention to this change of sentiment, it is right to add that Platonic love in the "erotic" dialogues of Plato is very different from what has often been so named, and that nothing even in the noble passage of the *Laws* above referred to casts the slightest shadow of blame on the Socrates of the *Symposium*.

Such changes are, amongst other things, a ground for caution in comparing the two steeds of the *Phædrus* with the spirit (θυμός) and desire (ἐπιθυμία) of the *Republic* and *Timæus*. The *Phædrus*, in common with these dialogues, asserts the existence of higher and lower impulses in human nature, but there is no sufficient ground for supposing that when Plato wrote the *Phædrus* he would have defined them precisely as they are defined in the *Republic*.

Cratylus.

The *Cratylus* is full of curious interest as marking the highest point reached by the "science of language" in antiquity; but, as this dialogue "hardly derives any light from Plato's other writings,"[2] so neither does it reflect much light on them. It deals slightly with the contrast between Heracliteanism and Eleaticism, the importance of dialectic, the difficulty about the existence of falsehood, and ends with a brief allusion to the doctrine of ideas,—but these topics are all more fully discussed elsewhere.

Three persons maintain different views respecting the nature and origin of language.

Hermogenes affirms that language is conventional, Cratylus (the Heraclitean) that it is natural. Socrates, mediating between these sophistical extremes, declares that language, like other institutions, is national, and therefore (1) is based on nature, but (2) modified by convention.

In his dialectical treatment of the subject, Socrates displays a tissue of wild etymologies in reliance on the "inspiration" of Euthyphro. Presently a distinction appears between primary and secondary words. Many primary words convey the notion of movement and change. It follows that the legislator or word-maker held Heraclitean views. Socrates thus far presses on Hermogenes the view of Cratylus. Then turning to Cratylus he asks if there are no false names. "False language," Cratylus argues, "is impossible." Socrates shows that a true image may be inadequate, so that we have a right to criticize the work of the word-maker. And the facts indicate an element of meaningless convention. Nor was the original word-maker consistently Heraclitean. For some important words point not to motion but to rest.

But the question returns—Are we sure that the theory of nature which the word-maker held was true? This difficulty cannot be touched by verbal arguments. In seeking to resolve it we must consider, not words, but things. If there is a true beauty and a true good, which are immutable, and if these are accessible to knowledge, that world of truth can have nothing to do with flux and change.

V. *Gorgias*, *Republic.*—In the *Symposium* and *Phædrus* Plato largely redeems the promise implied in the *Phædo*, where Socrates tells his friends to look among themselves for a charmer who may soothe away the fear of death. But he was pledged also to a sterner duty by the warning of Socrates to the Athenians, in the *Apology*, that after he was gone there would arise others for their reproof, more harsh than he had been. To this graver task, which he had but partially fulfilled with the light satire upon Lysias or the gentle message to Isocrates, the philosopher now directs his powers, by holding up the mirror of what ought to be against what is, the principles of truth and right against the practice of men. For the good has more than one aspect. The beautiful or noble when realized in action becomes the just. And to the question, What is just? are closely allied those other questions of Socrates—What is a state? What is it to be a statesman?

In the *Gorgias* Plato asserts the absolute supremacy of justice through the dramatic portraiture of Socrates in his opposition to the world; in the *Republic* he strives at greater length to define the nature of justice through the imaginary creation of an ideal community.

Gorgias.

In the former dialogue the Platonic Socrates appears in direct antagonism with the Athenian world. The shadow of his fate is hanging over him. Chærephon (who is still alive) understands him, but to the other interlocutors, Gorgias, Polus, Callicles, he appears perversely paradoxical. Yet he effectively nominates them all. And to the reader of the dialogue this image of "Socrates contra mundum" is hardly less impressive than that former image of Socrates confronting death.

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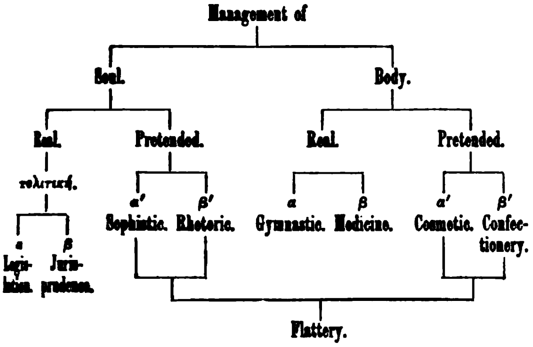
[1] *Laws*, viii. 836.

[2] Professor Jowett,—who has, notwithstanding, thrown much light on the *Cratylus* in his brilliant introduction.

1. Gorgias asserts that rhetoric is an art concerned with justice, and that persuasion is the secret of power.

a. Socrates, after suggesting some ironical doubts, declares his opinion that rhetoric is no art, but a knack of pleasing, or in other words "the counterfeit of a subsection of statesmanship." This oracular definition rouses the interest of Gorgias, and Socrates proceeds with the following "generalization and division":



Flattery influences men through pleasure without knowledge. And the rhetor is a kind of confectioner, who can with difficulty be distinguished from the sophist.

b. Rhetoric, then, is not an art. And persuasion is not the secret of power. Here Socrates maintains against Polus the three paradoxes:

The tyrant does what he chooses but not what he wishes;
It is less evil to suffer wrong than to do wrong;
It is better for the wrongdoer to be punished than to escape punishment.

The only use of rhetoric, therefore, is for self-accusation, and (if it is ever permissible to do harm) to prevent the punishment of one's enemy.

2. Callicles here loses patience and breaks in. He propounds his theory, which is based on the opposition of nature and custom.

"There is no natural right but the right of the stronger. And natural nobility is to have strong passions and power to gratify them. The lawful

is a word that cowards use,
Devised at first to keep the strong in awe."

Socrates entangles him in an argument in which it is proved that pleasure is different from good, and that there are good and bad pleasures.

Now the question is whether the life of philosophy, or the life which Callicles defends, is conducive to good. And it has been shown that rhetoric is one of a class of pursuits which minister to pleasure without discriminating what is good.

Callicles again becomes impatient. Did not Themistocles, Cimon, Pericles labor for their country's good? Socrates then renews his demonstration, proving that if the just man is wronged the evil lies with the wrongdoer, not with him, and that it is worst for the wrongdoer if he escape. And for avoidance of this greatest evil not rhetoric avails anything, nor any of the arts which save life (seeing that life may be used well or ill), nor even such an art of politics as Themistocles, Cimon, or Pericles knew, but another science of politics which Socrates alone of the Athenians practices. The pursuit of it may well endanger him; but his strength lies in having done no wrong. For in the world to come he can present his soul faultless before her judge. Not the show of justice but the reality will avail him there.

This truth is enforced by an impressive myth. And Callicles is invited to leave the life which relies on rhetoric and to follow Socrates in practicing the life of philosophic virtue.

The value of justice has been shown. But what is justice? Is the life upheld by Socrates sufficiently definite for practical guidance? The views of Callicles have been overborne; but have they been thoroughly examined? Socrates claims to be the only politician. But how can that deserve the name of policy which results in doing nothing? These and cognate questions may well have haunted Plato when he planned the greatest of his works. For that which lay deepest in him was not mere speculative interest or poetic fervor, but the practical enthusiasm of a reformer. The example of Socrates had fired him with an ideal of wisdom, courage, temperance, and righteousness, which under various guises, both abstract and concrete, has appeared and reappeared in the preceding dialogues. But the more vividly he conceived of this ideal life, the more keenly he felt its isolation in the present world—that of the restored Athenian democracy. For to a Greek mind above all others life was nothing without the social environment, and justice, of all virtues, could least be realized apart from a community. Hence it became necessary to imagine a form of society in which the ideal man might find himself at home, a state to which the philosopher might stand in harmonious relationship, no longer as an alien sojourner, but as a native citizen, not standing aloof in lonely contemplation, but acting with the full consent of other men and ruling in the right of wisdom. Plato did not regard his own republic as a barren dream. He believed that sooner or later in the course of time a state essentially resembling his ideal commonwealth would come into being. Still more firmly was he convinced that until then mankind would not attain their highest possible development. To ignore this real aspect of his most serious work is to lose much of the author's meaning. Yet it is hardly less erroneous to interpret a great imaginative creation *au pied de la lettre*, as if examining a piece of actual legislation. Even in his *Laws*, a far more prosaic writing, Plato himself repeatedly protests against such criticism. In his most aspiring flights he is well aware of the difference between the imaginary and actual embodiment of an ideal,[1] although as a literary artist he gives to his creations, whether in anticipation or retrospect, an air of sober reality and matter-of-fact. He is more in earnest about principles than about details, and if questioned would probably be found more confident with regard to moral than to political truth. He may have been wholly unconscious of the inconsistencies of his scheme, but it would not have greatly disconcerted him to have discovered them, or to have been told that this or that arrangement would not "work." He would have trusted the correction of his own rough draft to the philosopher-kings of the future.

Republic.

The *Republic* falls naturally into five portions. (1) Bk. i. is preliminary, raising the main question about justice. (2) Bks. ii., iii., iv. contain the outlines of the perfect state, including the education of the "guardians," and leading up to the definition of justice (*a*) in the state, and (*b*) in the individual. (3) Bks. v., vi., vii. (which to some critics present the appearance of an afterthought or excrescence on the original design) contain the cardinal provisions (1) of communism (for the guardians only), (2) that philosophers shall be kings, (3) of higher education for the rulers (viz., the philosopher-kings). This third provision occupies bks. vi. and vii. (which have again, as some think, the appearance of an outgrowth from bk. v.). (4) Bks. viii., and ix., resuming the general subject from bk. iv., present the "obverse side," by showing the declension of the state and individual through four stages, until in the life of tyranny is found the image of ideal injustice, as that of justice was found in the life of the perfect state. (5) Bk. x. forms a concluding chapter, in which several of the foregoing enactments are reviewed, and the work ends, like the *Gorgias*, with a vision of judgment.

Thus the main outlines of the scheme are contained in bks. ii., iii., iv., viii., ix. And yet bks. v., vi., vii. form the central portion, a sort of inner kernel, and are of the highest significance.

In speculating about the composition of the *Republic* (as is the fashion of some interpreters), it is important to bear in mind the general character of Plato's writings.

"The conception of unity," says Professor Jowett,[2]

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[1] See especially *Rep.*, v. p. 472; *Legg.*, v. p. 746.

[2] Jowett, Introd. to the *Phædrus*.

> "really applies in very different degrees to different kinds of art—to a statue, for example, far more than to any kind of literary composition, and to some species of literature far more than to others. Nor does the dialogue appear to be a style of composition in which the requirement of unity is most stringent; nor should the idea of unity derived from one sort of art be hastily transferred to another. . . . . Plato subjects himself to no rule of this sort. Like every great artist he gives unity of form to the different and apparently distracting topics which he brings together. He works freely, and is not to be supposed to have arranged every part of the dialogue before he begins to write. He fastens or weaves together the frame of his discourse loosely and imperfectly, and which is the warp and which the woof cannot always be determined."

It should be added, that as Dialectic was still a "world not realized," and he was continually conscious of using imperfect methods, he was not solicitous to bind himself to any one method, or to watch carefully over the logical coherence of his work. "Sailing with the wind of his argument," he often tacks and veers, changing his method with his subject-matter, much as a poet might adopt a change of rhythm. Absorbed as he is in each new phase of his subject, all that precedes is cancelled for the time. And much of what is to come is deliberately kept out of view, because ideas of high importance are reserved for the place where their introduction will have most effect. Another cause of apparent inconsequence in Plato is what he himself would call the use of hypothesis. He works less deductively and more from masses of generalized experience than Platonists have been ready to admit. And in the *Republic* he is as much engaged with the criticism of an actual as with the projection of an ideal condition of society.[1] If we knew more of the working of Attic institutions as he observed them, we should often understand him better.

These general considerations should be weighed against the inequalities which have led some critics to suppose that the "first sketch of the state" in bks. ii.–iv. is much earlier than the more exalted views of Bks. v.–vii. If in these later books new conditions for choosing the future rulers are allowed to emerge, if in discussing the higher intellectual virtues the simple psychology of bk. iv. is lost sight of (it reappears in the *Timæus*), if the "knowledge of the expedient" at first required falls far short of the conception of knowledge afterwards attained, all this is quite in keeping with Plato's manner elsewhere, and may be sufficiently accounted for by artistic and dialectical reserve. It can hardly be an altogether fortuitous circumstance that the culminating crisis, the third and highest wave of difficulty—the declaration that philosophers must be kings and kings philosophers—comes in precisely at the central point of the whole long work.

The great principle of the political supremacy of mind, though thus held back through half the dialogue, really dominates the whole. It may be read between the lines all through, even in the institution of gymnastic and the appraisement of the cardinal virtues. It is a genuine development of Socratic thought. And it is this more than any other single feature which gives the *Republic* a prophetic significance as "an attempt towards anticipating the work of future generations."[2]

Other aspects of the great dialogue, the Dorian framework, so inevitable in the reaction from Ionian life, the traces of Pythagorean influence, the estimate of oligarchy and democracy, the characters of the interlocutors in their bearing on the exposition, have been fully treated by recent writers, and for brevity's sake are here passed over.

There are other points, however, which must not be omitted, because they are more intimately related to the general development of Plato's thoughts.

1. The question debated by Proclus has been raised before and since, whether the proper subject of the *Republic* is justice or the state. The doubt would be more suggestive if put in a somewhat different form: Is Plato more interested in the state or the individual? That he is in earnest about both, and that in his view of them they are inseparable, is an obvious answer. And it is almost a truism to say that political relations were prior to ethical in the mind of a Greek. Yet if in some passages the political analogy reacts on moral notions (as in the definition of temperance), in others the state is spoken of in language borrowed from individual life. And it remains questionable whether the ethics or the politics of the *Republic* are less complete. On the whole Plato himself seems to be conscious that the ideal derived from the lifework of Socrates could be more readily stamped on individual lives than on communities of men (see especially *Rep.*, vii. 528 A, ix. 592).

2. The analogy of the individual is often used to enforce the requirement of political unity and simplicity (see especially v. 462 C). This is also to be referred, however, to Plato's general tendency to strain after abstractions. He had not yet reached a point of view from which he could look steadily on particulars in the light of universal principles. He recurs often to experience, but is soon carried off again into the abstract region which to him seemed higher and purer.[3] "It has been said that Plato flies as well as walks, but this hardly expresses the whole truth, for he flies and walks at the same time, and is in the air and on firm ground in successive instants" (Jowett). Plato's scheme of communism had been suggested to him partly by Dorian institutions and partly by the Pythagorean rule. But it was further commended by the general consideration that the state is a higher and more abstract unity than the family. The lower obligation must give way to the higher; the universal must overrule the particular bond.

3. Similarly it may be argued that, while the subordination of music to state discipline, and the importance attached to rhythm and harmony in education, had likewise a connection with Sparta and the Pythagoreans severally, Plato's deliberate attitude towards poetry and art could hardly be other than it is. Philosophy, while still engaged in generalization, could not assign to the imagination its proper function. "Æsthetik" could not enter into her purview. For a moment, in the *Symposium*, the ancient quarrel of poetry and philosophy had seemed to be melted in a dominant tone, but this was only a fond anticipation. Plato, if man ever did so, had felt the siren charm, but he is now embarked on a more severe endeavor, and, until the supreme unity of truth and good is grasped, vagrant fancy must be subdued and silent.

4. In the early education of the guardians a place is found for the unconscious virtue acquired through habit which the *Protagoras* and *Meno* stumbled over and the *Phædo* treated with disdain. In the ideal state, however, this lower excellence is no longer a wild plant, springing of itself through some uncovenanted grace of inspiration, but cultivated through an education which has been purified by philosophy so as to be in harmony with reason. But if Plato were cross-questioned as to the intrinsic value of habits so induced as a preservative for his pupils against temptation, he would have replied, "I do not pretend to have removed all difficulties from their path. Enough of evil still surrounds them to test their moral strength. I have but cleared the well-springs of the noxious weeds that have been fatal to so many, in order that they may have little to unlearn, and be exposed only to such dangers as are inevitable."

5. It is a singular fact, and worth the attention of those who look for system in Plato, that the definition of justice here so laboriously wrought out, viz., the right division of labor between the three classes in the state and between the three corresponding faculties in the individual soul, is nowhere else repeated or applied,

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[1] Krohn, *Der Platonische Staat*, Halle, 1876.

[2] Grote.

[3] See, for example, the admission of luxury and the after-purification through "music," bks. ii., iii.

although the tripartite division of the soul recurs in the *Timæus*, and the notion of justice is of great importance to the arguments of the *Politicus* and the *Laws*.

6. Before leaving the *Republic*, it is important to mark the stage which has now been reached by Plato's doctrine of ideas. The statements of the *Republic* on this subject are by no means everywhere consistent.

a. Towards the end of bk. v. philosophers are defined as lovers of the whole, who recognize the unity of justice, goodness, beauty, each in itself as distinguished from the many just or good or beautiful things. The former are said to be objects of knowledge, the latter of opinion, which is intermediate between knowledge and ignorance. Knowledge is of being, ignorance of the non-existent, opinion of that which is and is not.

b. In bk. vi. there is a more elaborate statement, implying a more advanced point of view. The "contemplation of all time and all existence" is a riper conception than "the love of each thing as a whole." Ignorance and nonentity have now disappeared, and the scale is graduated from the most evanescent impression of sense to the highest reach of absolute knowledge. And in the highest region there is again a gradation, rising to the form of good, and descending from it to the true forms of all things. In the application of this scheme to the theory of education in bk. vii. there are still further refinements. The psychological analysis becomes more subtle, and more stress is laid on the connection of ideas.

c. The doctrine reverts to a cruder aspect in bk. x., where we are told of an ideal bed, which is one only and the pattern of all the many actual beds.

d. A yet different phase of idealism presents itself in bk. ix. (*sub fin.*), in the mention of a "pattern" of the perfect state laid up in heaven which the philosopher is to make his rule of life.

What is said above concerning Plato's mode of composition has some bearing on these inconsistencies of expression. And that bks. vi., vii., as being the most important, were finished last is a not untenable hypothesis. But that Plato, in preparing the way for what he had in contemplation, should content himself with provisional expressions which he had himself outgrown, or that in a casual illustration (as in bk. x.) he should go back to a crude or even childish form of his own theory, is equally conceivable and in accordance with his manner elsewhere. Socrates in the *Parmenides* confessedly wavers on this very point. And there are "ideas" of the four elements in the *Timæus*.

The dialectical dialogues.

VI. *Euthydemus*, *Parmenides*, *Theætetus*, *Sophist*, *Statesman*, *Philebus* (the dialectical dialogues).—Even in the most advanced metaphysics of the *Republic* there is a hyperbolical, transcendental tendency, from which Plato ultimately to some extent worked himself free. But it was not in conversation with "dear Glaucon," or "between the lines" of an ethico-political writing, that this partial emancipation could be effectually attained. We have now to consider a series of dialogues, probably intended for a narrower circle of readers, in which Plato grapples directly with the central difficulties of his own theory of knowing and being. It is not necessary to assume that all of these are later than the *Republic*. The position of the *Euthydemus* and *Parmenides* in the order of composition is very uncertain. The *Theætetus* has points of affinity with the *Republic*. The *Sophist*, *Politicus*, and *Philebus* are in a later style. But, on account of their cognate subject-matter, these six dialogues may be conveniently classed together in a group by themselves. And the right place for such a group is intermediate between the *Republic* and the *Laws*.

The unity of the object of definition, the identity of virtue and knowledge, the existence of an absolute good, which would be universally followed if universally known, and of a standard of truth which is implied in the confession of ignorance, were postulates underlying the Socratic process, which in so far made no claim to be a "philosophy without assumptions." These postulates, when once apprehended, drew Plato on to speculate concerning the nature, the object, and the method of knowledge. Now, so far as we have hitherto followed him, his speculation has either been associated with ethical inquiry, or has been projected in a poetical and semi-mythical form. In the *Phædrus*, however, the vision of ideas was expressly conjoined with an outline of psychology and a foreshadowing of scientific method. And, while the opposition of ideas to phenomena and of knowledge to opinion has been repeatedly assumed, it has also been implied that there is a way between them, and that the truth can only be approached by man through interrogation of experience. For it is nowhere supposed that the human inquirer is from the first in a position to deduce facts from ideas. Much rather, the light of the ideas is one which fitfully breaks in upon experience as men struggle towards the universal.

But it is not less true that the metaphysical aspirations from which Socrates had seemed to recall men's thoughts had been reawakened in consequence of the impulse which Socrates himself had given. From asking, Is virtue one? Can virtue be taught? Plato passes on to ask, What is unity? What are knowledge and being? From criticising imperfect modes of teaching virtue, he has begun to speculate about the right and wrong uses of the intellect, and from dramatic portraits of the individual Protagoras or Gorgias goes on to the ideal delineation of the sophist. He has entered upon the "longer way," and is no longer contented with mere "hypotheses." With this demand for scientific precision his conception of the ideas themselves is modified, and he strives anew to conceive of them in relation to one another, to the mind, and to the world. As the balance of ethical truth was restored by admitting an unconscious (or inspired) conformity to reason, so now a fresh attempt is made on the intellectual side to bridge the gulf between sense and knowledge.

This endeavor involves, not only an expansion of the method of Socrates, but an examination of the earlier philosophies from which Socrates had turned away. Their influence on Plato has been traceable in the preceding dialogues, though, except in the case of Pythagoreanism (*Phæd.*, *Rep.*), it has been mostly indirect and casual. But in these dialectical dialogues he manifests his serious conviction that the contemporary fallacies which formed the chief hindrance to inquiry were deeply rooted in forms of thought created by earlier thinkers, above all by Heraclitus and Parmenides. To the exclusiveness of their first principles as held by their followers Plato attributed the barrenness and impracticable unreality of many discussions, which put shadow-fighting and controversy in the place of real investigation, and led men to think that truth was unattainable. He therefore enters into conversation, as it were, with the great minds of former times, and in the spirit of Socrates compels each of them to yield up his secret, and to acknowledge a supplemental truth. To this effort he may very probably have been stimulated by the dialectical activity of his Socratic friends at Megara, whose logical tastes had drawn them towards Eleaticism. But, unlike them, while strengthening his metaphysical theory, he was also led to give to his political speculations a more practical turn.

Euthydemus.

The *Euthydemus* is a treatise "De Sophisticis Elenchis" in the form of a farce, and may serve to introduce the five other dialogues, as the encounter with Thrasymachus introduces the serious part of the *Republic*. Under the veil of mockery there is more of concentrated thought, and also more of bitterness, in this dialogue than in the *Protagoras* or the *Gorgias*.

A sample of educational dialectic—in which Socrates draws out of young Clinias the admissions (1) that a philosophy is needed, (2) that the highest philosophy is a science of king-craft, which remains for the present undefined,—is contrasted with a series of ridiculous sophisms, propounded by Dionysodorus and his brother Euthydemus, in which absolute and relative notions, whether affirmative or negative, object and subject, universal and particular, substance and attribute, action and modality, are capriciously confused. Crito, to whom Socrates narrates the scene, is moved to contempt. But Socrates warns him not on this account to despair of philosophy. In conclusion, Isocrates, or some one else, who prematurely mixes up philosophy with practical politics, is cautioned against spoiling two good things.

Such puzzles as—How can I learn either what I know or what I do not know?[1] How can things become what they are not? How is falsehood or denial possible?—although treated jocularly here, will be found returning afterwards to "trouble the mind's eye."

Parmenides.

Plato appears in the same act to have become aware of his affinity with Parmenides, and to have been led to reconsider the foundations of his own doctrine. The one being of Parmenides was a more abstract notion than justice, beauty, or the good. And the Zenonian method had more pretension to exactness than the Socratic. But it remained barren, because contented to repeat its own first essays in the destructive analysis of experience, without rising to the examination of its own first principles. For this higher criticism, of which he himself also stood in need, Plato looks up from the disciples to the master, Parmenides. The appeal to him is put into the mouth of Socrates, as a very young man, who has framed for himself a theory of ideas, and would gladly see the Zenonian process applied to the notions of sameness, difference, likeness, unlikeness, unity, and being.

Parmenides whom Plato treats with tender reverence not unmixed with irony, proposes to the youth a series of questions which reveal the crudity of the doctrine of εἴδη. (1) Are there ideas of trivial things?[2] (2) How do things "partake" of them? (3) Must not idealism proceed *in infinitum?* (4) If ideas are thoughts, do they and their participants think? (5) If they are patterns, and things resemble them, must there not be a pattern of the resemblance, and so on *in infinitum?* (6) If absolute, are they thinkable by man?

These difficulties are real, and yet to deny ideas is to destroy philosophy. (As the paradoxical doubts in the *Protagoras* do not shake the faith of Socrates in the existence of good, so neither does Plato here intend for a moment to derogate from the belief in the existence of the One and the True.)

Parmenides advises Socrates to arm himself for the further pursuit of truth (1) by the higher application and (2) by the extension or completion of the Zenonian method. (1) The method is to be applied to abstractions. (2) It is not enough to show the inferences which may be drawn from the admission of an hypothesis, but account must also be taken of the inferences which follow from its rejection.

Parmenides exemplifies his suggestion by examining his own first principle in conversation with a youth who, while a contemporary of Socrates, is a namesake of Plato's pupil Aristotle.[3] Not content with the affirmative and negative hypotheses, he pursues either along two lines, according as either term of the proposition is emphasized, and this not only as regards the hypothesis of unity, but also as applied to the alternative hypothesis of plurality. The result, as in the *Protagoras*, is purely destructive, and the dialogue ends abruptly without a word of reply from Socrates.

The second part of the *Parmenides* may be regarded as an experiment in which Plato "assays to go" in Eleatic armor. Yet the strange web is "shot" with colors of original thought. The mode of conceiving time and becoming, and the vision of nothingness towards the end, may be noted as especially Platonic. These passages may be regarded in the same light as the wise words of Protagoras or the sober truths which occur amidst the wild fancies of the *Cratylus*. They should not mislead the interpreter into a search for recondite meanings.

The Zenonian method has been carried out to the utmost in application to the highest subject, and has led the mind into a maze of contradiction. It remains to call in question the method itself, and the notion of absolute identity and difference on which it hinges, and so to lay anew the foundation-stone of thought.

Theætetus.

Before this can be attempted, however, another set of difficulties have to be met, and another set of philosophers examined. For the current skepticism had undermined the conception of knowledge as well as that of being, and the fame of Heraclitus was hardly second to that of Parmenides. Protagoras appeared in a former dialogue as the champion of ordinary morality; he is now made the exponent of ordinary thinking. His saying "Man the measure" is shown to rest on the unstable basis of the Heraclitean flux. By an elaborate criticism of both theories knowledge is at last separated from the relativity of sense; but the subsequent attempt to distinguish on abstract grounds between true and false opinion, and to define knowledge as true opinion with a reason (comp. *Meno*), proves ineffectual. Plato still shows traces of Megarian influence. But the disjunctive method of the *Parmenides* is not resumed. The indirect proofs are so arranged as to exhibit the skill of Socrates in "bringing to the birth" the germs of thought in a richly-endowed and "pregnant" young mind. Theætetus is the embodiment of the philosophic nature described in *Rep.*, bk. vi., and has already been trained by Theodorus of Cyrene in geometry and the other preparatory sciences of *Rep.*, bk. vii. It is in conversation with Theodorus that Socrates impressively contrasts the lives of the lawyer and the philosopher. The *Theætetus* marks a great advance in clearness of metaphysical and psychological expression. See for example the passage (184–186) in which the independent function of the mind is asserted, and ideas are shown to be the truth of experience. There is also a distinct approach towards a critical and historical method in philosophy, while the perfection of style continues unimpaired, and the person of Socrates is as vividly represented as in any dialogue.

Notwithstanding the persistence of an indirect and negative method, the spirit of this dialogue also is the reverse of skeptical. "Socrates must assume the reality of knowledge or deny himself" (197 A). Perhaps in no metaphysical writing is the balance more firmly held between experience, imagination, and reflection. Plato would seem to have made a compact with himself to abstain rigidly from snatching at the golden fruit that had so often eluded his grasp, and to content himself with laboriously "cutting steps" towards the summit that was still unscaled.

Sophist.

With Plato, as with other inventive writers, a time seems to have arrived when he desired to connect successive works in a series. Thus in planning the *Sophistes* he linked it to the *Theætetus* (which had been written without any such intention), and projected a whole tetralogy of dialectical dialogues, *Theætetus*, *Sophistes*, *Politicus*, *Philosophus*, of which the last piece seems never to have been written.

After an interval, of which our only measure is a change of style, the philosopher returns to the great central question of knowledge and being. The obstacle in his path, on which he has often played with light satire, dramatic portraiture, and indirect allusion, is now to be made the object of a seriously planned attack. He has made his approaches, and the enemy's fortress is to be forthwith sapped and overthrown. This hostile position is not merely the "Sophistik" which, as some tell us, is an invention of the Germans, and as Plato himself declares is only the reflection or embodiment of the average mind,[1] but the fallacy of fallacies, the prime falsehood (πρῶτον ψεῦδος) of all contemporary thought. This is nothing else than the crude alsoluteness of affirmation and negation which was ridiculed in the *Euthydemus*, and has been elsewhere mentioned as the first principle of the art of controversy.[2] For dramatic purposes this general error is personified. And the word "sophist," which had somehow become the *bête noire* of the Platonic school, thus for the first time fixedly acquires the significance which has since clung to the name.—That Plato himself would not adhere pedantically to the connotation here implied is shown by the admission, at the opening of the dialogue, that amongst other disguises under which the philosopher walks the earth, the sophist is one.—In this dialogue, as in the *Parmenides*, a new method is introduced, and again by an Eleatic teacher. This method is repeated with improvements in the *Politicus*, and once more referred to in the *Philebus*. It bears a strong resemblance to the "synagoge" and "diæresis" of the *Phædrus*, but is applied by the "friend from Elea" with a degree of pedantry which Socrates nowhere betrays. And the two methods, although kindred, have probably come through different channels,—the classifications of the *Phædrus* being Plato's own generalization of the Socratic process, while the dichotomies of the *Sophistes* and *Politicus* are a caricature of Socrates cast in the Megarian mould. Plato seems to have regarded this method as an implement which might be used with advantage only when the cardinal principles on which it turned had been fully criticised.

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[1] Comp. *Meno*.

[2] Comp. *Rep.*, x. 597.

[3] Comp. the younger Socrates of the *Politicus*. It would be precarious to draw any inference from this minute fact.

1. After various attempts to "catch the sophist," he is defined as the maker of an unreal likeness of truth. Here the difficulty begins—for the definition implies the existence of the unreal, *i.e.*, of not-being. In our extremity it is necessary to "lay hands on our father Parmenides."

2. The contradictions attendant on the notion of "being," whether as held by Parmenides or his opponents or by the "less exact" thinkers who came after them, are then examined, and in an extremely subtle and suggestive passage (246–249) an attempt is made to mediate between idealism and materialism. The result is that while consummate being is exempt from change it cannot be devoid of life and motion. "Like children, 'Give us both,' say we."

3. This leads up to the main question: (*a*) are different notions incommunicable, or (*b*) are all ideas indiscriminately communicable, or (*c*) is there communion of some kinds and not of others? The last view is alone tenable, and is confirmed by experience. And of the true combination and separation of kinds the philosopher is judge.

4. Then it is asked (in order to "bind the sophist") whether being is predicable of not-being.

Five chief kinds (or categories) are now examined, viz., being, rest, motion, sameness, difference. Rest and motion are mutually incommunicable, but difference is no less universal than being itself. For everything is "other" than the rest, *i.e.*, is not. Thus positive and negative not only coexist but are coextensive.

5. And, in spite of Parmenides, we have discovered the existence, and also the nature, of not-being. It follows that the mere pursuit of contradictions is childish and useless and wholly incompatible with a philosophic spirit.

Negation, falsity, contradiction, are three notions which Plato from his height of abstraction does not hold apart. His position is the converse of the Spinozistic saying, "Omnis determinatio est negatio." According to him every negative implies an affirmative. And his main point is that true negation is correlative to true affirmation, much as he has said in the *Phædrus* that the dialectician separates kinds according to the "lines and veins of nature." The *Sophistes* is a standing protest against the error of marring the finely-graduated lineaments of truth, and so destroying the vitality of thought.

The idealists whom the Eleatic stranger treats so gently have been identified with the Megarians. But may not Plato be reflecting on a Megarian influence operating within the Academy?

Here, as partly already in the *Parmenides* and *Theætetus*, the ideas assume the nature of categories, and being is the sum of positive attributes, while negation, as the shadow of affirmation, is likewise finally comprehended in the totality of being.

The remark made incidentally, but with intense emphasis, that the universe lives and moves "according to God," is an indication of the religious tone which reappears increasingly in the *Politicus*, *Philebus*, *Timæus*, and *Laws*.

Politicus (Statesman).

In passing on to consider the statesman, true and false, the Eleatic stranger does not forget the lesson which has just been learned. While continuing his method of dichotomies, he is careful to look on both sides of each alternative, and he no longer insists on dividing between this and not-this when another mode of classification is more natural. A rule not hitherto applied is now brought forward, the rule of proportion or right measure (τὸ μέτριον), as distinguished from arbitrary limitations. Nor is formal logical treatment any longer felt to be adequate to the subject in hand, but an elaborate myth is introduced. On the ethico-political side also a change has come over Plato. As he has stripped his ideas of transcendental imagery, so in reconsidering his philosopher-king he turns away from the smiling optimism of the *Republic* and looks for a scientific statemanship that shall lay a strong grasp upon the actual world. He also feels more bitterly towards the demagogues and other rulers of Hellas. The author of the *Politicus* must have had some great quarrel with mankind. But so far as they will receive it he is still intent on doing them good.

1. The king is first defined as a herdsman of men, who as "slow bipeds" are distinguished from the pig and the ape. But the king is not all in all to his charges, as the herdsman is. The above definition confuses human with divine rule.

2. Now the universe is like a top, which God first winds in one direction and then leaves to spin the other way. In the former or divine cycle all was spontaneous, and mankind, who had all things in common, were under the immediate care of gods. They were happy, if they used their leisure in interrogating nature. But in this reign of Zeus it is far otherwise. Men have to order their own ways and try to imitate in some far-off manner the all-but forgotten divine rule.

3. Therefore in our present definition the term "superintendent" must be substituted for "herdsman."

What special kind of superintendence is true statesmanship?

4. By way of an example, the art of weaving is defined. The example shows that kingcraft has first to be separated from other kindred arts, both causal and co-operative. Nine categories are adduced which exhaust social functions. Eight are eliminated, and the ninth, the class of ministers, remains. Of these (*a*) slaves, (*b*) hirelings, (*c*) traders, (*d*) officials, (*e*) priests are again parted off, although the last are only with difficulty separated from the king, when (*f*) a strange medley of monstrous creatures come into view. Some are fierce like lions, some crafty like the fox, and some have mixed natures like centaurs and satyrs. These are the actual rulers of mankind, more sophistical and juggling than the sophist himself. And they too must be separated from the true king.

5. The familiar tripartite distinction of monarchy, oligarchy, democracy, is doubled by introducing into each the distinction involved in the presence or absence of wealth, and in the observance or non-observance of law. But no one of the six carries in itself a scientific principle.

The true government is the rule, not of many, but of one or of a few. "And they may govern, whether poor or rich, by freewill or compulsion, and either with or without law, so long as they govern scientifically."

6. The respondent, a youthful namesake of Socrates, is shocked at the remark that the true ruler may govern without law.

This leads to a discussion of the nature of law, which is compared to the prescription left by a physician. If present, he might dispense with his own rule. So the presence of a competent ruler is better than the sovereignty of law, which makes no allowance for nature or circumstance, but tyrannically forces its own way. Imagine medicine, navigation, etc., similarly conducted by time-honored prescription, with penalties for innovation; what would become of civilization? Yet if law is disregarded by rulers who are unscientific and warped by self-interest, this leads to far worse evils. For the laws are based on some experience and wisdom. Hence, in the continued absence of the true ruler, the best course, though only second best, is the strict observance of law. And he who so rules in humble imitation of the scientific governor may be truly called a king, although if the divine lawgiver were to appear his living will would supersede the law.

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[1] *Rep.*, vi. 493.

[2] ἀντιλογική.

7. As it is, though cities survive many evils, yet many are shipwrecked because of the ignorance of those at the helm. The order of badness in the actual states is—

1. Constitutional monarchy.
2. Constitutional oligarchy.
3. Law-abiding democracy.
4. Law-breaking democracy.
5. Law-defying oligarchy.
6. Tyranny.

8. It remains to separate from the true ruler those who co-operate with him as subordinates, the general, the judge, the orator. His own peculiar function is an art of weaving strength (the warp) with gentleness (the woof), when education has prepared them,—and this (1) by administration, (2) by marriage.

The four preceding dialogues have shown (1) the gradual transformation of the Platonic ideas (while still objective) into forms of thought, (2) the tendency to group them into series of categories, (3) a corresponding advance in psychological classification, (4) an increasing importance given to method, (5) the inclination to inquire into processes (γενέσεις) as well as into the nature of being.

Philebus.

Meanwhile Plato's approach to the Eleatics, though in the way of criticism, has brought into prominence the notions of unity, being, sameness, difference, and has left somewhat in abeyance the idea of good. To this "highest of all studies" Plato now returns, equipped with his improved instruments, and ready to forge new ones in the same laboratory, or in some other, should occasion serve. His converse with Parmenides ended in his assertion of an element of difference prevading all things, in other words, of an indeterminate element underlying all determinations. This brings him again into relation with the Pythagoreans, who had similarly asserted the combination of finite and infinite in the universe.

Taking advantage of their help, he gains a more advanced (but still ideal) conception of the concrete harmony of things, and approaches the definition of that which in the *Republic* he but shadowed forth.

With this most serious inquiry there is combined (as in the *Sophistes* and *Politicus*) an ironical and controversial use of dialectic, by which the juggler and false pretender (who is in this case the goddess of pleasure), after claiming the highest place, is thrust down to the lowest.

It must be admitted that the style of the *Philebus* is far from brilliant, or even clear. In the effort of connecting abstractions Plato's movement is more labored than in his first glad realization of them.

Instead of attempting here to follow the windings of the dialogue, it must suffice to state the main result. Neither pleasure nor knowledge is the highest good, and the good eludes definition; but the shrine, or habitation, of the good is a complex life of which the elements are, in order of merit—(1) measure, the cause of all right mixture.; (2) (*a*) beauty, the effect, and (*b*) reality, the inseparable condition; (3) intellect; (4) science, art, and right opinion; (5) pure pleasure unaccompanied with pain. "Not all the animal kingdom shall induce us to put pleasure first."

The *Philebus* introduces us to the interior of the Academy in the lifetime of the master. More than any other of the dialogues it recalls Aristotle's description of Plato's teaching. But, while his followers seem early to have fallen under the dominance of the latest phase of his doctrine, Plato himself, even in the *Philebus*, is still detached from any servitude to the creations of his own mind. He manipulates them as the medium for expressing his fresh thoughts, but they are not yet crystallized into a system.

"I will remind you," Socrates, "of what has been omitted," says Protarchus at the conclusion of this dialogue. The last (presumably) of Plato's metaphysical writings thus fitly ends with a confession of incompleteness. But if, as M. Renan says, "the most fatal error is to believe that one serves one's country by calumniating those who founded it," neither is it for the interest of science to ignore these imperfect anticipations. By methods elaborated in the course of centuries, and far more sure than any which Plato had at his command, mankind have gained an extent of knowledge which he dreamt not of.[1] But the Greek metaphysician is none the less a pioneer of knowledge,[2] while the special sciences of ethics and psychology had been carried from infancy to adolescence in a single lifetime.

The imaginative dialogues.

VII. *Timæus Critias* [*Hermocrates*].—As the *Sophistes* and *Politicus* were written in continuation of the *Theætetus*, so, at some uncertain time, Plato conceived the design of writing a great trilogy, for which the ideal state depicted in the *Republic* should be the point of departure. The grand outline there sketched by Socrates was now to be filled up by Critias and Hermocrates. The form set up by reasoning should be made alive, the "airy burghers" should be seen "making history." As a prelude to this magnificent celebration, Timæus, the Pythagorean philosopher, who is present at the Panathenæa, is invited to discourse of the origin of all things and to bring down the glorious theme to the creation of man. What should have followed this, but is only commenced in the fragment of the *Critias*, would have been the story, not of a fall, but of the triumph of reason in humanity.

In the *Philebus* (59 A, comp. 62 D) Plato speaks with a touch of contempt of the life-long investigation of nature, as being concerned only with this visible universe and immersed in the study of phenomena, whether past, present, or to come, which admit of no stability, and therefore of no certainty. "These things have no absolute first principle and can never be the objects of reason and true science."

Yet even this lower knowledge is there admitted as an element of that life which is the habitation of the good. And there are not wanting signs in his later dialogues that Plato's imagination had again been strongly drawn towards those physical studies which, as the *Phædo* shows, had fascinated him in youth. That nature and the world proceed "according to God and not according to chance" is the belief of the Eleatic stranger, to which he perceives that Theætetus will be irresistibly drawn as he grows older. In the midst of dialectical abstractions, the processes of actual production (γενέσεις) have been increasingly borne in mind. And the myth in the *Politicus* turns on cosmological conceptions which, although differing from those in the *Timæus* and more accordant with Plato's bitterest mood, yet throw a new light on the deeper current of his thoughts. In the same passage (272 C) there occurs the first clear anticipation of an *interrogatio naturæ*.

The impulse in this new direction, if not originated, was manifestly reinforced, through closer intercourse with the Pythagorean school. And the choice of Timæus the Pythagorean as chief speaker is an acknowledgement of this obvious tendency. If in the course of the dialogue there occur ideas apparently borrowed from the Atomists, whom Plato persistently ignored, this fact ought probably to be referred to some early reaction of Atomic on Pythagorean doctrine. It is important to observe, however, that not only the *Timæus*, but the unfinished whole of which it forms the introduction, is professedly an imaginative creation. For the legend of prehistoric Athens and of Atlantis, whereof Critias was to relate what belonged to internal policy and Hermocrates the conduct of the war, would have been no other than a prose poem, a "mythological lie," conceived in the spirit of the *Republic* and in the form of a fictitious narrative. And, therefore, when Timæus professes to give only a probable account of shadowy truths, he must be taken at his word and not criticized in too exacting a spirit. His descriptions have much the same relation to the natural philosophy of Plato's time that Milton's cosmology has to the serious investigations of Galileo or Copernicus—except that all physical speculation hitherto partook in some measure of this half-mythological character, and that Plato's mind, although working in an unfamiliar region, is still that of a speculative philosopher.

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[1] See, however, *Polit.*, 272 C. D.

[2] See Jowett, Introd. to the *Timæus*.

Timæus.

As Parmenides after demonstrating the nonentity of growth and decay, was yet impelled to give some account of this non-existent and unintelligible phenomenal world, so Plato, although warned off by Socrates, must needs attempt to give a probable and comprehensive description of the visible universe and its creation. In doing so he acknowledges an imperfect truth in theories which his dialectic had previously set aside. In examining the earlier philosophers he has already transgressed the limits prescribed by Socrates, and the effort to connect ideas has made him more and more conscious of the gap between the ideal and the actual. He cannot rest until he has done his utmost to fill up the chasm—calling in the help of imagination where reason fails him.

His dominant thought is still that of a deduction from the "reason of the best," as in the *Phædo*, or "the idea of good," as in the *Republic*. But both his abstract idealism and his absolute optimism were by this time considerably modified, and, although not confounding "causes with conditions," as he once accused Anaxagoras of doing, he yet assigns more scope to "second causes" than he would then have been willing to attribute to them. This partly comes of ripening experience and a deepening sense of the persistency of evil, and partly from the feeling—which seems to have grown upon him in later life—of the distance between God and man.

Timæus begins by assuming (1) that the universe being corporeal is caused and had a beginning, and (2) that its mysterious author made it after an everlasting pattern. Yet, being bodily and visible, it can only be made the subject, humanly speaking, of probable discourse.

Thus much being premised, he proceeds to unfold—(A) the work of mind in creation, (B) the effects of necessity, including the general and specific attributes of bodies, (C) the principles of physiology, and (D) an outline of pathology and medicine.

To give a full account of such a comprehensive treatise is beyond the scope of this article, and the *Timæus*, however great and interesting, has been well described as an outbuilding of the great fabric of original Platonism. A very few scattered observations are all that there is space for here.

(A) 1. In the mythology of the *Timæus* some of the conceptions which attained logical clearness in the *Sophist* and *Philebus* resume an ontological form. Thus, in compounding the soul-stuff of the universe the father of all takes of the continuous and discrete and fuses them into an essence (the composite being of the *Philebus*). Again he takes of the same and other (comp. the *Sophist*), overcoming their inherent repugnance by his sovereign act.

2. The notion of an economy or reservation in Plato has been often exaggerated and misapplied. But it is difficult to acquit him of intentional obscurity in speaking of the creation of the Earth. It is clear, though Plato does not say so, that she is meant to have been created together with Heaven and together with Time, and so before the other "gods within the heaven," *i.e.*, the sun and moon and five planets, and it is a plausible supposition that she is the "artificer of day and night," by interposing her bulk to the sun's rays. If the word *ειλλομένη* in p. 40 implies motion (as Aristotle thought[1]), it cannot be, as Grote supposed, a motion consentaneous with that of the outer sphere, but either some far slower motion, perhaps assumed in order to account for the shifting of the seasons, or an equal retrograde motion which is supposed to neutralize in her case the "motion of the same." She clings to the centre, as her natural abode. And the diurnal motion of the heavens is due not to any mechanical force but to the soul of the world extending from the centre to the poles and comprehending all.

3. Immortality is in the *Timæus* dependent on the will of the Eternal. And the sublime idea of eternity is here first formulated.

4. The phenomena of vision and hearing are included among the works of reason, because the final cause of these higher senses is to give men perception of number through contemplation of the measures of time.

(B) 1. It has been commonly said that the four elements of the *Timæus* are geometrical figures, without content. This is not true. For what purpose does Plato introduce, "beside the archetype and the created form, a third kind, dim and hard to conceive, a sort of limbec or matrix of creation," if not to fill up the triangles which are elements of elements, and to be the vehicle of the forms compounded of them? It has been supposed that this "nurse of generation" is identical with "space," and it cannot be said that they are clearly kept apart by Plato. But he had a distinct nomenclature for either, and, although gravity is explained away (so that his molecules, unlike Clerk Maxwell's, may be called imponderable), yet extension, or the property of filling space, is sufficiently implied.

2. The difference of size in the triangles and varying sharpness of their outlines are ingenious though inadequate expedients, adopted in order to account for qualitative difference and physical change.

3. In criticizing the illusory notion of up and down Plato broaches the conception of antipodes.

4. More distinctly than in the *Philebus*, bodily pleasure is explained by "a sudden and sensible return to nature" (comp. Ar., *Rhet.*, i. 11, § 1; *N. E.*, vii. 10).

5. Natural philosophers are warned against experimenting on the mixture of colors, which is a divine process and forbidden to man.

(C) 1. Plato tends more and more in his later writings to account for moral evil by physical conditions, thus arriving at the Socratic principle of the involuntariness of vice by a different road.

Hence in the *Timæus* not the body only is made by the inferior gods, but they also create the lower and mortal parts of the human soul:—the principle of anger which is planted in the breast, within hearing of reason, and that of appetite which is lodged below the diaphragm like an animal tied in a stall, with the stomach for a crib and the liver for a "soothsaying" looking-glass to soothe or terrify it when tempted to break loose.

2. The brain-pan was left bare of protecting flesh "because the sons of God who framed us deliberately chose for us a precarious life with capability of reason, in preference to a long secure existence with obstruction of thought."

3. The nails are a rudimentary provision for the lower animals, into which degenerate souls were afterwards to be transformed.

4. Vegetables have sensation but not motion.

5. By way of illustrating the very curious account here given of respiration, it is asserted that what is commonly thought to be the attraction of the magnet is really due to rotatory motion and displacement.

6. When the original particles wear out, and the bonds of soul and body in the marrow give way, the soul escapes delightedly and flies away. This is the painless death of natural decay.

(D) 1. The dependence of mental disease on bodily conditions is more fully recognized in the *Timæus* than elsewhere in Plato (contrast the *Charmides*, for example).

2. He has also changed his mind about the treatment of disease, and shows more respect for regimen and diet than in the *Republic*. Diseases are a kind of second nature, and should be treated accordingly.

3. It is also a remark in contrast with the *Republic*, that over-study leads to head complications, which physicians ascribe to chill and find intractable.

Lastly, it is one of the strange irregularities in the composition of the *Timæus* that the creation of woman and the relation of the sexes[2] to each other are subjects reserved to the end, because this is the place given to the lower animals, and woman (compare the *Phædrus*) is the first transmigration from the form of man. This order is probably not to be attributed to Plato's own thought, but to some peculiarity of Pythagorean or Orphic tradition.

VIII. *The Laws.*—The two series of dialogues, the dialectical and the imaginative—*Sophistes*, *Politicus*, *Philosophus*—*Timæus*, *Critias*, *Hermocrates*—were left incomplete. For Plato had concentrated his declining powers, in the evening of his life,[1] upon a different task. He was resolved to leave behind him, if he could so far overcome the infirmities of age,[2] a code of laws conceived in a spirit of concession, and such as he still hoped that some Hellenic state might sanction. The motive for this great work may be gathered from the *Politicus*. The physician in departing is to give a written prescription, adapted as far as possible to the condition of those from whom he goes away. This is the second-best course, in the absence of the philosopher-king. And, as the Hellenic world will not listen to Plato's heroic remedy, he accommodates his counsel to their preconceptions.

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[1] Aristotle, however, uses *εἰλουμένη*, a different word.

[2] There is an anticipation of microscopic observation in the words *ἀόρατα ὑπὸ σμικρότητος καὶ ἀδιάπλαστα ζῷα*—spermatozoa.

Laws.

He returns once more from abstract discussions to study the application of ideas to life, and though, by the conditions of the problem, his course is "nearer earth and less in light," this long writing, which is said to have been posthumous,[3] has a peculiar interest. The ripeness of accumulated experience and the mellowness of wise contemplation make up for the loss of prophetic insight and poetic charm.

The form of dialogue is still retained, and an aged Athenian is imagined as discoursing of legislation with the Lacedæmonian Megillus and the Cretan Clinias, who has in view the foundation of a new colony, and is on his way with his two companions from Cnossus to the temple and oracle of Zeus.

Plato now aims at moderating between Dorian and Ionian law, freely criticizing both, and refining on them from a higher point of view. "The praise of obedience, the authority assigned to elders, the prohibition of dowries, the enforcement of marriage, the common meals, the distribution and inalienability of land, the institution of the Crypteia, the freedom of bequest to a favorite son, the dislike of city walls—all reflect the custom of Sparta." . . . "The use of the lot, the scrutiny of magistrates, the monthly courses of the council, the pardon of the forgiven homicide, most of the regulations about testaments and the guardianship of orphans, the degrees of consanguinity recognized by law, correspond to Athenian laws and customs" (Jowett).

The philosopher's own thoughts come out most strongly in the "preludes" to the laws,[4] and in the regulations concerning education, marriage, and the punishment of impiety (*i.e.*, 1st, atheism, 2d, denial of providence, 3d and worst, immoral superstition). The difficulty which is met in the *Politicus* by the abandonment of the world for a time, and in the *Timæus* by the lieutenancy of lower gods, here leads to the hypothesis of an evil soul. The priority of mind (often before asserted) and the increased importance attached to numbers are the chief indications of Plato's latest thoughts about the intelligible world. But it must be remembered that the higher education (answering to *Rep.*, vi., vii.) is expressly reserved.[5] Had Plato written his own *Epinomis*, the proportions of the whole work (not then "acephalous") might have been vastly changed.

The severity of the penalties attached to the three forms of heresy, especially to the third and worst of them, has led to the remark that Plato, after asserting "liberty of prophesying," had become intolerant and bigoted in his old age. But the idea of toleration in the modern sense was never distinctly present to the mind of any ancient philosopher. And, if in the *Laws* the lines of thought have in one way hardened, there are other ways in which experience has softened them. Plato's "second-best" constitution contains a provision, which was not admissible in the "perfect state," for possible changes and readaptations in the future. The power of self-reformation is hedged round indeed with extreme precautions; and no young or middle-aged citizen is ever to hear a word said in depreciation of any jot or tittle of the existing law. But that it should be provided, however guardedly, that select commissioners, after travelling far and wide, should bring back of the fruit of their observations for the consideration of the nocturnal council, and that a power of constitutionally amending the law should thus be admitted into the state, is sufficiently remarkable, when the would-be finality of ancient legislation is considered. Plato even comes near to the reflection that "constitutions are not made, but grow" (iv. 709 A).

Plato in the *Laws* desists finally from impersonating Socrates. But he is in some ways nearer to his master in spirit than when he composed the *Phædrus*. The sympathy with common life, the acceptance of Greek religion, the deepening humanity, are no less essentially Socratic than the love of truth which breathes in every page. And some particular aspects of Socratism reappear, such as the question about courage[6] and that concerning the unity of virtue.[7]

Doubtful and spurious works.

Of the dialogues forming part of the "Platonic canon," and not included in the preceding survey, the *Lesser Hippias*, *First Alcibiades*, and *Menexenus* are the most Platonic, though probably not Plato's. The *Greater Hippias* and the *Clitophon* are also admitted to have some plausibility. The *Second Alcibiades* (on Prayer), the *Hipparchus* (touching on Pisistratus and Homer), *Minos* ("de lege"), *Epinomis*, *Erastæ*, *Theages*, are generally condemned, though most of them are very early forgeries or Academic exercises.[8] And the *Axiochus* (though sometimes prized for its subject, "the contempt of death"), the *De Justo*, *De Virtute*, *Demodocus*, *Sisyphus*, *Eryxias* (a not-uninteresting treatise on the use of money), together with the so-called *Definitions*, were rejected in ancient times, and are marked as spurious in the MSS.

Two great forces are persistent in Plato, the love of truth and zeal for human improvement. In the period culminating with the *Republic*, these two motives, the speculative and the practical, are fused in one harmonious working. In the succeeding period, without excluding one another, they operate with alternate intensity. In the varied outcome of his long literary career, the metaphysical "doctrine of ideas" which has been associated with Plato's name underwent many important changes. But pervading all of these there is the same constant belief in the supremacy of reason and the identity of truth and good. From that abiding root spring forth a multitude of thoughts concerning the mind and human things—turning chiefly on the principles of psychology, education, and political reform—thoughts which, although unverified, and often needing correction from experience, still constitute Plato the most fruitful of philosophical writers. While general ideas are powerful for good or ill, while abstractions are necessary to science, while mankind are apt to crave after perfection, and ideals, either in art or life, have an acknowledged value, so long the renown of Plato will continue. "All philosophic truth is Plato rightly divined; all philosophic error is Plato misunderstood"—is the verdict of one of the keenest of modern metaphysicians.[9]

Plato's followers, however, have seldom kept the proportions of his teaching. The diverse elements of his doctrine have survived the spirit that informed them. The Pythagorizing mysticism of the *Timæus* has been more prized than the subtle and clear thinking of the *Theætetus*. Logical inquiries have been hardened into a barren ontology. Semi-mythical statements have been construed literally, and mystic fancies perpetuated without the genuine thought which underlay them. A part (and not the essential part) of his philosophy has been treated as the whole. But the influence of Plato has extended far beyond the limits of the Platonic schools. The debt of Aristotle to his master has never yet been fully estimated. Zeno, Chrysippus, Epicurus borrowed from Plato more than they knew. The moral ideal of Plutarch and that of the Roman Stoics, which have both so deeply affected the modern world, could not have existed without him. Neopythagoreanism was really a crude Neoplatonism. And the Skeptics availed themselves of weapons either forged by Plato or borrowed by him from the Sophists. A wholly distinct line of infiltration is suggested by the mention of Philo and the Alexandrian schools, and of Clement and Origen, while Gnostic heresies and even Talmudic mysticism betray perversions of the same influence. The effect of Hellenic thought on Christian theology and on the life of Christendom is a subject for a volume, and has been pointed out in part by Professor E. Zeller and others (comp. NEOPLATONISM). Yet when Plotinus in the 3d century (after hearing Ammonius), amidst the revival of religious paganism, founded a new spiritualistic philosophy upon the study of Plato and Aristotle combined, this return to the fountain-head had all the effect of novelty. And for more than two centuries, from Plotinus to Proclus, the great effort to base life anew on the Platonic wisdom was continued. But it was rather the ghost than the spirit of Plato that was so "unsphered." Instead of striving to reform the world, the Neoplatonist sought after a retired and cloistered virtue. Instead of vitalizing science with fresh thought, he lost hold of all reality in the contemplation of infinite unity. He had some skill in dealing with abstractions, but laid a feeble hold upon the actual world.

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[1] ἡμεῖς δ' ἐν δυσμαῖς τοῦ βίου, *Legg.*, vi. 770 A.

[2] ἂν . . . . γήρως ἐπικρατῶμέν γε τοσοῦτον, *Legg.*, vi. 752 A.

[3] Published by Philippus the Opuntian.

[4] See especially iv. 716 *sq.*; v. 727 *sq.*, 735 *sq.*; vi. 766; vii. 773 *sq.*, 777, 794, 803 *sq.*, 811, 817; viii. 835 *sq.*; ix. 875; x. 887 *sq.*, 897 *sq.*, 904 *sq.*

[5] *Legg.*, xii. 968 E. (Ath.) "I am willing to share with you the danger of stating to you my views about education and nurture, which is the question coming to the surface again."

[6] Comp. *Laches*.

[7] Comp. *Protagoras*.

[8] According to Schaarschmidt, only nine dialogues are genuine—*Protag.*, *Phædr.*, *Symp.*, *Apol.*, *Crito*, *Phædo*. *Rep.*, *Tim.*, *Legg.*

[9] Ferrier, *Institutes of Metaphysics*, p. 169 (sect. i., prop. vi. § 12),

"Hermes Trismegistus" and "Dionysius Areopagita" are names that mark the continuation of this influence into the Middle Ages. The pseudo-Dionysius was translated by Erigena in the 9th century.

Two more "Platonic" revivals have to be recorded —at Florence in the 15th and at Cambridge in the 17th century. Both were enthusiastic and both uncritical. The translation of the dialogues into Latin by Marsiglio Ficino was the most lasting effect of the former movement, which was tinged with the unscientific ardor of the Renaissance. The preference still accorded to the *Timæus* is a fair indication of the tendency to bring *fumum ex fulgore* which probably marred the discussions of the Florentine Academy concerning the "chief good." The new humanism had also a sentimental cast, which was alien from Plato. Yet the effect of this spirit on art and literature was very great, and may be clearly traced not only in Italian but in English poetry.

"The Cambridge Platonists" have been described by Principal Tulloch in his important work on *Rational Theology in England in the 17th Century*. Their views were mainly due to a reaction from the philosophy of Hobbes, and were at first suggested as much by Plotinus as by Plato. It is curious to find that, just as Socrates and Ammonius (the teacher of Plotinus) left no writings, so Whichcote, the founder of this school, worked chiefly through conversation and preaching. His pupils exercised a considerable influence for good, especially on English theology; and in aspiration if not in thought they derived something from Plato, but they seem to have been incapable of separating his meaning from that of his interpreters, and Cudworth, their most consistent writer, was at once more systematic and less scientific than the Athenian philosopher. The translations of Sydenham and Taylor in the 18th century and the beginning of the 19th are proofs of the continued influence of Platonism in England.

The critical study of Plato begins from Schleiermacher, who did good work as an interpreter, and tried to arrange the dialogues in the order of composition. His attempt, which, like many efforts of constructive criticism, went far beyond possibility, was vitiated by the ground-fallacy of supposing that Plato had from the first a complete system in his mind which he partially and gradually revealed in writing. At a considerably later time Karl Friedrich Hermann, to whom all students of Plato are indebted, renewed the same endeavor on the far more plausible assumption that the dialogues faithfully reflect the growth of Plato's mind. But he also was too sanguine, and exaggerated the possibility of tracing a connection between the outward events of Plato's life and the progress of his thoughts. This great question of the order of the dialogues, which has been debated by numberless writers, is one which only admits of an approximate solution. Much confusion, however, has been obviated by the hypothesis (first hinted at by Ueberweg, and since supported by the present writer and others) that the *Sophistes* and *Politicus*, whose genuineness had been called in question by Socher, are really intermediate between the *Republic* and the *Laws*. The allocation of these dialogues, and consequently of the *Philebus*, not only on grounds of metaphysical criticism, but also on philological and other evidence of a more tangible kind, supplies a point of view from which it becomes possible to trace with confidence the general outlines of Plato's literary and philosophical development. Reflecting at first in various aspects the impressions received from Socrates, he is gradually touched with an inspiration which becomes his own, and which seeks utterance in half-poetical forms. Then first the ethical and by and by the metaphysical interest becomes predominant. And for a while this last is all absorbing, as he confronts the central problems which his own thoughts have raised. But, again, the hard-won acquisitions of this dialectical movement must be fused anew with imagination and applied to life. And in a final effort to use his intellectual wealth for the subvention of human need the great spirit passed away.

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PLATON, LEVSHIN (1737–1812) a celebrated Russian archbishop, was born at the village of Tchashnikovo, near Moscow, in 1737, and was educated in the academy of that city. On completing his studies there in 1758 he was appointed teacher of rhetoric in the school connected with the monastery of St. Sergius, and about this time entered the priesthood. In 1763 Catherine invited him to instruct her son Paul in theology, and he became one of the court chaplains. Three years afterwards Platon was appointed archimandrite of the monastery of the Trinity (Troitzkaia Lavra) near Moscow; in 1770 he was made archbishop of Tver, and finally in 1787 archbishop of Moscow and metropolitan. He died in 1812. Platon was a brilliant and learned man, not only in the opinion of his countrymen, but in the estimation of all foreigners who made his acquaintance. We get a graphic and interesting picture of him at the beginning of the present century in the travels of Edward Clarke of Cambridge, who was much struck with his wit and wide range of reading. As a preacher he enjoyed great celebrity, one of the most remarkable specimens of his eloquence being the sermon preached at the coronation of Alexander I. He was also the author of several works which enjoyed considerable reputation in their time, such as *A Short Course of Divinity*, compiled for the use of the emperor Paul when grand duke, several *Catechisms*, *A Short History of the Russian Church*, which has been translated into English, and other works. Platon is altogether a striking and important figure in a very eventful period of his country's history.

PLATTNER, CARL FRIEDRICH (1800–1858), a famous scientific metallurgist, was born in Kleinwaltersdorf, near Freiberg in Saxony, on the 2d January, 1800, and died in the latter town on the 22d January, 1858. Plattner's father, though only a poor working miner, found the means for having his son educated first at the "Bergschule" and then at the "Bergakademie" of Freiberg. After having completed his curriculum there in 1820, he obtained a position in connection with the royal mines and metal works, and was employed chiefly as an assayer, in which capacity he soon became conspicuous by his rare exactness and circumspection, and his constant striving after scientific advancement.

The mouth-blowpipe, after doing service for centuries to metal-workers as a soldering tool (hence the German name Löthrohr), in the hands of Gahn and subsequently of Berzelius became the most useful of instruments for the qualitative testing of mineral substances. Through the efforts of the latter, in fact, blowpipe analysis had developed into almost an independent branch of analysis. But nobody dreamt of quantitative mouth-blowpipe assaying until Harkort in 1827 (while a student in the Freiberg academy) succeeded in working out a blowpipe-assay for silver. Harkort stopped there; but the idea of blowpipe-assaying was taken up subsequently by Plattner, who, by bringing his characteristic thoroughness, indefatigability, and unexampled dexterity to bear on the subject, succeeded in working out reliable methods for all the ordinary useful metals. His modes of assaying for cobalt and nickel more especially quickly found favor with metallurgists, because they were more exact than the then known corresponding methods of "wet-way" analysis, and required a less number of hours than the latter required of days for their execution. Our analytical methods for the determination of cobalt have since become far more perfect but no less troublesome, and to the present day Plattner's nickel-assay is the most precise method for the estimation of this metal in complex mixtures.

Plattner, while working at this specialty of his own, at the same time overhauled the entire field of qualitative blowpipe assaying, and ultimately summed up the whole of his vast experience in his *Probirkunst mit dem Löthrohr*, which soon became, and to the present day ranks as, the standard book on the subject. Since its first publication in 1835 the work has gone through four editions, apart from two independent English translations.

With all his high and recognized distinction in his own specialty, Plattner most keenly felt that his scientific education in Freiberg had been somewhat one-sided; and in 1839 he left his post and family to work for a year in Heinrich Rose's laboratory in Berlin, and supplement his knowledge of modern methods of chemical analysis. While there as a student he at the same time acted as a teacher in his branch, and won the lasting friendship of a number of distinguished scientific men. On his return home in 1840 he was raised to the rank of assessor at the Government board of mining and metallurgy, and made chief of the royal department of assaying. In 1842 he was deputed to complete a course of lectures on metallurgy in the Bergakademie which had been commenced by Lampadius; and he subsequently became Lampadius's successor as professor of that branch, and for the then newly instituted course of blowpipe-assaying. In addition to these functions he instituted, in 1851, a special course on the metallurgy of iron. He continued lecturing in the academy as long as he was able,—until the session of 1856–57. It was during this period of professorial activity that he made the extensive studies and experimental researches which form the basis of his work *Die metallurgischen Röstprocesse theoretisch betrachtet* (Freiberg, 1856). His well-known *Vorlesungen über allgemeine Hüttenkunde* (vol. i. and ii., Freiberg, 1860) is a posthumous publication edited by Prof. Thomas Richter.

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[1] [Rev. C. H. A. Bulkey published (New York, 1876, new edition 1883) a volume compiled from Jowett entitled *Plato's Best Thoughts*, which is probably the book referred to.—AM. ED.]

In addition to these great works (and the *Probirkunst*) Plattner published (in *Erdmann's Journal* and in *Schweigger's Journal* and elsewhere) numerous memoirs on metallurgical or mineralogical subjects, regarding which we must confine ourselves to saying that they mark him as an investigator of rare diligence and power. How he found time for all his original work is difficult to say; it certainly did not cause him to neglect his students. He attended to them in the most conscientious and efficient manner, as hundreds of his pupils all over the world can testify. His marked success as a teacher was no doubt owing greatly to his high personal qualities,—his cheerful, untiring, unselfish devotion to duty, his kindliness of heart and manner, his freedom from all cant and morbid ambition. The latter years of his life were embittered by intense suffering. After a long period of lingering illness he succumbed to a disease of the brain.

PLATTSBURGH, a village and township of the United States, the shire-town of Clinton county, New York, and the port of entry of Champlain customs district, lies on the west side of Lake Champlain at the mouth of the Saranac. By rail it is 168 miles north of Albany and 73 south-southeast of Montreal (Canada). A branch line runs 20 miles southwest to Au Sable and forms a favorite route to the Adirondacks, and the Chateaugay Railroad runs 34 miles west by north to Lyon Mountain, where there are extensive iron mines. Plattsburgh contains county buildings and court-house, a custom-house, a high school, and a small public library. It has nail and wagon factories, flour-mills, saw-mills, an iron furnace, machine shops, and a large sewing-machine manufactory. It is a garrison town of the United States Army, with extensive barracks about a mile south of the village. The value of the imports and exports of the district for the year ending June 30th, 1884, was $3,169,780 and $1,319,422; and 1279 vessels entered from Canada, while 1179 cleared. The aggregate burthen of the vessels belonging to the district was 57,477 tons. In 1870 the township had 8414 inhabitants, the village 5139; in 1880 the figures were 8283 and 5245.

Plattsburgh dates from 1785. It has twice been destroyed by fire (1849 and 1867). In 1812 it became the headquarters of the U. S. army on the northern frontier; and in September, 1814, it was rendered famous through the capture of the British flotilla under Commodore Downie by the United States flotilla under Commodore Macdonough, and the consequent retreat across the Saranac of Sir George Prevost, who had been attacking the village with a powerful army. Downie and fifteen other officers of the contending forces are buried in Plattsburgh cemetery.

PLATYHELMINTHES. See PLANARIANS and TAPEWORMS.

PLATYPUS. The Duck-billed Platypus (*Platypus anatinus*) was the name assigned to one of the most remarkable of known animals by Shaw, who had the good fortune to introduce it to the notice of the scientific world in the *Naturalist's Miscellany* (vol. x., 1799). In the following year it was independently described by Blumenbach (*Voigts Magazin*, ii. p. 205) under the name of *Ornithorhynchus paradoxus*. Shaw's generic name, although having priority to that of Blumenbach, could not be retained, as it had been used at a still earlier time (1793) by Herbst for a genus of *Coleoptera*. *Ornithorhynchus* is, therefore, now universally adopted as the scientific designation, although Duck-billed Platypus may be conveniently retained as a vernacular appellation. By the colonists it is called "Water-Mole," but its affinities with the true moles are of the slightest and most superficial description.

The anatomical differences by which the platypus, and its only ally the echidna, are separated from all other mammals, so as to form a distinct subclass with relationship to the inferior vertebrated classes, have been described in the article MAMMALIA (vol. xv. pp. 374 and 379), where also will be found the main distinctive characters of the two existing representatives of the group. It is there stated that the early stages of the development of the young are not yet fully known; in fact this was till very recently one of the most interesting problems in zoology to be solved. It has been repeatedly affirmed, in some cases by persons who have had actual opportunities of observation, that the platypus lays eggs; but these statements have been generally received with skepticism and even denial. This much-vexed question has, however, been settled by the researches of Mr. W. H. Caldwell (1884), who has found that these animals, although undoubtedly mammals throughout the greater part of their structure, are oviparous, laying eggs, which in the manner of their development bear a close resemblance to the development of those of the *Reptilia*. Two eggs are produced at a time, each measuring about three-fourths of an inch in its long and half an inch in its short axis, and enclosed in a strong, flexible, white shell.

The platypus is pretty generally distributed in situations suitable to its aquatic habits throughout the island of Tasmania and the southern and eastern portions of Australia. Slight variations in the coloring and size of different individuals have given rise to the idea that more than one species may exist; but all naturalists who have had the opportunity of investigating this question by the aid of a good series of specimens have come to the conclusion that there is but one; and no traces of any extinct allied forms have yet been discovered.

The length of the animal when full grown is from 18 to 20 inches from the extremity of the beak to the end of the tail, the male being slightly larger than the female. The fur is short, dense, and rather soft to the touch, and composed of an extremely fine and close under-fur, and of longer hairs which project beyond this, each of which is very slender at the base, and expanded, flattened, and glossy towards the free end. The general color is deep brown, but paler on the under parts. The tail is short, broad, and depressed, and covered with coarse hairs, which in old animals generally become worn off from the under surface. The eyes are small and brown. There is no projecting pinna or ear-conch. The mouth, as is well known, bears a striking resemblance to the bill of a duck. It is covered with a naked skin, a strong fold of which projects outwards around its base. The nostrils are situated near the extremity of the upper surface. There are no true teeth, but their purposes are served by horny prominences, two on each side of each jaw,—those in the front narrow, longitudinal, sharp-edged ridges, and those behind broad, flattened, and moleriform. The upper surface of the lateral edges of the mandible has also a number of parallel fine transverse ridges, like those on the bill of a duck. In the cheeks are tolerably capacious pouches, which appear to be used as receptacles for food.

The limbs are strong and very short, each with five well-developed toes provided with strong claws. In the fore feet the web not only fills the interspaces between the toes, but extends considerably beyond the ends of the long, broad, and somewhat flattened nails, giving great expanse to the foot when used for swimming, though capable of being folded back on the palm when the animal is burrowing or walking on the land. On the hind foot the nails are long, curved, and pointed, and the web extends only to their base. On the heel of the male is a strong, curved, sharply pointed, movable horny spur, directed upwards and backwards, attached by its expanded base to the accessory bone of the tarsus. This spur, which attains the length of nearly an inch, is traversed by a minute canal, terminating in a fine longitudinal slit near the point, and connected at its base with the duct of a large gland situated at the back part of the thigh. The whole apparatus is so exactly analogous in structure to the poison gland and tooth of a venomous snake as to suggest a similar function, but evidence that the platypus ever employs its spur as an offensive weapon has, at all events until lately, been wanting. A case is, however, related by Mr. Spicer in the *Proceedings* of the Royal Society of Tasmania for 1876 (p. 162) of a captured platypus inflicting a severe wound by a powerful lateral and inward movement of the hind legs, which wound was followed by symptoms of active local poisoning. It is not improbable that both the inclination to use the weapon and the activity of the secretion of the gland may be limited to the breeding season, and that their purpose may be, like that of the antlers of deer and many similar organs, for combat among the males. In the young of both sexes the spur is present in a rudimentary condition, but it disappears in the adult females.

Platypus. From Gould's *Mammals of Australia*.

The platypus is aquatic in its habits, passing most of its time in the water or close to the margin of lakes and streams, swimming and diving with the greatest ease, and forming for the purpose of sleeping and breeding deep burrows in the banks, which generally have two orifices, one just above the water level, concealed among long grasses and leaves, and the other below the surface. The passage at first runs obliquely upwards in the bank, sometimes to a distance of as much as 50 feet, and expands at its termination into a cavity, the floor of which is lined with dried grass and leaves, and in which the eggs are laid and the young brought up. Their food consists of aquatic insects, small crustaceans, and worms, which are caught under water, the sand and small stones at the bottom being turned over with their bills to find them. They appear at first to deposit what they have thus collected in their cheek pouches, and when these are filled they rise to the surface and quietly triturate their meal with the horny teeth before swallowing it. Swimming is effected chiefly by the action of the broad forepaws, the hind feet and tail taking little share in locomotion in the water. When asleep they roll themselves into a ball, as shown in the figure. In their native haunts they are extremely timid and wary, and very difficult to approach, being rarely seen out of their burrows in the daytime. Mr. A. B. Crowther, who has supplemented the often quoted observations of Dr. George Bennet upon the habits of these animals in confinement, says, "They soon become very tame in captivity; in a few days the young ones appeared to recognize a call, swimming rapidly to the hand paddling the water; and it is curious to see their attempts to procure a worm enclosed in the hand, which they greedily take when offered to them. I have noticed that they appear to be able to smell whether or not a worm is contained in the closed hand to which they swim, for they desisted from their efforts if an empty fist was offered." When irritated they utter a soft low growl, resembling that of a puppy. (W. H. F.)

PLAUEN, a busy manufacturing town of Saxony, in the government district of Zwickau, is situated on the Elster, 60 miles to the south of Leipsic. It was formerly the capital of the Voigtland, a territory governed directly by the imperial voigts o bailiffs, and this name still clings in popular speech to the hilly manufacturing district in which it lies. The most prominent buildings are the fine Gothi church of St. John, the town-house (about 1550), the new post-office, and the loftily-situated ol castle of Hradschin, now occupied by a law court. Plauen is now the chief place in Germany for th manufacture of embroidered white goods of all kind and for the finishing of woven cotton fabrics. Dyeing, tanning, bleaching, and the making of paper an machinery are also prosecuted; and an active trad is carried on in these various industrial product In 1880 the town contained 35,078 inhabitants an in 1884 above 40,000 almost all protestants.

As indicated by the name of the castle, Plauen was probably founded by the Slavs, after whose expulsion it w governed directly by the imperial bailiffs. In 1327 it became a Bohemian fief, but passed into the possession o Saxony in 1466 and remained permanently united to from 1569 onwards. The manufacture of white goods w introduced by Swabian or Swiss immigrants about 157 and since then the prosperity of the town has been grea in spite of the storms of the Thirty Years' and Seve Years' Wars. The advance of Plauen has been especiall rapid since its incorporation in the Zollverein.

PLAUTUS, T. **Maccius**, was the greatest comi and dramatic genius of Rome, and still ranks amon the great comic dramatists of the world. While th other creators of Roman literature, Nævius, Enniu Lucilius, etc., are known to us only in fragments, w still possess twenty plays of Plautus. A few of the are incomplete, and in some cases they show traces o later interpolations, but they have reached us in th main as they were written by him in the end of th 3d and the beginning of the 2d century B.C. At th date of his birth Roman literature may be said to hav been non-existent. When he died the Latin languag had developed its full capacities as an organ of soci intercourse and familiar speech, and the literature o the world had been enriched by a large number o adaptations from the New Comedy of Athens, anim ted by the new life of ancient Italy and vivified by th genius and robust human nature of their author; an these have been the chief means of transmitting th traditions of the ancient drama to modern times. Th maturity which comedy attained in a single generatio affords a remarkable contrast to the slow processes which the higher forms of Roman poetical and pro literature were brought to perfection. It may explained partly by the existence, for some generatio before the formal beginning of Literature at Rom of the dramatic and musical medleys ("saturæ implet modis") which in their allusions to current events a their spirit of banter must have had a considerable affinity with the dialogue of Plautus, and partly to the diffusion of the Latin language, as the organ of practical business among the urban communities of Italy. But much also was due to the individual genius and the command over their native idiom possessed by the two oldest of the genuine creators of Roman literature, Nævius and Plautus.

A question might be raised as to whether Plautus or his younger contemporary Ennius was the most characteristic representative of the national literature of their time. Ennius certainly exercised a much more important influence on its subsequent development. He arrested the tendency imparted to that development by Nævius and Plautus. He made literature the organ of the serious spirit and imperial ambition of the Roman aristocracy, while the genius of Plautus appealed to the taste and temperament of the mass of the people, at a time when they were animated by the spirit of enjoyment and comparatively indifferent to political questions. The ascendency of the aristocracy in public affairs for two generations after the end of the Second Punic War determined the ascendency of Ennius in Roman literature; and it may be admitted that, if the genius of Plautus and of Ennius could not work harmoniously together, it was best that that of the younger poet, as representative of the truer genius of Rome, should prevail. The popularity of Plautus was greatest in his own time and in the generation succeeding him, but his plays still continued to be acted with applause till the age of Cicero, and he was greatly admired both by Cicero and by the man among his contemporaries who, both from his learning and taste, retained most of the antique spirit, Varro. The literary taste of the Augustan age and of the first century of the empire was adverse to him; but the archaic revival in the latter part of the 2d century of our era brought him again into favor, with the result of securing the preservation of his works through mediæval times and their revival with great acceptance at the Renaissance. That his original popularity was due to genuine gifts of humor and genuine power in representing human life is clear from their reception by a world so much altered from that in which he himself had played his part. And if his influence was not felt like that of Ennius in determining the form and spirit of the literature of his country, it was not without effect on the two greatest dramatists of modern times, Shakespeare and Molière.

The few facts known of his life rest on the authority of Cicero, of Aulus Gellius, and of Jerome in his continuation of the Eusebian *Chronicle*. He was born in the earlier half of the 3d century B.C., and died at an advanced age in the year 184 B.C. He was a native of Sarsina in Umbria. His first employment was in some way connected with the stage "in operis artificum scenicorum." He saved money in this employment, engaged in foreign trade, and returning to Rome in absolute poverty was reduced to work as a hired servant in a mill; and then for the first time he began to write comedies. The earliest allusion to any contemporary event which we find in any of his plays is that in the *Miles Gloriosus* (l. 212–3) to the imprisonment of Nævius, which happened about the year 207 B.C. The *Cistellaria* and *Stichus* were apparently written immediately after the end of the Second Punic War. The last ten years of his life were the most productive, and the greater number of his extant comedies belong to that period. They do not seem to have been published as literary works during his lifetime, but to have been left in possession of the players, to whom the interpolations and some other unimportant changes are to be ascribed. The prologues to the plays, with three or four exceptions, belong to the generation after his death. In a later age the plays of many contemporary playwrights were attributed to him. Twenty-one were accepted by Varro as undoubtedly genuine, and of these we possess twenty nearly complete, and fragments of another, the *Vidularia*. Other nineteen Varro regarded as probably genuine, and the titles of some of them, *e.g.*, *Saturio*, *Addictus*, *Commorientes*, are also known to us.

We get the impression from his works and from ancient criticisms on them that he was, in his latter years, a rapid and productive writer, more concerned with the immediate success of his works than with their literary perfection.[1] Yet he shows that he took pride and pleasure in his art (*Bacch.*, 214), and Cicero testifies especially to the gratification which he derived from the two works of his old age, the *Pseudolus* and *Truculentus* (*De Senec.*, 14). We get further the impression of a man of strong animal spirits and of large intercourse with the world, especially with the trading and middle classes. We find no indication of familiarity with the manners, tastes, or ideas of the governing aristocracy. The story told of his unsuccessful mercantile speculations might seem to derive confirmation from the "flavor of the sea" and the spirit of adventure present in many of his plays, from his frequent colloquial use of Greek phrases, and from indications of familiarity with the sights, manners, and pleasures of the Greek cities on the Mediterranean. He has many allusions to works of art, to the stories of Greek mythology, and to the subjects of Greek tragedies; and he tried to enrich the native vocabulary with a considerable number of Greek words which did not maintain their place in the language. The knowledge of these subjects which he betrays, and his copious use of Greek words and phrases, seem to be the result rather of active and varied intercourse with contemporary Greeks than of the study of books.

Like all the old Roman dramatists, he borrows his plots, incidents, scenes, characters, and probably the outlines of his dialogue from the authors of the new comedy of Athens,—Diphilus, Philemon, Menander, and others. But he treated his borrowed materials with much more freedom and originality than the only other dramatist of whom we possess complete pieces—Terence. A note of this difference appears in the fact that the titles of all the plays of Terence are Greek, while those of Plautus are nearly all Latin. We find a much greater range and variety in the scenes and incidents introduced by Plautus, and much greater divergence from a conventional type in his characters. But it is especially on his dialogue and his metrical soliloquies that his originality is stamped. Though all the personages of his plays are supposed to be Greeks, living in Greek towns, they constantly speak as if they were Romans living in the heart of Rome. Frequent mention is made of towns in Italy, of streets, gates, and markets in Rome itself, of Roman magistrates and of their duties, of the business of the law-courts, the comitia, and the senate, etc. We constantly meet with Roman formulæ, expressions of courtesy, proverbs, and the like. While avoiding all direct reference to politics, he frequently alludes to recent events in Roman history, and to laws of recent enactment. Although he maintains and seems to inculcate an attitude of political indifference, he is not altogether indifferent to social conditions, and in more than one of his plays comments on the growing estrangement between the rich and poor, as an element of danger to the state. Still he writes neither as a political nor as a social satirist, but simply with the wish to represent the humors of human life and to amuse the people in their holiday mood.

His independence of his originals, in regard to expression, is further shown by the puns and plays on words, the alliterations, assonances, etc., which do not admit of being reproduced in translation from one language to another; in the metaphors taken from Roman military operations, business transactions, and the trade of various artisans; and in his profuse use of terms of endearment and vituperation, characteristic of the vivacity of the Italian temperament in modern as in ancient times. But in nothing is his difference from Terence, and presumably from the originals which they both followed, more decided than in his large use of lyrical monologue, or "cantica," alternating with the ordinary dialogue in much the same way as the choral odes do in the old Greek comedy. These one may conjecture to have been a partial survival of passages in the old dramatic *saturæ*, which were repeated to a musical accompaniment. In the naiveté of the reflections which they contain, and the prolixity with which the thought is worked out, we recognize the earliest effort of the Roman mind applied to reflection on life, and no reproduction of any phase of the Greek mind to which the expression of such reflection had been familiar for generations.

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[1] "Securus cadat an recto stet fabula talo."—Hor. *Ep.* ii. 1, 176.

In the diction of Plautus accordingly we may consider that we have a thorough reflection of his own mind, and an important witness of Roman life and thought in his time. The characters in his plays are the stock characters of the New Comedy of Athens, the "fallax servus," the "leno insidiosus," the "meretrix blanda," the "parasitus edax," the "amans ephebus," the "pater attentus," etc. We may miss the finer insight into human nature and the delicate touch in drawing character which Terence presents to us in his copies from Menander, but there is wonderful life and vigor, and considerable variety in the embodiment of these different types by Plautus. The characters of Ballio and Pseudolus, of Euclio in the *Aulularia*, of the two Menæchmi, and of many others have a real individuality, which shows that in reproducing Greek originals Plautus thoroughly realized them and animated them with the strong human nature of which he himself possessed so large a share. For his plots and incidents he has been much more indebted to his originals. There is a considerable sameness in many of them. A large number turn upon what are called "frustrationes"—tricks by which the slave who plays the principal part in the comedy succeeds in extracting either from the father of his young master or from some other victim a sum of money to aid his master in his love affairs. But Plautus, if not more original, is more varied than Terence in his choice of plots. In some of them the passion of love plays either no part or a subordinate one. He also varies his scenes much more than Terence. Thus in some of his plays we find ourselves at Epidamnus, at Ephesus, at Cyrene, and not always in Athens.

The following is a list of the comedies according to their usual arrangement, which is nearly, but not strictly alphabetical:—*Amphitruo*, *Asinaria*, *Aulularia*, *Captivi*, *Curculio*, *Casina*, *Cistellaria*, *Epidicus*, *Bacchides*, *Mostellaria*, *Menæchmi*, *Miles Gloriosus*, *Mercator*, *Pseudolus*, *Pœnulus*, *Persa*, *Rudens*, *Stichus*, *Trinummus*, *Truculentus*. Of these the most generally read, and on the whole the most interesting, are the *Aulularia*, *Captivi*, *Menæchmi*, *Miles Gloriosus*, *Mostellaria*, *Pseudolus*, *Rudens*, and *Trinummus*. Besides these the *Amphitruo*, *Bacchides*, and *Stichus* (although the last two are incomplete) are of special interest. The *Amphitruo* is altogether exceptional, and gives, perhaps, as high an idea both of the comic and of the imaginative power of the author as any of the others. The interest attaching to it is enhanced by the fact that it has been imitated both by Molière and Dryden, that attaching to the *Aulularia* by its having suggested the subject of *L'Avare* of the French dramatist, and to the *Menæchmi* by the reappearance of its principal motive in the *Comedy of Errors* of Shakespeare. The *Captivi* was characterized by Lessing as the best constructed drama in existence. It may be classed with the *Rudens* as appealing to a higher and purer class of feelings, and as coming nearer to the province of serious poetry, than any other extant specimens of Latin comedy. The *Aulularia* and *Trinummus* may be mentioned along with these as bringing us into contact with characters more estimable and attractive than those in the great majority of the other pieces.

While there are abundant good sense and good humor in the comedies of Plautus, and occasional touches of pathos and elevated feeling in one or two of them, there is no trace of any serious purpose behind his humorous scenes and representations of character. He presents a remarkable exception to the didactic and moralizing spirit which appears in most of the leading representatives of Roman literature. He is to be judged on the claim which is put forward in the epitaph which in ancient times was attributed to himself:

> Postquam est mortem aptus Plautus, comœdia luget,
> Scæna est deserta, dein risus, ludu' jocusque,
> Et numeri innumeri simul omnes conlacrumarunt."[1]

He has not the more subtle and penetrating irony which we recognize in Terence, in Horace, and in Petronius; still less can we attribute to him the "rigidi censura cachinni" which accompanied and inspired the humorous fancies of Lucilius and Juvenal. But among all the ancient humorists, with the exception of Aristophanes, he must have had the power of immediately provoking the heartiest and broadest mirth and laughter. He was too careless in the construction of his plots to be a finished dramatic artist. He was apparently more popular among the mass of his countrymen than any Roman author of any age; but to be thoroughly popular he had to satisfy the tastes of an audience accustomed to the indigenous farces of Italy. This is the defect, according to the judgment of educated critics in the Augustan age, which Horace indicates in the line

> "Quantus sit Dossennus edacibus in parasitis."

But he had the most wonderful power of dramatic expression of feeling, fancy, and character by means of action, rhythm, and language. In the line in which Horace expresses the more favorable criticism of his time,—

> "Plautus ad exemplar Siculi properare Epicharmi."

the term *properare* expresses the vivacity of gesture, dialogue, declamation, and recitative in which the plays of Plautus never fail, and which must have made them admirable vehicles for the art of the actor. The lyrical recitative occupies a much larger place in his comedies than in those of Terence, and in them he shows the true poetical gift of adapting and varying his metres in accordance with the moods and fancies of his characters. But the gift for which he is pre-eminent above almost every other Roman author is the vigor and exuberant flow of his language. No other writer enables us to feel the life and force of the Latin idiom, undisguised by the mannerisms of a literary style, in the same degree. Among the masters of expression in which the prose and poetical literature of Rome abounds, none was more prodigally gifted than Plautus, and this gift of expression was the accompaniment of the exuberant creativeness of his fancy and of the strong vitality and lively social nature which was the endowment of the race to which he belonged.

In the beginning of the 15th century only the first eight plays (from *Amphitruo* to *Epidicus*) were in circulation. The other twelve were recovered in the course of that century, and two new manuscripts, one containing the whole twenty, were discovered in the following century. The Ambrosian palimpsest, discovered in 1815, has been recognized as the most trustworthy text for those plays which it preserves, and it is on this that the critical labors of Ritschl have been based. His great critical edition is being continued by his pupils G. Loewe, G. Götz, Fr. Schoell. An edition of the plays with a commentary by Professor Ussing of Copenhagen is now nearly complete. The most useful editions of separate plays are those of Lorenz and Brix. (W. Y. S.)

PLAYFAIR, JOHN (1748–1819), mathematician and physicist was born at Benvie, Forfarshire, where his father was parish minister, on March 10, 1748. He was educated at home until the age of fourteen, when he entered the university of St. Andrews. Ability for scientific studies must have appeared very early with him, for while yet a student he was selected to teach natural philosophy during the occasional absence of the professor. In 1766, when only eighteen, he was candidate for the chair of mathematics in Marischal College, Aberdeen, and, although he was unsuccessful, his claims were admitted to be high. Six years later he made application for the chair of natural philosophy in his own university, but again without success, and in 1773 he was offered and accepted the living of the united parishes of Liff and Benvie, vacant by the death of his father. He continued, however, to carry on his mathematical and physical studies, and in 1782 he resigned his charge in order to become the tutor of Ferguson of Raith. By this arrangement he was able to be frequently in Edinburgh, and to cultivate the literary and scientific society for which it was at that time specially distinguished; and through Maskelyne, whose acquaintance he had first made in the course of the celebrated Schiehallion experiments in 1774, he also gained access to the scientific circles of London. In 1785 when Dugald Stewart succeeded Ferguson in the Edinburgh chair of moral philosophy, Playfair succeeded the former in that of mathematics. In 1802 he published a volume entitled *Illustrations of the Huttonian Theory of the Earth*, and in 1805 he exchanged the chair of mathematics for that of natural philosophy in succession to Robison, whom also he succeeded as general secretary to the Royal Society of Edinburgh. He took a prominent part, on the liberal side, in the ecclesiastical controversy which arose in connection with Leslie's appointment to the post he had vacated, and published a satirical *Letter* (1806) which was greatly admired by his friends. His election as a fellow of the Royal Society took place in 1807. In 1815, after the establishment of a European peace, he made a journey through France and Switzerland to Italy, and remained abroad for nearly eighteen months, interesting himself chiefly in the geology and mineralogy of the districts he visited. After a few years of gradually failing health he died on July 19, 1819.

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[1] "After Plautus died, comedy mourns, the stage is deserted then laughter, mirth, and jest, and his numberless numbers all wept in concert."

A collected edition of Playfair's works, with a memoir by James G. Playfair, appeared at Edinburgh in 4 vols. 8 vo. His writings include a number of essays contributed to the *Edinburgh Review* from 1804 onwards, various papers in the *Phil. Trans.* (including his earliest publication "On the Arithmetic of Impossible Quantities," 1779, and an "Account of the Lithological Survey of Schehallion" 1811) and in the *Transactions* of the Royal Society of Edinburgh ("On the Causes which affect the Accuracy of Barometrical Measurement," etc.), also the articles "Æpinus" and "Physical Astronomy," and a "Dissertation on the Progress of Mathematical and Physical Science since the Revival of Learning in Europe," in the *Encyclopædia Britannica* (Supplement to fourth, fifth, and sixth editions). His *Elements of Geometry* first appeared in 1795 and have passed through many editions; his *Outlines of Natural Philosophy* (2 vols., 1812–16) consist of the propositions and formulæ which were the basis of his class lectures. Playfair's contributions to pure mathematics were not considerable, his paper "On the Arithmetic of Impossible Quantities," that "On the Causes which affect the Accuracy of Barometrical Measurements," and his *Elements of Geometry*, all already referred to, being the most important. As a mathematician simply he was far inferior to the first two Gregorys, to Colin Maclaurin, and even to Matthew Stewart. He was, however, a man of great general ability and was conspicuous for a calm intellect. His scientific style was a model of clearness, and his *Illustrations of the Huttonian Theory of the Earth* attained great popularity through its literary merits. His lives of Matthew Stewart, Hutton, Robison, many of his reviews, and above all his "Dissertation" are of the utmost value. The English mathematicians of his day professed unlimited admiration of Newton, but few of them were found able to wield his weapons, and the majority had come simply to rest under the shadow of that great man; to Playfair belongs the credit of having been one of the first to diffuse among his countrymen a knowledge of the substantial progress which the infinitesimal calculus had been making in the hands of the Continental analysts.

PLEADING, in law, denotes in civil procedure the statement in legal form of the grounds on which a party to an action claims the decision of the court in his favor, in criminal procedure the accusation of the prosecutor or the answer of the accused. The term "pleadings" is used for the collected whole of the statements of both parties, the term "pleading" for each separate part of the pleadings. A pleading may be the statement of either party; a "plea" is (except in Scots and ecclesiastical law) confined to the defence made by an accused person. To "plead" is to frame a pleading or plea.

All systems of law agree in making it necessary to bring the ground of a claim or defence before the court in a more or less technical form. In Roman law the action passed through three stages (see ACTION), and the manner of pleading changed with the action. In the earliest historical period, that of the *legis actiones*, the pleadings were verbal, and made in court by the parties themselves, the proceedings imitating as far as possible the natural conduct of persons who had been disputing, but who suffered their quarrel to be appeased (Maine, *Ancient Law*, ch. x.). Though pleadings were probably not couched in technical language originally, this soon became a necessity, and was regarded as so important that, as Gaius tells us, the party who made even the most trifling mistake would lose his suit. This excessive reverence for formality is a universal characteristic of archaic law. Its probable explanation is to be found in the weakness of the executive. In the second period, that of the procedure by *formulæ*, the issue which the *judex* decided was made up by the *prætor* in writing from the statements of the parties before him. The *formula* was a short summary of the facts in dispute in technical language, with instructions to the *judex*. The part of the *formula* which contained the plaintiff's claim was called the *intentio*. Any equitable defence in the *formula* was set up by means of an *exceptio*, which was either peremptory, denying the right of the plaintiff to recover at all, or dilatory, denying only that the action could be brought at the time or by the particular plaintiff. The plaintiff might meet the *exceptio* with a *replicatio*, the defendant on his side might set up a *duplicatio*, and the plaintiff might traverse the *duplicatio* by a *triplicatio*. The parties might proceed even further, but beyond this point the pleadings had no special names. Actions *bonæ fidei* implied every *exceptio* that could be set up; in other actions the *exceptio* must be specially pleaded. From the *formula* the *judex* derived his whole authority, and he was liable to an action for exceeding it. He could not amend the *formula*; that could only be done by the *prætor*. In the third period the *formula* did not exist, the plaintiff's claim appeared in the summons (*libellus conventionis*), and the defendant might take any defence that he pleased, all actions being placed on the footing of actions *bonæ fidei*. The issue to be tried was determined by the judge from the oral statements of the parties. In criminal procedure the indictment (*inscriptio* or *libellus accusationis*) was usually in writing, and contained a formal statement of the offence. In some cases oral accusations were allowed. The pleading of the accused seems to have been informal.

The development of the system of pleading in Roman and English law proceeded upon very similar lines. It is possible that the English system was directly based upon the Roman. Bracton (*temp.* Henry III.) uses many of the Roman technical terms. Pleading was oral as late as the reign of Henry VIII., but in the reign of Edward III. pleadings began to be drawn up in writing, perhaps at first more for the purpose of entry on the court records than of the instruction of the court (see 2 Reeves, *History of English Law*, 398). The French language was used up to 36 Edw. III. st. 1, c. 15, after which English was used for oral pleading, but Latin for enrollment. Latin was the language of written pleadings at common law until 4 Geo. II. c. 26.[1] Such terms as *declaration*, *answer*, *replication* are survivals of the oral period. It is no doubt from the circumstance of pleading having been originally oral that the word in the popular though not in the legal sense is used for the oral conduct of the case by an advocate.[2] The period of the Roman *formula* has its analogue in the period of the original writ in England.[3] The writ was at first a formal commission from the crown to a judicial officer to do justice between the parties, the claim being made by means of a count. The issue of the writ was part of the prerogative of the crown, unlimited until the Provisions of Oxford (1258) forbade the issue of fresh writs (except writs *de cursu*) without the consent of the council. Gradually the writ came to absorb the count and included the plaintiff's claim and sometimes the nature of his evidence. The defendant pleaded to the writ. The writ became the universal form of instituting proceedings in the king's court, irrespective of the method of trial which followed, and probably grew fixed in form about the reign of Henry II. (see Bigelow, *History of Procedure*, ch. iv.). At a later date the writ again tended to approach its earlier form and to split into two parts, the writ of summons and the declaration or plaintiff's claim. The writ of summons was addressed to the defendant, and not, as the original writ, to a judicial officer. The pleadings became the act of the party, differing in this from Roman law, in which they were a judicial act. The writs became precedents for the forms of action, which, like the writs, were limited in number. The plaintiff's claim was a substantial repetition of the writ. Modern legislation, in the case of the specially indorsed writ of summons (see below), practically returns to this ancient stage of law. In the writ, as in the *formula*, the slightest failure in form was as a rule fatal. "The assigning of a writ of a particular frame and scope to each particular cause of action, the appropriating process of one kind to one action and of a different kind to another, these and the like distinctions rendered proceedings very nice and complex, and made the conduct of an action a matter of considerable difficulty" (1 Reeves, *Hist. of English Law*, 147). Fines were levied for mistakes in pleading, non-liability to which was sometimes granted by charter as a special privilege to favored towns. In both Roman and English law fictions, equity, and legislation came to mitigate the rigor of the law. In England this result was largely attained by the framing of the action of trespass on the case under the powers of the Statute of Westminster the Second (13 Edw. I. stat. 1, c. 24), and by the extension of the action of *assumpsit* to non-feasance. To a less extent the same difficulties were found in the period of special pleading[1] which followed the writ period, owing to the particularity with which the claim had to be set out and the narrow powers of amendment possessed by the courts. The practical questions at issue were thrown into the shade by questions of the proper way of stating them. Substantive law could only be arrived at through the medium of adjective law. Special pleading became an art of the utmost nicety, depending on numerous rules, some of them highly technical (see Coke upon Littleton, 303). Those who made it their business to frame pleadings were called special pleaders. They were not necessarily members of the bar, but might be licensed to practice under the bar. Pleaders under the bar still exist, but recent legislation has much diminished their numbers and importance. Changes were gradually introduced by a long series of statutes of which the most important have been the Statutes of Jeofails, beginning as early as 14 Edw. III., c. 6, the Statutes of Set-off, the Common Law Procedure Acts, and the Judicature Acts. The advance has always been, as in Roman law, in the direction of less formality. Up to 1875 the system of pleading varied in the different courts which now compose the High Court of Justice. In the Common Law Courts the action was commenced by a *declaration* (containing either *special* or *common counts*, or both combined), to which the defendant put in a *plea* or pleas. The plea was either of the general issue, *i, e.*, a bare denial (as "Never Indebted" to an action of debt), or special, setting out the facts with greater particularity. Pleas were also peremptory or dilatory, names taken from the Roman law. By the Common Law Procedure Act, 1854, equitable pleas might be pleaded. To the defendant's plea the plaintiff pleaded a *replication;* the defendant might follow with a *rejoinder*, the plaintiff with a *surrejoinder*, the defendant with a *rebutter*, the plaintiff with a *surrebutter*. Beyond that point, which was seldom reached, the pleadings had no special names. The pleadings concluded with a *joinder of issue*. A copy of the pleadings constituted the *record*. Since the Judicature Acts there has been no record, properly so called, in civil cases, though it has not been expressly abolished. Its place is supplied by copies of the pleadings delivered for the use of the judge and of the officer entering the judgment under the Rules of the Supreme Court, 1883 (Ord. xxxvi. r. 30; Ord. xli. r. 1). Either party might demur at any stage of the pleadings (see DEMURRER). In certain cases the replication of the plaintiff proceeded by way of *new assignment; e. g.*, in an action of trespass to which justification was pleaded, the plaintiff might complain of acts in excess of those covered by the justification. In this case he was said to new assign, and the defendant pleaded to the new assignment. In the Court of Chancery the plaintiff's claim was contained in a *bill* (in certain matters of a public nature an *information*), to which the defendant filed an *answer* on oath or a *demurrer* or, more rarely, *pleas*, and the plaintiff a *replication*. Beyond the replication equity pleadings did not extend, the place of further pleadings being supplied by amendment. *Exceptions* (note again a Roman law term) might be taken to the bill or answer on various grounds. Equity pleadings, unlike common law pleadings, were signed by counsel.[2] In the High Court of Admiralty the pleadings were called *petition*, *answer*, *reply*, and *conclusion*. In the Court of Probate they were called *declaration*, *plea*, and *replication*, but the procedure was not the same as that in use in the Common Law Courts. In all the courts a *special case* without pleadings could by leave of the court be stated for the opinion of the court.

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[1] In Chancery the "English Bill," so called from its being in the English language, had existed long before this time,—according to Mr. Spence, as early as the reign of Henry V. (*Equitable Jurisdiction*, vol. i. p. 348).

[2] In France *plaider* and *plaidoyer* still bear this meaning.

[3] The original writ was so called to distinguish it from the judicial writ, which was a part of the process of the court. The judicial writs still exist, *e. g.*, writs of *certiorari* or *fieri facias*.

The Judicature Act, 1873, introduced a uniform system of pleading in the High Court of Justice. The practice is now regulated by the Rules of the Supreme Court, 1883. By Ord. xix. r. 4, "every pleading shall contain, and contain only, a statement in a summary form of the material facts on which the party pleading relies for his claim or defence, as the case may be, but not the evidence by which they are to be proved, and shall, when necessary, be divided into paragraphs, numbered consecutively. Dates, sums, and numbers shall be expressed in figures and not in words. Signature of counsel shall not be necessary; but where pleadings have been settled by counsel or a special pleader they shall be signed by him, and if not so settled they shall be signed by the solicitor or by the party if he sues or defends in person." The term "pleading" in the Judicature Acts includes a petition or summons, 36 & 37 Vict. c. 66, § 100. From 1875 to 1883 the plaintiff had in almost every case to deliver a *statement of claim*. But now no statement of claim is delivered where the action is commenced by a specially indorsed writ, or where the writ is not specially indorsed unless the defendant gives notice in writing that he requires a statement of claim to be delivered.[3] The defendant presents his case in a *statement of defence*, and may also *set off* or set up by way of *counter-claim* any right or claim against the plaintiff whether sounding in damages or not. A counter-claim may be made against the plaintiff and a third party. To a statement of defence or counter-claim the plaintiff or third party delivers a *reply*. No pleading other than a joinder of issue can be pleaded after reply except by leave of the court or a judge. Both the parties and the court or a judge have large powers of amending the pleadings. Issues are in certain cases settled by the court or a judge. Demurrers are abolished, and a party is now entitled to raise by his pleading any point of law. Forms of pleadings are given in Appendices C, D, and E to the Rules of 1883. In actions for damages by collision between ships, a document called a *preliminary act* (before the Judicature Act peculiar to the Court of Admiralty) must be filed, containing details as to the time and place of collision, the speed, tide, lights, etc. The case may be tried on the preliminary act without pleadings. In all actions such ground of defence or reply as if not raised would be likely to take the opposite party by surprise, or would raise issues of fact not arising out of the preceding pleadings, must be specially pleaded. Such are compulsory pilotage, fraud, the Statute of Limitations, the Statute of Frauds. The pleadings in *replevin* and *petition of right* are governed by special rules. To courts other than the High Court of Justice the Judicature Acts do not apply. In some courts, however, such as the Chancery of the County Palatine of Lancaster and the Court of Passage of the City of Liverpool, the rules of pleading used in the High Court have been adopted with the necessary modifications. In the Mayor's Court of London the common law pleading, as it existed before the Judicature Acts, is still in use. In the ecclesiastical courts the statements of the parties are called generally *pleas*. The statement of the plaintiff in civil suits is called a *libel*, of the promoter in criminal suits *articles*. Every subsequent plea is called an *allegation*. To the responsive allegation of the defendant the promoter may plead a counter-allegation. The cause is concluded when the parties renounce any further allegation. In the Divorce Court the pleadings are named *petition*, *answer*, *replication*. In that court and in the ecclesiastical courts there exists in addition a more short and summary mode of pleading called an *act on petition*. In the county courts proceedings are commenced by a *plaint*, followed by an *ordinary* or *default summons*. No further pleadings are necessary, but the defendant cannot set up certain special defences, such as set-off or infancy, without the consent of the plaintiff, unless after notice in writing of his intention to set up the special defence.

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[1] The ingenuity of the pleader chiefly showing itself in framing special as opposed to general pleas, the term special pleading grew to be used for the whole proceedings of which it was the most important part.

[2] For the pleading before 1875 see Stephen on *Pleading* for the Common Law Courts, Story on *Equity Pleading* for the Court of Chancery, and the articles BILL and DECLARATION.

[3] A specially indorsed writ may be used in an action for a debt or liquidated demand. The advantage of using it is that the defendant must obtain leave to defend the action by showing to the satisfaction of a judge that he has reasonable grounds of defence.

The pleading in English criminal law has been less affected by legislation than the pleading in actions. The pleading is more formal, and oral pleading is still retained. Cases in which the crown was a party early became known as pleas of the crown (*placita coronæ*), as distinguished from common pleas (*communia placita*), or pleas between subject and subject, that is to say, ordinary civil actions. Pleas of the crown originally included all matters in which the crown was concerned, such as exchequer cases, franchises, and liberties, but gradually became confined to criminal matters, strictly to the greater crimes triable only in the king's courts. In criminal pleading the crown states the case in an *indictment* or *information*. The answer of the accused is a *plea*, which must in almost all cases be pleaded by the accused in person. The plea, according to Blackstone, is either to the jurisdiction, a demurrer, in abatement, special in bar, or the general issue. The latter is the only plea that often occurs in practice; it consists in the oral answer of "Guilty" or "Not Guilty" to the charge. A demurrer is strictly not a plea at all, but an objection on legal grounds. Pleas to the jurisdiction or in abatement do not go to the merits of the case, but allege that the court has no jurisdiction to try the particular offence, or that there is a misnomer or some other technical ground for stay of proceedings. The power of amendment and the procedure by motion in arrest of judgment have rendered these pleas of little practical importance. The special pleas in bar are *autrefois convict* or *autrefois acquit* (alleging a previous conviction or acquittal for the same crime), *autrefois attaint* (practically obsolete since the Felony Act, 1870, has abolished attainder for treason or felony), and pardon (see PARDON). There are also special pleas in indictments for libel under the provisions of Lord Campbell's Act, 6 & 7 Vict. c. 96 (see LIBEL), and to indictments for non-repair of highways and bridges, where the accused may plead that the liability to repair falls upon another person. These special pleas are usually, and in some cases must be, in writing. Where there is a special plea in writing, the crown puts in a *replication* in writing. (For the history of criminal pleading see Stephen, *History of the Criminal Law*, vol. i. ch. ix.)

In Scotland an action in the Court of Session begins by a *summons* on the part of the pursuer to which is annexed a *condescendence*, containing the allegations in fact on which the action is founded. The *pleas in law*, or statement of the legal rule or rules relied upon (introduced by 6 Geo. IV. c. 120, § 9), are subjoined to the condescendence. The term *libel* is also used (as in Roman law) as a general term to express the claim of the pursuer or the accusation of the prosecutor. The statement of the defender, including his pleas in law, is called his *defences*. They are either dilatory or peremptory. There is no formal joinder of issue, as in England, but the same end is attained by adjustment of the pleadings and the closing of the record. Large powers of amendment and revisal are given by the Court of Session Act, 1868. In the Sheriff Court pleadings are very similar to those in the Court of Session. They are commenced by a *petition*, which includes a condescendence and a note of the pursuer's pleas in law. The defender may upon notice lodge defences. The procedure is now governed by 39 & 40 Vict. c. 70. The term "pleas of the crown" is confined in Scotland to four offences—murder, rape, robbery, and fire-raising. A prosecution is commenced either by *indictment* or *criminal letters*, the former being the privilege of the lord advocate. In the Supreme Court the indictment or criminal letters run in the name of the lord advocate; in the Sheriff Court the criminal letters (indictments not being used in that court) run in the name of the judge. The Scotch indictment differs from the English, and is in the form of a syllogism, the major proposition stating the nature of the crime, the minor the actual offence committed and that it constitutes the crime named in the major, the conclusion that on conviction of the panel he ought to suffer punishment. The panel usually pleads "Guilty" or "Not Guilty" as in England, but he may plead in bar want of jurisdiction or *res judicata*, or make special defences (such as *alibi* or insanity), which must be lodged with the clerk of the court in writing signed by him or his counsel. The special defence is read to the jury immediately after they have been sworn. (See Macdonald, *Criminal Law of Scotland*.)

In the United States two systems of pleading in civil procedure exist side by side. Up to 1848 the pleading did not materially differ from that in use in England at the same date. But in 1848 the New York legislature made a radical change in the system, and the example of New York has been followed by more than twenty States. The New York Civil Code of 1848 established a uniform procedure called the civil action, applicable indifferently to common law and equity. The pleadings are called *complaint*, *answer* (which includes *counterclaim*), and *reply*. The *demurrer* also is still used. In some States which follow the new procedure the complaint bears the name of *petition*. In the inferior courts, such as courts of justices of the peace, the pleadings are more simple and in many cases oral. In States which do not adopt the amended procedure, the pleading is much the same as it was in the days of Blackstone, and the old double jurisdiction of common law and equity still remains. Criminal pleading differs little from that in use in England. (See Bishop, *Law of Criminal Procedure*.) (J. W†.)

PLEBEIANS. See NOBILITY and ROME.

PLEDGE, or PAWN, in law, is "a bailment of personal property as a security for some debt on engagement" (Story on *Bailments* § 286.) The term is also used to denote the property which constitutes the security. Pledge is the *pignus* of Roman law, from which most of the modern law on the subject is derived. It differs from hypothec and from the more usual kind of mortgage in that the pledge is in the possession of the pledgee; it also differs from mortgage in being confined to personal property. A mortgage of personal property in most cases takes the name and form of a bill of sale (see BILL, the giving of bills of sale being now regulated by the Bills of Sale Acts, 1878 and 1882). The chief difference between Roman and English law is that certain things, *e. g.*, wearing apparel, furniture, and instruments of tillage could not be pledged in Roman law, while there is no such restriction in English law. In the case of a pledge, a special property passes to the pledgee, sufficient to enable him to maintain an action against a wrongdoer, but the general property, that is the property subject to the pledge, remains in the pledgor. As the pledge is for the benefit of both parties, the pledgee is bound to exercise only ordinary care over the pledge. The pledgee has the right of selling the pledge if the pledgor make default in payment at the stipulated time. No right is acquired by the wrongful sale of a pledge except in the case of property passing by delivery, such as money or negotiable securities. In the case of a wrongful sale by a pledgee, the pledgor cannot recover the value of the pledge without a tender of the amount due. For pledges by factors see FACTOR. A pledge by a banker, merchant, broker, attorney, or other agent, in violation of good faith, and contrary to the purpose for which the property pledged was intrusted to him, or a pledge of property with which he was intrusted for safe custody, renders the offender guilty of a misdemeanor, punishable with a maximum term of seven years' penal servitude, 24 & 25 Vict. c. 96, §§ 75, 76. Pledges with pawnbrokers are regulated by the Pawnbrokers' Act, 1872, 35 & 36 Vict. c. 93 (which applies to Great Britain). By the provisions of the Act (which does not affect loans above £10 ($48.60), a pledge is redeemable within one year and seven days of grace added to the year. Pledges pawned for 10s. ($2.43) or under not redeemed in time become the property of the pawnbroker, pledges above 10s. ($2.43) are redeemable until sale. The sale must be by public auction. The pawnbroker is entitled to charge as interest one halfpenny per month on every two shillings lent where the loan is under 40s. ($9.72), on every two shillings and sixpence where the loan is above 40s. ($9.72). Special contracts may be made where the loan is above 40s. ($9.72). Unlawful pawning of goods not the property of the pawner, and taking in pawn any article from a person apparently under the age of sixteen or intoxicated, or any linen or apparel or unfinished goods or materials intrusted to wash, make up, etc., are (*inter alia*) made offences punishable by summary conviction. An annual license, costing £7.10s. ($36.45), must be taken out for every pawnbroker's shop.

The law of Scotland as to pledge generally agrees with that of England, as does also that of the United States. The main difference is that in Scotland and Louisiana a pledge cannot be sold unless with judicial authority. In some of the States the common law as it existed apart from the Factors' Acts is still followed; in others the factor has more or less restricted power to give a title by pledge. In some States pawnbroking is regulated by the local authorities, and not, as in most, by the general law of the State.

PLESIOSAURIANS. The remarkable extinct marine reptiles included in the group of the *Plesiosauria* (or *Sauropterygia*, as they are sometimes called) existed during the whole of the Mesozoic period, that is, from Triassic into Cretaceous times, when they appear to have died out. The best known of these reptiles, and that which gives its name to the group is the *Plesiosaurus*, a genus established by Conybeare in 1821, and including numerous species, some of which may have attained a length of as much as 20 feet. The nearly allied *Elasmosaurus* of North America, however, reached a much greater size, its remains indicating an animal about 45 feet in length. Several almost perfect skeletons of *Plesiosaurus* having at different times been found, the general proportions of the body are well known. Although the different species vary in regard to proportions, the small size of the head and extreme length of the neck are always striking points in the skeleton of a *Plesiosaurus*, while the tail is proportionately short. The limbs, both fore and hind, are well developed and modified for swimming, the forms of the various bones making it clear that the digits of each limb were not separate, but enclosed in one covering of integument, as in the flippers of a whale or a turtle. The exterior of the body, there is every reason to believe, was smooth as it is in *Cetacea*, and not provided with either bony or horny scutes or scales as in the living crocodiles and turtles. The internal skeleton therefore is the only part available for study.

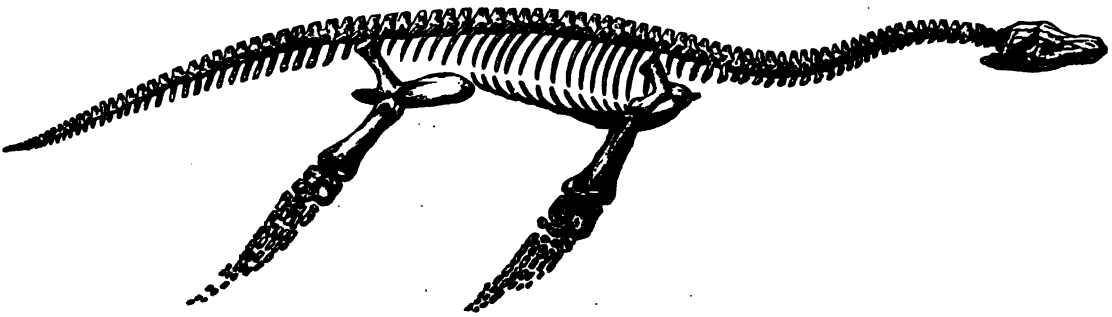

FIG. 1.—*Plesiosaurus* (after Owen).

The skull of *Plesiosaurus* has a tapering and depressed snout, and in consequence of the large size of the premaxillary bones the nasal apertures are placed far back, just in front of the orbit, as in birds. There is a distinct parietal foramen, as in lizards. The orbit is completely surrounded by bone, and there are supra- and infra-temporal fossæ. The single occipital condyle is formed almost entirely by the basi-occipital bone. The basi-sphenoid is well developed, and is produced into a long rostrum. On the base of the skull four fossæ are to be seen; the front pair of these are bounded behind by the palatine bones, and are regarded as the true posterior nares. The teeth are slender, sharp, curved, and striated; they have single fangs, and are placed loosely in separate alveolar sockets.

The spinal column is composed of a large number of vertebræ, some species having ninety or more in the entire series. The centrum of each vertebræ has the fore and hind surfaces slightly concave; the neural arch is connected with the centrum by a suture, which seems never to have been entirely obliterated. The cervical vertebræ vary in number from twenty-four to upwards of forty in different species. Each is provided with a pair of ribs, closely resembling those found in the cervical region in a crocodile, but with a single articular head only. Towards the hinder part of the neck the ribs become more elongated, and take

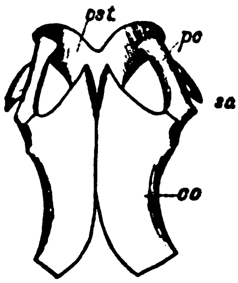

FIG. 2.

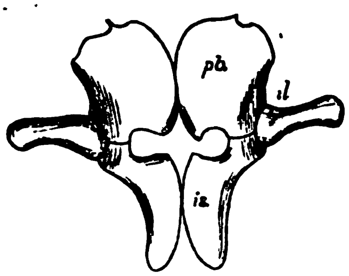

FIG. 3.

FIG 2.—Pectoral arch of *Plesiosaurus*, seen from below (after Hulke). *co*, coracoid; *sc*, scapula; *pc*, precoracoid; *ost*, omosternum.

FIG. 3.—Pelvic arch of *Plesiosaurus*, from above (after Huxley). *is*, ischium; *pb*, pubis; *il*, ilium.

on the form of dorsal ribs; but, as none of the ribs join the sternum, the usual means of distinguishing the dorsal and cervical regions is wanting. There may be from twenty to thirty dorsal vertebræ. True sternal ribs have never been detected; but abdominal bones, or ribs, are well developed. The sacrum consists of two vertebræ, with stout broad ribs for attachment to the iliac bones. The caudal vertebræ, between thirty and forty in number, have distinct chevron bones, which are attached between the successive vertebræ. The pectoral arch (Fig. 2) consists of a large coracoid on each side, in front and outside of which is a peculiarly shaped scapula with a plate extending dorsally from the glenoid cavity, and a second process directed inwards and downwards. The latter process is now regarded as the precoracoid by Mr. J. W. Hulke, who also considers the plate of bone—originally of two pieces—found in the middle and in front of the coracoids to be the homologue of the omosternum of *Batrachia*. If this interpretation be correct *Plesiosaurus* has neither clavicles nor interclavicles. In the forelimb all the characteristic bones are present. The humerus is an elongated bone with the anterior border nearly straight and the hinder border concave; it is rounded at the upper end, and flattened below, where it is articulated to two much shorter bones, the radius and ulna. Next to these is a row of three carpal bones—the radiale (scaphoid), the ulnare (cuneiform), and the intermedium (lunar); a second row of four bones succeeds these, three of which are carpals, but the outer one may be a metacarpal; next comes a row of five metacarpals. The digits are five in number, and with the exception of the first are made up of numerous separate ossicles, or phalanges.

The pelvic arch (Fig. 3) is large, and ventrally consists of a pair of flattened more or less quadrate pubes, and a pair of somewhat triangular ischia. The iliac bones are elongated, narrower where they form part of the acetabular articulation and becoming broader above where they join the sacral ribs. The hind limb very closely resembles the fore limb. The front and back margins of the femur are straighter than they are in the humerus; but the other parts almost exactly repeat the corresponding bones of the fore limb.

With regard to the probable habits of the *Plesiosaurus* we are not without some indications. The paddle-like form of the limbs leaves no doubt as to its aquatic mode of life, and judging from the fossils with which it is usually associated it must have been an inhabitant of the sea; it is highly probable, however, that some species at least ascended rivers, for remains of *Plesiosauria* are found in the Wealden freshwater deposits. The comparatively small tail and large paddles render it probable that the limbs were the chief means of propulsion. The long neck would tend to impede its progress through the water, and it would be better adapted, therefore, for swimming on or near the surface. It is unlikely that the *Plesiosaurus* could move as rapidly through the water as the *Ichthyosaurus*; but this slower movement would be compensated for by the rapidity with which its long and flexible neck could be darted at its prey. Seeing that the marine turtles and seals of the present day make their way on shore, it is quite possible that the *Plesiosaurus* may also have occasionally visited the land. The sharp and slender teeth would be admirably adapted for catching and holding a slippery prey, and there is no doubt that fishes formed in part, if not altogether, its natural food. Indeed, the scales and teeth of fishes have been found, in one case at least, just below the vertebræ, in the region which must have been occupied by the creature's stomach.

It is of interest to note the differences which exist between the *Plesiosaurus* and the ICHTHYOSAURUS (*q.v.*), the latter being the type of another group, the *Ichthyosauria*, which is by some palæontologists included with the *Plesiosauria* in a larger group called *Enaliosauria*. In outward form the *Ichthyosaurus* must have resembled some of the recent *Cetacea*, inasmuch as the head is proportionately large, and without any appearance of a neck joins directly on to the trunk. The hind limbs are smaller than the front ones, and the bones of both limbs are much more shortened and flattened than in *Plesiosaurus*; in addition to this there are supernumerary rows of bones, besides the five typical digital series. The pectoral arch differs in having distinct clavicles and interclavicles. The vertebræ are short from back to front, deeply biconcave, and their neural arches never have a bony connection with the centra. There is no sacrum. The teeth are placed in a groove, and not in separate sockets. The eye-ball was protected by a series of bony sclerotic plates, which are not found in *Plesiosaurus*.

The group *Plesiosauria* includes several other genera besides the *Plesiosaurus*; but most of these are only represented by such imperfect specimens that the distinctions between them, as at present known, are far from satisfactory. The characters which have been relied upon for their separation are to be found chiefly in the structure of the pectoral arch, limbs, and vertebræ. *Plesiosaurus* is only certainly known to have existed from the time of the Lower Lias to the Chalk; and it is especially characteristic of the Lias. More than fifty species, sometimes placed in several subgenera, have been described from different localities in Britain, some of which are represented by remarkably perfect specimens, and others by fragments only. This genus has a wide geographical distribution, species having been named from Secondary strata, on the continent of Europe, in India, Australia, South America, and North America. The closely allied and gigantic form *Pliosaurus* is chiefly characteristic of the English Oolites.

In European Triassic beds, *Plesiosauria* are represented by such genera as *Nothosaurus*, *Simosaurus*, and *Pistosaurus*, in all of which the neural arches seem to have been less closely united to the vertebral centra than in *Plesiosaurus*. *Leusticosaurus* is another Triassic form, remarkable, not only on account of its small size, being less than 12 inches in length, but also because its limbs seem to show a transitional condition; for, while the structure of the hind limb resembles that of a land reptile, the fore limb seems to have had more the structure of a paddle.

A number of forms closely related to the *Plesiosaurus* have been described from rocks of Cretaceous age in North America under the following generic names—*Cimoliasaurus*, *Elasmosaurus*, *Oligosimus*, *Piratosaurus*, and *Polycotylus*. Of these the *Elasmosaurus* is better known than any of the others. It was an extremely elongated form, as may be gathered from the fact that the snake-like neck alone consisted of more than sixty vertebræ,—the entire body, as we have noticed above, being more than 45 feet in length.

See Conybeare, *Trans. Geol. Soc.*, ser. 1, vol. v. p. 559. 1821, and ser. 2, vol. i. p 103, 1824; Owen, *Brit. Assoc. Rep.*, 1839, p. 43; Hawkins. *Great Sea Dragons*. 1840; Phillips, *Valley of the Thames*, 1871; Huxley, *Anat. of Vert Anim.*, 1871, p. 208; Nicholson, *Palæontology*, vol. ii. p. 218, 1879; Sollas, *Quart. Journ. Geol. Soc.*, vol. xxxviii. p. 440, 1881; Hulke, *Presidential Address*, *Geol.* Soc., 1883; Leidy, "Fossil Vertebrates," in *Report U. S. Geol. Surv. Territories*, vol. i., 1873; and Cope, *ibid.*, vol. ii., 1875. (E. T. N.)

PLETHO. See GEMISTUS.

PLEURISY, or PLEURITIS, inflammation of the pleura or serous membrane investing the lungs and lining the interior of the thoracic cavity. It is a common form of chest complaint, and may be either acute or chronic, more frequently the former.

The morbid changes which the pleura undergoes when inflamed are similar to those which take place in other serous membranes, such as the peritoneum (see

PERITONITIS), and consist of three chief conditions or stages of progress. (1) Inflammatory congestion and infiltration of the pleura, which may spread to the tissues of the lung on the one hand, and to those of the chest wall on the other. (2) Exudation of lymph on the pleural surfaces. This lymph is of variable consistence, sometimes composed of thin and easily separated pellicles, or of extensive thick masses or strata, or again showing itself in the form of a tough membrane. It is of grayish-yellow color, and microscopically consists mainly of coagulated fibrine along with epithelial cells and red and white blood corpuscles. Its presence causes roughening of the two pleural surfaces, which, slightly separated in health, may now be brought into contact by bands of lymph extending between them. These bands may break up or may become organized by the development of new bloodvessels, and adhering permanently may obliterate throughout a greater or less space the pleural sac, and interfere to some extent with the free play of the lungs. (3) Effusion of fluid into the pleural cavity. This fluid may vary in its characters. Most commonly it is clear or slightly turbid, of yellowish-green color, sero-fibrinous, and containing flocculi of lymph. In bad constitutions or in cases where the pleurisy complicates some severe form of disease, *e.g.*, the acute infectious maladies, it is deeply-colored, bile-stained, sero-purulent, purulent, or bloody, occasionally containing bubbles of air from decomposition. The amount may vary from an almost inappreciable quantity to a gallon or more. When large in quantity it may fill to distention the pleural sac, bulge out the thoracic wall externally, and compress more or less completely the lung, which may in such cases have all its air displaced and be reduced to a mere fraction of its natural bulk lying squeezed up upon its own root. Other organs, such as the heart and liver, may in consequence of the presence of the fluid be shifted away from their normal position. In favorable cases the fluid is absorbed more or less completely and the pleural surfaces again may unite by adhesions; or, all traces of inflammatory products having disappeared, the pleura may be restored to its normal condition. When the fluid is not speedily absorbed it may remain long in the cavity and compress the lung to such a degree as to render it incapable of re-expansion as the effusion passes slowly away. The consequence is that the chest wall falls in, the ribs become approximated, the shoulder is lowered, the spine becomes curved and internal organs permanently displaced, while the affected side scarcely moves in respiration. Sometimes the unabsorbed fluid becomes purulent, and an *empyœma* is the result. In such a case the matter seeks vent in some direction, and it may point as an abscess upon the chest or abdominal wall, or on the other hand burst into the lung and be discharged by the mouth. It must be observed that many cases of pleurisy do not reach the stage of effusion, the inflammation terminating with the exudation of lymph. To this form the term *dry pleurisy* is applied. Further pleurisy may be limited to a very small area, or, on the contrary, may effect throughout a greater or less extent the pleural surfaces of both lungs.

Pleurisy frequently arises from exposure to cold; hence it is more common in the colder weather; but besides this various other causes are connected with its occurrence. Thus it is often associated with other forms of disease within the chest, more particularly pneumonia, bronchitis, and phthisis, and also occasionally accompanies pericarditis. Again it is apt to occur as a secondary disease in certain morbid constitutional states, *e.g.*, the infectious fevers, rheumatism, gout, Bright's disease, diabetes, etc. Further, wounds or injuries of the thoracic walls are apt to set up pleurisy, and the rupture of a phthisical cavity in the lungs causing the escape of air and matter into the pleura has usually a similar effect.

The symptoms of pleurisy vary, being generally well-marked, but sometimes obscure. In the case of dry pleurisy, which is on the whole the milder form, the chief symptom is a sharp pain in the side, felt especially in breathing. Fever may or may not be present. There is slight dry cough; the breathing is quicker than natural, and is shallow and of catching character. If much pain is present the body leans somewhat to the affected side, to relax the tension on the intercostal muscles and their covering, which are even tender to touch. On listening to the chest by the stethoscope the physician recognizes sooner or later "friction," a superficial rough rubbing sound, occurring only with the respiratory acts and ceasing when the breath is held. It is due to the coming together during respiration of the two pleural surfaces which are roughened by the exuded lymph. The patient may himself be aware of this rubbing sensation, and its vibration or fremitus may be felt by the hand laid upon the thoracic wall during breathing. This form of pleurisy may be limited or may extend over the greater part of one or both sides. It is a not unfrequent complication of phthisis in all its stages. In general it disappears in a short time, and complete recovery takes place; or on the other hand extensive adhesions may form between the costal and pulmonary surfaces of the pleura, preventing uniform expansion of the lung in respiration, and leading to emphysema. Although not of itself attended with danger, dry pleurisy is sometimes preliminary to more serious lung disease, and is always therefore to be regarded while it lasts with some degree of anxiety.

Pleurisy with effusion is usually more severe than dry pleurisy, and, although it may in some cases develop insidiously, it is in general ushered in sharply by rigors and fever, like other acute inflammatory diseases. Pain is felt in the side or breast, of a severe cutting character, referred usually to the neighborhood of the nipple, but it may be also at some distance from the affected part such as through the middle of the body or in the abdominal or iliac regions. This transference of the pain occasionally misleads the medical examiner. The pain is greatest at the outset, and tends to abate as the effusion takes place. A dry cough is almost always present, which is particularly distressing owing to the increased pain the effort excites. The breathing is painful and difficult, tending to become shorter and shallower as the disease advances and the lung on the affected side becomes compressed. The patient at first lies most easily on the sound side, but as the effusion increases he finds his most comfortable position on his back or on the affected side. When there is very copious effusion and, as is apt to happen, great congestion of the other lung, or disease affecting it, the patient's breathing may be so embarrassed that he cannot lie down.

On physical examination of the chest the following are among the chief points observed. (1) On inspection there is more or less bulging on the side affected, obliteration of the intercostal spaces, and sometimes elevation of the shoulder. (2) On palpation with the hand applied to the side there is diminished expansion of one-half of the thorax, and the normal vocal fremitus is abolished. Should the effusion be on the right side and copious, the liver may be felt to have been pushed downwards, and the heart somewhat displaced to the left; while if the effusion be on the left side the heart is displaced to the right. (3) On percussion there is absolute dulness over the seat of the effusion. If the fluid does not fill the pleural sac the floating lung may yield a hyper-resonant note. (4) On auscultation the natural breath sound is inaudible over the effusion. Should the latter be only partial the breathing is clear and somewhat harsh, with or without friction, and the voice sound is ægophonic. Posteriorly there may be heard tubular breathing with ægophony. These various physical signs render it impossible to mistake the disease for other maladies the symptoms of which may bear a resemblance to it, such as pleurodynia.

The absorption or removal of the fluid is marked by the disappearance or diminution of the above-mentioned physical signs, except that of percussion dulness, which may last a long time, and is probably due in part to the thickened pleura. Friction may again be heard as the fluid passes away and the two pleural surfaces come together. The displaced organs are restored to their position, and the compressed lung re-expanded. Frequently this expansion is only partial, and consequently, as already indicated, the chest falls in, the respiration on one side is imperfectly performed, and the patient remains permanently short in breathing to a greater or less degree.

In most instances the termination is favorable, the acute symptoms subsiding and the fluid (if not drawn off) gradually or rapidly becoming absorbed, sometimes after re-accumulation. On the other hand it may remain long without undergoing much change, and thus a condition of *chronic pleurisy* becomes established. Such cases are to be viewed with suspicion, particularly in those who are predisposed to phthisis, of which it is sometimes the precursor.

Pleurisy may exist in a latent form, the patient going about for weeks with a large accumulation of fluid in his thorax, the ordinary acute symptoms never having been present in any marked degree. Cases of this sort are often protracted, and their results unsatisfactory as regards complete recovery.

The chief dangers in pleurisy are the occurrence of a large and rapid effusion, particularly if both sides be affected, causing much embarrassment to the breathing and tendency to collapse; the formation of an empysæmia (often marked by recurring rigors and hectic symptoms); severe collateral congestion of the other lung; imperfect recovery; and the supervention of phthisis. Further the consequences are apt. to be more serious where pleurisy exists as a complication of some pre-existing disease.

The treatment of pleurisy need only be alluded to in general terms. It will necessarily depend as regards details upon the form and severity of the attack. One of the first symptoms calling for treatment is the pain. Opiates in the form of morphia or Dover's powder are useful along with the application to the chest of hot poultices or fomentations sprinkled with turpentine. In severe cases much relief to the pain and difficulty of breathing may be afforded by the application of a few leeches to the side. Cases of simple dry pleurisy usually soon yield to such treatment, aided if need be by the application of a fly-blister or of iodine to the chest. The fixing as far as possible of the one side of the thorax by means of cross straps of adhesive plaster according to the plan recommended by Dr. Roberts seems of use in many instances. In the case of pleurisy with effusion, in addition to these measures, including blistering, the internal use of saline cathartics and diuretics appears to be often of service in diminishing the amount of the fluid in the pleural cavity, as are also powerful diaphoretics such as pilocarpin. When these measures fail to reduce the effusion the question of the artificial removal of the fluid comes to be considered. The operation (thoracentesis) was practiced by the ancient physicians, but was revived in modern times by Trousseau in France and Bowditch in America, by the latter of whom an excellent instrument was devised for emptying the chest, which, however, had been displaced in practice by the still more convenient aspirator. The propriety of this proceeding in pleurisy with effusion has been much discussed, but there now appears to be a general consent that in cases of extensive accumulation, when other means such as those briefly referred to fail to reduce or remove the fluid in a short time, the only hope of preventing such compression of the lung as will impair its function lies in the performance of thoracentesis. All the more will the operation be justifiable if the accumulated fluid is interfering with the function of other organs, such as the heart, or is attended with marked embarrassment of the breathing. The chest is punctured in the lateral or posterior regions, and in most cases the greater portion or all of the fluid may be safely drawn off. In general the operation is unattended with danger, although not entirely exempt from such risks as sudden syncope, and therefore not to be undertaken without due vigilance as well as a careful consideration of the individual case and its associations. In many instances not only is the removal of distressing symptoms speedy and complete, but the lung is relieved from pressure in time to enable it to resume its normal function. When there is any evidence that the fluid is purulent the operation should be performed early. In such cases it is sometimes necessary to establish for a time a drainage of the pleural cavity by surgical measures.

The convalescence from pleurisy requires careful tending, and the state of the chest should be inquired into from time to time, in view of the risks of more serious forms of lung disease supervening. (J. O. A.)

PLEURO-PNEUMONIA. See MURRAIN, vol. xvii. p. 66.

PLEVNA, or **PLEVEN**, the chief town of one of the provinces in the principality of Bulgaria, lies in the midst of a series of hills (whose crests rise above it for 200 to 600 feet) and about 6000 yards to the east of the river Vid (a tributary of the Danube), into which the streamlets by which it is traversed discharge. Its position at the meeting place of roads from Widdin, Sofia, Shipka, Biela, Zimnitza, and Nikopoli gives it a certain military importance, and in the Russian campaign of 1877 it became one of the great centres of operation. The Russians, who had been defeated in two minor attacks on the 20th and 30th of July, were again repulsed with a loss of 18,000 men in an assault (September 7-13) in which they employed 75,000 infantry and 60,000[1] cavalry. They formally invested the town on October 24th and obliged Osman Pasha to surrender on December 10th. In 142 days the assailants had lost 40,000 men and the defenders 30,000. Plevna, which contains two old Christian churches as well as a number of mosques, had 11,129 inhabitants in 1881, the province at the same date containing 100,870.

See F. V. Greene, *The Russian Army and its Campaigns in Turkey in* 1877-78, London, 1879.

PLEYEL, IGNAZ JOSEPH (1757-1831), though now almost forgotten, was once one of the most popular composers in Europe. He was born at Ruppersthal, near Vienna, June 1, 1757, studied the pianoforte under Van Hal (known in England as Vanhall), and learned composition from Haydn, who became his dearest friend. He was appointed maître de chapelle at Strasburg in 1783; and in 1791 he was invited to London, where, though Haydn was also there, he achieved an immense success. On his return to Strasburg he narrowly escaped the guillotine; but, after proving that he was not an aristocrat, he was permitted to remain until 1795, when he migrated to Paris. Here he opened a large music shop, published the first complete edition of Haydn's quartets, and founded, in 1807, the pianoforte manufactory which still bears his name. He died at Paris, November 14, 1831.

Pleyel's compositions are very numerous, but it is only in the earlier ones that the fire of true genius is discernible. His daughter-in-law, Maria Pleyel,—*née* Moke (1811-1875), and wife of his eldest son, Camille,—was one of the most accomplished pianists of the age.

PLINY, THE NATURALIST (23-79 A. D.). Caius Plinius Secundus, commonly distinguished as the elder Pliny, the author of the *Natural History*, is believed to have been born (23 A. D.) at Novum Comum (Como). In the first sentence of his preface he calls Catullus, born at Verona, "conterraneum meum," meaning, perhaps, a native of Gallia Cisalpina, though it may be that Verona was the actual birthplace of both.[2] At Comum, however, was the family estate which the younger Pliny inherited from his uncle. Like his nephew, the elder Pliny had seen military service, having joined the campaign in Germany under L. Pomponius Secundus;[3] like him also, he had been a pleader in the law-courts, and a diligent student of Greek and Roman literature. Much of his literary work was done, he tells us himself, in the hours stolen from sleep. Of his many works the *Naturalis Historia* in thirty-seven books has alone been preserved, and in a nearly complete state. This voluminous treatise professes to be an encyclopædia of Roman knowledge, mainly based on the researches and speculations of the Greek. What A. von Humboldt accomplished in our own times, in his great work *Cosmos*, Pliny had essayed to carry out on similar principles,—but, of course, without the scientific knowledge, and also without the comprehensive view of the universe which is the inheritance of the present age. Pliny, we must admit, was an industrious compiler, but he was not, like Aristotle, a man of original research.[1]

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[1] [F. V. Greene in *Russian Army and its Campaigns in Turkey in* 1877-8 says, "The force brought against Plevna, therefore, numbered over 90,000 men, and was composed of 74,000 infantry, 10,000 cavalry, 24 siege guns, 364 field guns, and 54 horse guns."—AM. ED.]

[2] But, as has been shrewdly remarked by Mr. Long, "this somewhat barbarous word is much better adapted to intimate that Catullus was a fellow-countryman of Pliny than that he was a fellow-townsman."

[3] "De Vita Pomponi Secundi duo (libri)" are enumerated among his uncle's works by the younger Pliny, *Ep.* iii. 5 § 3, who adds, "a quo singulariter amatus hoc memoriæ amici quasi debitum munus exsolvit."

In his first book, which contains a summary of the whole work, he names the authors, both Greek and Latin, from which the matter of each book was derived.[2] The list indeed is a surprising one, and of comparatively few have we any remains. Among Roman authors he most frequently cites Cato the censor, M. Varro, Celsus, Cornelius Nepos, Pomponius Mela, Columella; among the Greeks, Aristotle, Theophrastus, Democritus, more than one Apollodorus, Appollonius of Pergamum, and Hippocrates. The Latin writers he calls simply "auctores;" the Greeks, of whom the list is considerably longer, are "externi."

The preface, written in a rather inflated and by no means clear style, very inferior to the Latinity of the younger Pliny, is a dedication of the work in a strain of extravagant adulation to Titus, who was then, as Cæsar, joint emperor with his father Vespasian. Pliny apologizes for dedicating to such a man a work of such commonplace and hackneyed subject-matter, but he pleads the novelty of the undertaking, and boasts of being the first who had attempted so comprehensive a theme.

The work itself commences with a pantheistic definition of the universe, *Mundus*, *i.e.*, world and sky, and the sun and stars in space. This, he says, is reasonably regarded as a divinity—eternal, boundless, uncreated, and indestructible. Nature, he adds, and Nature's work are one, and to suppose there is more than one universe is to believe there can be more than one Nature,—which he calls "furor." His theology is "agnostic," or Epicurean; if there is any God, he says, it is vain to inquire His form and shape; He is entirely a Being of feeling and sentiment and intelligence, not of tangible existence. He believes in the "religion of humanity," according to a rather recent definition of the idea. God is what Nature is; God cannot do what Nature cannot do; He cannot kill Himself, nor make mortals immortal, nor raise the dead to life, nor cause one who has lived never to have lived at all, or make twice ten anything else than twenty. The last sentence of his work is remarkable, and is characteristic of a pagan piety which takes Nature alone for its God: "Salve, parens rerum omnium Natura, teque nobis Quiritium solis celebratum esse numeris omnibus tuis fave" (xxxvii. 205).

But, although he regarded nature as one whole, of the great doctrine of the unity of nature and the tendency of all its operations to one definite end Pliny had no correct idea. He had a great store of ill-digested knowledge, not only imperfect in itself, but put together on no consistent plan. His style too is forced and somewhat pedantic, so that to read through and understand even a single book is by no means a light task.

To give an outline sketch of the *Natural History*, it may be said that book ii. treats of earth, stars, meteorics, and terrestrial phenomena, such as earthquakes, elevation of islands, etc. Books iii. to vi. inclusive are devoted to a geographical account of the known world, in giving which the author makes no mention of Strabo. Book vii. contains a physical treatise on man, his form, the laws of his birth, age, mental qualities, etc. Book viii. treats of the larger beasts, as elephants, lions, tigers, camels, descending to snakes, crocodiles, and the smaller and domesticated animals. Book ix. includes marine animals of all kinds, fishes, shells, crustaceans, sponges, etc. Book x. is on birds, xi. insects,—the latter half being devoted to an anatomical description of animals generally. Book xii. is on trees; xiii. on their products, fruit, gums, perfumes, etc.; xiv. on the grape and the making of wine; xv. on the olive, fig, apple, and other luscious fruits; xvi. on forest trees, canes, and reeds, kind of timber, and different ages of trees. Book xvii. treats chiefly of the culture of trees, their diseases, and the arts of pruning, manuring, training, etc. Book xviii. is on farming and cereal crops; xix. on other kinds of produce, including horticulture; xx. on the medicinal properties of plants; xxi. on flowers, bees, honey, and on botanical distinctions as to leaves, thorns, and times of flowering. Book xxii. treats of all kinds of herbs used in medicine and in cookery; xxiii. the medicinal properties of cultivated trees; xxiv. the same of forest trees, and their useful products generally. (These two books are chiefly derived from Greek authorities, and include the names and properties of a vast number of species.) Books xxv. to xxvii. inclusive treat of the properties of plants, and these books also are chiefly from Greek sources,—Cornelius Celsus being the principal Roman authority. Books xxviii. to xxx, discuss the medicinal properties residing in animals; xxxi. and xxxii. those in fishes. These books are full of the most extraordinary and nonsensical superstitions, including discussions on magic in book xxx. Book xxxiii. is on the nature and use of the precious metals; xxxiv. on the different kind of bronze, on lead, iron, and the oxides generally. Book xxxv. is on the origin and practice of painting; xxxvi. on the different kinds of stone and marble, including lime, sand, and gypsum; xxxvii. on precious stones.

It will be observed that, though there is no scientific classification in this long work, a kind of sequence, not altogether unphilosophical, is observed. The amount of matter and the number of subjects treated of in each book are always recorded at the end of the epitome (book i.), just before the list of authors, in the formula, "Summa: res et historiæ et observationes MDCVI." etc.; but in the medical books, in place of *res*, "subjects," *medicinæ*, "prescriptions," is used. By *historiæ* he means "inquiries," or "the results of inquiries," as distinguished from *observationes*, "remarks."

With all its faults, inevitable to the infant state of science, Pliny's work is an astounding monument of industry. It is believed to have been published about two years before his death. He wrote, besides several other treatises,[3] a history of the wars from the first in Germany,[4] in twenty books, and a continuation of the history of Aufidius Bassus down to his own times, in thirty-one books—all now lost.

He is said to have been a great student, an early riser, abstemious and temperate in his meals.[5] In his later days he appears to have grown somewhat unwieldy and asthmatic, for Pliny the younger, in describing his uncle's death by suffocation from the fumes in the eruption of Vesuvius, 79 A.D., says that his breathing "propter amplitudinem corporis gravior et sonantior erat."[6] Pliny's intimate friendship with Vespasian may be inferred from his custom of attending the morning levée; he seems to have first known him in the German wars in the time of Claudius.

Besides his published works, the elder Pliny left, as his nephew tells us, one hundred and sixty notebooks of extracts (electorum commentarios clx.), written in a very small hand on both sides of the page. So valuable were these volumes considered that Pliny assured his nephew he could have sold them in Spain for £3500 ($17,010), even before the full number had been made up. He acted as procurator in Spain in 71, and was recalled to Rome by the death of his brother-in-law Caius Cæcilius, who by will appointed him guardian of the younger Pliny. At the time of his death, the elder Pliny had the command of the Roman fleet at Misenum. He fell a victim to his imprudent curiosity in advancing within the range of the thickly-falling ashes during the eruption of Vesuvius in 79 A.D.

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[1] He claims for himself "ingenium perquam mediocre," *Præf.* § 12. His nephew (iii. 5, § 8) calls it "acre ingenium," which may mean active and energetic.

[2] Hence he reckons the number of books at 36, the subject beginning with book ii. The matter of these, he says, comprising 20,000 points worthy of attention, he has collected from the perusal of about 2000 books, and from 100 Roman authors of special note (ex exquisitis auctoribus centum). *Præf.* § 17. The first book the author regards as an appendix to the dedicatory letter or preface, "Quia occupationibus tuis publico bono parcendum erat, quid singulus contineretur libris huic epistulæ subjunxi," *Præf.* § 33.

[3] Three books, in six volumes, were entitled "Studiosus," and eight books bore the title "Dubius Sermo." To this last he probably refers, *Præf.* § 28, "audio—Epicureos quoque parturire adversus libellos quos de grammatica edidi."

[4] Bellorum Germaniæ viginti (libri), quibus *omnia* quiæ cum Germanis gessimus bella collegit (Pliny, *Ep.* iii. 5, § 4). A treatise on throwing the lance from horseback, "De jaculatione equestri," is mentioned here as his first work, written when he was in command of a squadron of cavalry (præfectus alæ).

[5] Pliny, *Ep.* iii. 5, § 16; see *ibid.* §§ 8-10.

[6] *Epist.* vi. 16, § 13.

Pliny's influence on the nomenclature and the popular ideas about common objects long continued to be very extensive, and survived till the dawn of the age of more exact science. The knowledge he gives us of the writings and opinions of so large a number of lost authors opens a view of the whole cycle of the science of the period.

The best editions of the *Natural History* are those by Julius Sillig (Leipsic, 1831-36, in 5 vols. 12mo.), and by Louis Janus (Teubner, Leipsic, 1854-59, in 6 vols.), which is virtually a revised reprint of it, the whole of the last volume being occupied with copious and accurate indices of authors and subjects. These may be called critical editions; two French editions with scientific commentaries had preceded, —by Hardouin (1685 and 1723), and by Panckoucke (1829-33), in twenty volumes with a French translation.

(F. A. P.)

PLINY, THE YOUNGER (61–*c.* 115 A.D.). Caius Cæcilius Secundus, commonly called Pliny the Younger, was the nephew and heir of the elder Pliny, the naturalist. He was born 61 A.D. at Comum (Como) on the southern shore of Lake Larius in northern Italy, near to which, on the east side, stood the spacious and beautiful family villa.[1] He took the name of Cæcilius from his father, who had married Plinia, the elder Pliny's sister. At ten years of age he was left to the care of Virginius Rufus, a distinguished man and thrice consul.[2]

Pliny was a man of refined taste, highly accomplished, devoted to literature, kind and indulgent to his freedmen and his slaves, gentle and considerate in all his family relations, just in his dealings, munificent in the use of his wealth, humane and forgiving to all who had offended him.[3] By profession an advocate, and a pupil of the famous Quintilian (ii. 14), he was a frequent and very popular pleader at the courts of the centumviri held in the Julian basilica, as well as occasionally in the senate and in public prosecutions (vi. 29).

His fame in centumviral trials, which were chiefly concerned with will cases, is attested by Martial (x. 19, 17), whose epigram he quotes in lamenting the poet's death (iii. 21). But, though himself somewhat ambitious of praise as a pleader (for he seems to have regarded Cicero as his model in everything), he sternly reproved the arts of bribery and flattery which were commonly adopted by patrons to secure the applause of their clients. "For half-a-crown a head," he complains, "you may fill the benches with any number of shouters and bawlers of your praises." Fond as he was of eloquence, he seems to have given up legal practice from some feeling of disgust at these abuses, and to have devoted himself to the duties of the state-offices. He was appointed augur and præfect of the treasury in the temple of Saturn, and rose in due course through the offices of quæstor, prætor, and tribune of the people, finally attaining to the consulship, 100 A.D. His inaugural address to the emperor Trajan, a long and finished but rather pedantic oration in Ciceronian Latinity, entitled *Panegyricus*, is extant.[4] "The good old custom," he says in his opening sentence, "of commencing all public business with prayers to the gods is especially to be observed by a consul, and on an occasion of offering public thanks to the best of princes by the command of the senate and the state." The piece teaches us a good deal about the imperial policy and the military career of Trajan (§§13-16).

Between Pliny and Trajan the sincerest regard and even affection seem to have subsisted. In the last book of the *Epistles*, which contains a hundred and twenty-one letters and replies on matters of business connected with the province between Pliny and the emperor, the latter is always addressed as "Domine" (sire), the former as "Secunde (or mi Secunde) carissime." Most of these were written by Pliny as proprætor (103-5) of Bithynia and Pontica, and they show the careful interest taken in the welfare and prosperity of the cities under his charge. The replies of the emperor are characteristically brief; they are written in good and literary Latin, and show Trajan to have been a man of letters as well as a man of business. Pliny's celebrated inquiry what should be done with recusant Christians, in which he says[5] that "not only cities but country towns and rural districts have been touched by the contagion of this superstition," is briefly replied to; "conquirendi non sunt," writes the emperor, "si deferantur et arguantur, puniendi sunt, ita tamen ut qui negaverit se Christianum esse, idque re ipsa manifestum fecerit, id est supplicando dis nostris, quamvis suspectus in præteritum, veniam ex pœnitentia impetret." Pliny had said: "Those who obstinately persisted that they were Christians, after being warned of the consequence, I ordered to be led off to punishment, not doubting that, whatever it was that they professed, their inflexible obstinacy deserved it." Doubts have even been raised as to the genuineness of a passage which appears so inconsistent with the established Roman policy of tolerating every *superstitio*. But it is clear that what Pliny doubted was the fidelity to the emperor of those who refused to make the customary religious offerings to his statue. It was zeal for loyalty that led him into a course which his humane nature condemned.[6]

Pliny was twice married, but had no children. The emperor bestowed on him the *jus trium liberorum*, which conferred certain state privileges upon those who brought up that number of legitimate children to become Roman citizens. Three affectionate letters, none of them long, are addressed to his second wife Calpurnia Hispulla.

In health Pliny seems to have been far from robust. He speaks of his slight and thin figure, "gracilitas mea,"[7] though in his youth he had seen military service in the East.[8] He was fond too of hunting, but used to boast that he combined the worship of Diana with that of Minerva.[9]

Pliny's great wealth was most liberally bestowed, both privately and publicly. He undertakes to rebuild a temple of Ceres on his estate, entirely at his own cost, with a new statue and the addition of a portico, with walls and floor decorated with marbles.[1] To his friend Romatius Firmus, a fellow-townsman, he writes[2] that in order to have the pleasure of seeing him an *eques* he offers £2500 ($12,150) to make up the equestrian census. To Calvina, in addition to nearly £1000 ($4,860), which he had given her as a marriage portion, he offers to remit the whole of the mortgage debt on an encumbered estate which she had inherited from her father. He founded and endowed with landed property an almshouse for people of free birth of both sexes.[3] He presented his nurse with a farm worth nearly £1000 ($4,860);[4] he gave fifty sestertia[5] as a marriage present to the daughter of his tutor Quintilian; he gave up to the township of Comum a sum of about £3500 ($17,010), which having been illegally left to it by Saturninus, Pliny, as his heir, could have claimed for himself,—and this in addition to over £10,000 ($48,600) which he had already given to the same township. He generously returned a large percentage of the sum he had sold his vintage for, when the produce had been found to disappoint the purchasers.[6] In a beautiful letter to Sabinianus[7] he kindly intercedes for a *libertus* with whom his friend was offended. In a word, the letters are full of acts of Pliny's goodness and generosity, and these are not boastfully expressed, but rather with the view of inciting others by his example.

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[1] "Quid agit Comum, tuæ meæque deliciæ?" he writes to Caninius Rufus, *Ep*. i. 3. He had several country houses on this estate (plures villæ, *Ep*. ix. 7). Two of these, his especial favorites, he playfully called "Tragedy and Comedy," comparing the low and the lofty site to the *soccus* and the *cothurnus* of the actors.

[2] Pliny speaks of him with great regard in ii. 1, §8:- "Ille mihi tutor relictus adfectum parentis exhibuit."

[3] His motto was "to pardon others as if one daily needed pardon oneself, and to abstain from sins as if one viewed sin as unpardonable," viii. 22. In *Ep*. 2 of the same book he finely says, "Mihi egregium in primis videtur, ut foris ita domi, ut in magnis ita in parvis, ut in alienis ita in suis, agitare justitiam."

[4] He alludes to it in iii. 13, and in iii. 18 he explains how the address in the senate was afterwards expanded into a book, and recited for three consecutive days to his friends. The title *Panegyricus* appears then to have been given to it.

[5] x. 96, § 9.

[6] The context shows that he had some suspicion that the Christians were forming secret and illegal societies (hetæriæ, § 8). This is his only excuse for having put two deaconesses (ministræ) to the torture, to find out what they really held.

[7] ii. 11, § 15. [8] iii. 11, § 5.

[9] ix. 10. In i. 6 he gives a droll account of his hunting wild boars, and reading books while the beaters were at work: "ad retia sedebam; erat in proximo non venabulum aut lancea, sed stilus et pugillares; meditabar aliquid enotabamque, ut si manus vacuas plenas tamen ceras reportarem."

There are few, if indeed any, remains of Roman prose literature which are as elegant, as interesting, and as varied as Pliny's *Letters*. They were evidently written and published[8] on the model and precedent of Cicero's *Letters*. They are all carefully composed, and couched in the most graceful and polished Latinity. The first letter is a reply to a friend, Septicius, who had often requested Pliny to collect and publish his more carefully written correspondence,—"si quas paullo curatius scripsisset." An admirer of nature, and with the faculty for observation perhaps learnt from his uncle, he sometimes describes, and in the most beautiful language, the scenes or wonders he had visited.[9] Of his spacious and beautiful villas in Tuscany and at Laurentum he has given full and detailed accounts, which are of especial value as almost the sole authority on the difficult subject of Roman houses.[10] The Tuscan estate appears to have been his favorite residence. In reply to his friend Fuscus (ix. 36) he gives a pleasing account of the daily life and studies of a refined and temperate man, and a considerate country gentleman, neighbor and landlord. Of the eruption of Vesuvius in 79 A.D., and the death of his uncle, he gives a minute and evidently faithful account as an eye-witness. This is contained in two long letters[11] to his friend Tacitus the historian. Two excellent ghost-stories are given,[12] and a letter to Tacitus on the omens of dreams[13] shows that both the friends had considerable credulity on this subject.

Like Cicero, but not so frequently, Pliny occasionally[14] "ventilates" his Greek, and he tells us that at the age of fourteen he wrote a Greek tragedy, adding jocosely, "qualem? inquis: nescio; tragœdia vocabatur"(vii. 4, § 2). Like Cicero too, he was fond of art; he describes with enthusiasm[15] a Corinthian bronze statuette which he had just purchased out of a legacy received.

As a writer Pliny the younger is as graceful, fluent, and polished as the style of the elder Pliny is crabbed and obscure. Indeed the Latinity of the epistles cannot fairly be called inferior to that of Cicero himself. There are few indications of the "deterioration" (if progress and development in a language ought so to be called) of the "Silver Age." That he imitated Cicero both in his style and his eloquence is avowed by himself.[16] As a friend of Tacitus, whom he often mentions, he predicts the "immortality" of the books of his history, and he even proffered his services in reading Tacitus's MSS.[17] He writes also to Suetonius and to Cornelius Nepos, the latter of whom he speaks of as "vir gravissimus, doctissimus, disertissimus;" the former he praises to Trajan,[18] in asking for him the *jus trium liberorum*, "probissimum honestissimum eruditissimum virum."

Pliny's *Epistles* were first printed in 1471, but incomplete, as was the Aldine edition of 1508. A full account of the MSS. and editions is given by H. Keil in his preface; among the best editions of later times are that of Cortius, published in 1734; after his death that of G. H. Schaefer (who reprinted with corrections, in 1805, the text of Gesner and Gierig, 1800), and that of Maurice Doering, 1843. The latest and best is the Teubner text of H. Keil (Leipsic, 1865, 12mo), with full indices and brief introductory notice of the most important different readings. (F. A. P.)

PŁOCK (PLOTSK), a government of Russian Poland, on the right bank of the Vistula, having the provinces of Western and Eastern Prussia on the north, and the Polish provinces of Łomza on the east and Warsaw on the south; its area is 4200 square miles. Its flat surface, 350 to 500 feet above the sea-level, gently rises towards the north, where it merges in the Baltic coast-ridge of the Prussian lake district. Only a few hills reach 600 feet above the sea, while the broad valley of the Vistula has an elevation of but 130 to 150 feet. In the west—district of Lipno—broad terraces covered with forests, small lakes, and ponds, and very poor in vegetation, descend from the Baltic lake-district towards the plains of Płock; and in the central district of Mława extensive marshes cover the upper basin of the Wkra. The Vistula borders the province on the south, almost from Warsaw to Thorn, receiving the Skrwa and Wkra, which last rises on the Prussian frontier, and, flowing southeast, joins the Narew close to its confluence with the Vistula, in the southeastern corner of Płock. The Drwęca, or Drewenz, flows along the northwest boundary of Płock, while several small tributaries of the Narew water the northeastern district of Ciechanow. Petty lakes and ponds dot the plains in the west, and the whole country bears traces of a very wide extension of lakes during the post-Glacial period. Peat-bogs, used of late for fuel, and marshes containing bog-iron, fill many depressions in the north, while the more elevated parts of the plains are covered with fertile clays, or a kind of "black-earth." Lacustrine post-Glacial deposits cover all depressions in the thick sheet of boulder clay, with Scandinavian erratic boulders, which extends everywhere over the Tertiary sands and marls,—these last containing masses of silicated wood and lignite. Layers of gypsum are found in the hills on the Vistula. The soil is very fertile in several parts of the province, especially in the district of Lipno and closer to the Vistula, and agriculture is the chief occupation of the inhabitants even in the towns. The chief crops are, however, rye, oats, and barley; but wheat gives good crops in some parts of the province; beet-root is also cultivated for sugar, especially on the great estates of the west, where machinery finds application to agriculture on a large scale; in the north the property is much divided, and the *szlachta*-landholders, very numerous in Ciechanow, are far from prosperous. The average crops of late years may be valued at 1,700,000 quarters [13,600,000 bu.] of corn and 1,575,000 quarters [12,600,000 bu.] of potatoes. The forests, which formerly covered very extensive tracts, are much destroyed now, but still Płock is one of the best wooded provinces of Poland.

The population of the province of Płock, which was but 490,950 in 1873, reached 538,150 in 1881, and must be now about 557,000. It is Polish throughout, but contains a large admixture of Jews (more than 11 per cent.) and of Germans, the number of whom is yearly increasing. Besides agriculture, the inhabitants find a permanent source of occupation in shipping on the Vistula, some mining, and various domestic trades, such as the fabrication of wooden cars, sledges, and wheels, and textile industry. The whole value of manufactures in 1879 was £211,000 [$1.025,460] (flour mills £68,900 [$334,854], saw-mills £17,500 $85,050], sugar works £45,700 [$221,102], and iron works £32,200 [$156,492]), and 1750 hands were employed. There is some export trade, especially in the Lipno district; but its development is limited by the lack of facilities of communication, the best being those offered by the Vistula. The railway from Warsaw to Dantzic, *via* Ciechanow and Mława, will now help the eastern part of the province.

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[1] ix. 39. A similar offer is made to Trajan, including the dedication of his statue, *Ep. Pl. et Tr.*, 8.

[2] i. 19. [3] vii. 18. [4] vi. 8.

[5] About £430 ($2090), vi. 32. [6] viii. 2.

[7] ix. 21. "Tunc præcipua mansuetudinis laus," he well says, "cum iræ causa justissima est."

[8] Keil (*Præf.* to ed. Teubner, 1865, p. 1) quotes Sidonius Apollinaris, *Epist.* ix. 1, to show that nine books of his *Letters* were edited by Pliny himself.

[9] *E. g.*, the sources of the Clitumnus, viii. 8, and the floating islands on a lake at Ameria, viii. 20.

[10] See ii. 17 and v. 6. The former describes in glowing terms the Laurentian villa, though he says of it in iv. 6, "nihil ibi possideo præter tectum et hortum, statimque harenas"; but he is comparing the extent of other landed properties.

[11] vi. 16 and 20. [12] vii. 27.

[13] i. 18.[a] It is clear from *Ann.* vi. 28 that Tacitus had some belief in astrology. Pliny the elder wrote his history of the German wars "somnio monitus," *Ep.* iii. 5, § 4.

[14] *E. g.* in i. 18 and 20; ii. 3; iv. 7; ix. 26.

[15] iii. 6. He says, however (§ 1), that in bronzes he was not much of a critic; "in hac re certe perquam exiguum sapio."

[a] [Ep. 1, 18 is addressed to Suetonius.—AM. ED.]

[16] *Cf.* i. 5, § 12; iv. 8, § 4.

[17] See vii. 20; viii. 7; vii. 33, § 1; ix. 14.

[18] *Ep. Pl. et Traj.* 94.

Since the Prussian occupation, and perhaps under the influence of Prussian neighborhood, the province of Płock is somewhat better supplied with primary schools, especially in its northern districts, than other provinces of Poland; *still* there are only 272 primary schools (exclusive of the Jewish *heders*), with 15,000 scholars. There are two colleges for boys and girls, and one seminary for teachers at Wymysly.

The province is divided into eight districts, the chief towns of which are Płock (22,140 inhabitants), Ciechanow (5800), Lipno (5650), Mława (10,050), Płońsk (6350), Przasnysz (7200), Rypin (3350), and Sierpce (6850). Novogeorgievsk, or Modlin, on the Vistula, 12 miles below its confluence with the Narew, is a fortress of the first rank; Wyszgorod (4400) has considerable trade in corn.

History.—After the second dismemberment of Poland in 1793, what is now the government of Płock became part of Prussia. It fell under Russian dominion after the treaty of Vienna, and, in the division of that time into five provinces, extended over the western part of the present province of Łomza, which was created in 1864 from the Ostrolenka and Pultusk districts of Płock together with parts of the province of Augustowo.

Płock, capital of the above province, is situated on the right bank of the Vistula, 60 miles to the west-northwest of Warsaw. It is well built of stone on a high hill facing the river, and has an ancient cathedral. It is now of importance only as the seat of the provincial administration; and its population, which is partly agricultural, increases very slowly. In May, 1883, it had 19,640 inhabitants, of whom 7135 were Jews and about 450 Germans. The Russian garrison numbered 2500. Płock has two colleges for boys and girls, with 864 male and 496 female scholars, and twelve primary schools (exclusive of the Jewish *heders*), with 890 scholars. Its manufactures are insignificant (not above 100,000 roubles yearly), and there is some trade in agricultural produce.

PLOTINUS. See NEOPLATONISM, vol. xvii. p. 344 *sq.*

PLOUGH. See AGRICULTURE, vol. i. p. 277.

PLOVER, French *Pluvier*, Old French *Plovier*, which doubtless has its origin in the Latin *pluvia*, rain (as witness the German equivalent *Regenpfeifer*, Rain-fifer); but the connection of ideas between the words therein involved, so that the former should have become a bird's name, is doubtful. Belon (1555) says that the name *Pluvier* is bestowed "pour ce qu'on le prend mieux en temps pluvieux qu' en nulle autre saison." which is not in accordance with modern observation, for in rainy weather Plovers are wilder and harder to approach than in fine. Others have thought it is from the spotted (as though with rain-drops) upper plumage of two of the commonest species of Plovers, to which the name especially belongs—the *Charadrius pluvialis* of Linnæus, or Golden Plover, and the *Squatarola helvetica* of recent ornithologists, or Gray Plover. Both these birds are very similar in general appearance, but the latter is the larger and has an aborted hind-toe on each foot.[1] Its axillary feathers are also black, while in the Golden Plover they are pure white, and this difference often affords a ready means of distinguishing the two species when on the wing, even at a considerable distance. The Gray Plover is a bird of almost circumpolar range, breeding in the far north of America, Asia, and eastern Europe, frequenting in spring and autumn the coasts of the more temperate parts of each continent, and generally retiring further southward in winter—examples not unfrequently reaching the Cape Colony, Ceylon, Australia, and even Tasmania. *Charadrius pluvialis* has a much narrower distribution, though where it occurs it is much more numerous as a species. Its breeding quarters do not extend further than from Iceland to western Siberia, but include the more elevated tracts in the British Islands, whence in autumn it spreads itself, often in immense flocks, over the cultivated districts if the fields be sufficiently open. Here some will remain so long as the absence of frost or snow permits, but the majority make for the Mediterranean basin, or the countries beyond, in which to winter; and, as with the Gray Plover, stragglers find their way to the southern extremity of Africa. The same may be said, *mutatis mutandis*, of what are usually deemed to be two other cognate forms, *C. virginicus* and *C. fulvus*, which respectively represent *C. pluvialis* in America and eastern Asia, where they are also known by the same English name. The discrimination of these two birds from one another requires a very acute eye, and room is here wanting in which to specify the minute points in which they differ;[2] but both are easily distinguished from their European ally by their smaller size, their grayish-brown axillary feathers, and their proportionally longer and more slender legs. All, however,—and the same is the case with the Gray Plover,—undergo precisely the same seasonal change of color, greatly altering their appearance and equally affecting both sexes. In the course of spring or early summer nearly the whole of the lower plumage from the chin to the vent, which during winter has been nearly pure white, becomes deep black. This is partly due to the growth of new feathers, but partly to some of the old feathers actually changing their color, though the way in which the alteration is brought about is still uncertain.[3] A corresponding alteration is at the same season observable in the upper plumage; but this seems chiefly due (as in many other birds) to the shedding of the lighter-colored margins of the feathers, and does not produce so complete a transformation of appearance, though the beauty of the wearer is thereby greatly increased.

Though the birds just spoken of are those most emphatically entitled to be called Plovers, the group of Ringed Plovers before mentioned (KILLDEER, vol. xiv. p. 78) and the LAPWING vol. xiv. p. 308), with its allies, have, according to usage, hardly less claim to the name, which is also extended to some other more distant forms that can here have only the briefest notice. Among them one of the most remarkable is the "Zickzack" (so-called from its cry)—the τροχίλος of Herodotus (see HUMMING-BIRD, vol. xii. p. 371, n. 3), the *Pluvianus* or *Hyas ægyptius* of ornithologists, celebrated for the services it is said to render to the crocodile—a small bird whose plumage of delicate lavender and cream-color is relieved by markings of black and white. This probably belongs to the small section generally known as Coursers, *Cursorius*, of which some eight or ten species inhabit the deserts of Africa and India, while one, *C. gallicus*, occasionally strays to Europe and even to England. Allied to them are the curious PRATINCOLES (*q.v.*), also peculiar to the

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[1] But for this really unimportant distinction both birds could doubtless have been kept by ornithologists in the same genus, for they agree in most other structural characters. As it is they have long been sundered.

[2] Schlegel (*Mus. Pays-Bass Cursores*, p. 58) states that in some examples it seems impossible to determine the form to which they belong; but ordinarily American specimens are rather larger and stouter, and have shorter toes than those from Asia.

[3] It is much to be regretted that ornithologists favorably situated in regard to zoological gardens have not more extensively used opportunities which might thus be accorded to them of conducting useful observations on this subject and others of similar kind. Elsewhere it would be hardly possible to carry on such an investigation. and even under the best circumstances it would not be easy and would require unremitting attention. The results of some partial observations superintended by Yarrell in the gardens of the Zoological Society of London are given in its *Transactions* (i. pp. 13-19). Little has been done there since of this nature.

Old World, while the genera *Thinocoris* and *Attagis* form an outlying group peculiar to South America, that is by some systematists regarded as a separate Family *Thinocoridæ*, near which are often placed the singular SHEATHBILLS (*q.v.*). By most authorities the Stone-Curlews (CURLEW, vol. vi. p. 628), the OYSTER-CATCHERS (vol. xviii. p. 114), and TURNSTONES (*q.v.*) are also regarded as belonging to the Family *Charadriidæ*, and some would add the Avocets (*Recurvirostra*) and STILTS (*q.v.*), among which the Cavalier, *Dromas ardeola*—a form that has been bandied about from one Family and even Order to another—should possibly find its resting-place. It frequents the sandy shores of the Indian Ocean and Bay of Bengal from Natal to Aden, and thence to Ceylon, the Malabar coast, and the Andaman and Nicobar Islands,—a white and black bird, mounted on long legs, with webbed feet, and a bill so shaped as to have made some of the best ornithologists lodge it among the TERNS (*q.v.*).

Though the various forms here spoken of as Plovers are almost certainly closely allied, they must be regarded as constituting a very indefinite group, for hardly any strong line of demarcation can be drawn between them and the SANDPIPERS and SNIPES (*q.v.*). United, however, with both of the latter, under the name of *Limicolæ*, after the method approved by the most recent systematists, the whole form an assemblage the compactness of which no observant ornithologist can hesitate to admit, even if he be not inclined to treat as its nearest relations the Bustards on the one hand and the *Gaviæ* on the other, as before suggested (ORNITHOLOGY, vol. xviii. p. 49). (A. N.)

PLÜCKER, JULIUS (1801–1868), mathematician and physicist, was born at Elberfeld on the 16th June, 1801. After being educated at the gymnasium at Düsseldorf and studying at the universities of Bonn, Heidelberg, and Berlin, he went in 1823 for a short time to Paris, where he came under the influence of the great school of French geometers, whose founder, Monge, was only recently dead; and there can be no doubt that his intercourse with the mathematicians of that school, more particularly with Poncelet and Gergonne, greatly helped to determine the earlier part at least of his career. In 1825 he was received as "privat-docent" at Bonn, and after three years he was made professor extraordinary. The title of his "habilitationsschrift," *Generalem analyseos applicationem ad ea quæ geometriæ altioris et mechanicæ basis et fundamenta sunt e serie Tayloria deducit Julius Plücker* (Bonn, 1824), indicated the course of his future researches. The mathematical influence of Monge had two sides represented respectively by his two great works, the *Géométrie Descriptive* and the *Application de l'Analyse à la Géométrie.* Although fully master of those general ideas of modern geometry whose development began with the publication of the former of these works, Plücker's actual labors lay more in the direction of the latter. It was his aim to furnish modern geometry with suitable analytical methods and thus to give it an independent analytical development. In this effort he was as successful as were his great contemporaries Poncelet and Steiner in cultivating geometry in its purely synthetical form. From his lectures and researches at Bonn sprang his first great work *Analytisch-Geometrische Entwickelungen* (vol. i. 1828, vol. ii. 1831).

In the first volume of this treatise Plücker introduced for the first time[1] the method of abridged notation which has become one of the characteristic features of modern analytical geometry. The peculiarity of this method consists in this, that the letters used in the equations of curves and surfaces represent, not coördinates of a point with respect to arbitrary chosen axes, but straight lines, or it may be curves or surfaces, intrinsically related to the figure under discussion. For example, if it be wished to investigate the properties of a conic section with respect to a pair of tangents and their chord of contact, we write its equation $uv+w^2=0$, where $u=0$, $v=0$, $w=0$ represents the two tangents and the chord of contact respectively. This procedure has two great advantages. It enables us to greatly abridge the necessary analytical equations, to arrive at them more easily, and thus to lighten or altogether avoid the cumbersome algebraical calculations which had broken the back of the old-fashioned Cartesian geometry and arrested its progress altogether; and it greatly facilitates the geometrical interpretation of analytical results whether intermediate or final. In the first volume of the *Entwickelungen*, Plücker applied the method of abridged notation to the straight line, circle, and conic sections, and he subsequently used it with great effect in many of his researches, notably in his theory of cubic curves.

In the second volume of the *Entwickelungen*, Plücker clearly established on a firm and independent basis the great principle of duality. This principle had originally been established by Poncelet as a corollary on the theory of the pole and polar of a conic section. Gergonne maintained the independent and fundamental nature of the principle, and hence arose a violent discussion between him and Poncelet into which Plücker was drawn. He settled the matter in Gergonne's favor by introducing the notion of the coördinates of a line and of a plane, and showing that in plane geometry, for example, we could with equal readiness represent a point either by means of coördinates or by means of an equation, and that the same was true of a line. Hence it appeared that the point or the line in plane geometry, and the point or the plane in solid geometry, could with equal readiness and with equal reason be taken as elements. It was thus made evident that any system of equations proving a theorem regarding points and lines or regarding points and planes could at once be read as proving another in which the words *point* and *line* or the words *point* and *plane* were everywhere interchanged.

Another subject of importance which Plücker took up in the *Entwickelungen* was the curious paradox noticed by Euler and Cramer, that, when a certain number of the intersections of two algebraical curves are given, the rest are thereby determined. Gergonne had shown that when a number of the intersections of two curves of the $(p+q)$th degree lie on a curve of the pth degree the rest lie on a curve of the qth degree. Plücker finally (*Gergonne Ann.*, 1828–29) showed how many points must be taken on a curve of any degree so that curves of the same degree (infinite in number) may be drawn through them, and proved that all the points, beyond the given ones, in which these curves intersect the given one are fixed by the original choice. Later, simultaneously with Jacobi, he extended these results to curves and surfaces of unequal order. Allied to the matter just mentioned was Plücker's discovery of the six equations connecting the numbers of singularities in algebraical curves. It will be best described in the words of Clebsch: "Cramer was the first to give a more exact discussion of the singularities of algebraical curves. The consideration of singularities in the modern geometrical sense originated with Poncelet. He showed that the class k of a curve of the nth order, which Gergonne by an extraordinary mistake had considered to be identical with its order, is in general $n(n-1)$; and hence arose a paradox whose explanation became possible only through the theory of the simple singularities. By the principle of duality the order n of a curve should be derived in the same way from the class k as k is from n. But if we derive n in this way from k we return not to n but to a much greater number. Hence there must be causes which effect a reduction during this operation. Poncelet had already recognized that a double point reduces the class by 2, a cusp at least by 3, and a multiple point of the pth order, all of whose tangents are distinct, by $\frac{1}{2}p(p-1)$. Here it was that Plücker took up the question. By first directly determining the number of the points of inflection, considering the influence of double points and cusps, and finally applying the principle of duality to the result obtained, he was led to the famous formulæ for the singularities of curves which bear his name, and which completely resolve the paradox of Poncelet—formulæ which already in the year 1854 Steiner could cite as the 'well known,' without, however, in any way mentioning Plücker's name in connection with them. Plücker communicated his formulæ in the first place to *Crelle's Journal*, vol. xii. (1834), and gave a further extension and complete account of his theory in his *Theorie der Algebraischen Curven*, 1839."

In 1833 Plücker left Bonn for Berlin, where he occupied for a short time a post in the Friedrich Wilhelm's Gymnasium. He was then called in 1834 as ordinary professor of mathematics to Halle. While there he published his *System der Analytischen Geometrie, auf neue Betrachtungsweisen gegründet, und insbesondere eine Ausführliche Theorie der Curven dritter Ordnung enthaltend*, Berlin, 1835. In this work he introduced the use of linear functions in place of the ordinary coördinates, and thereby increased the generality and elegance of his equations; he also made the fullest use of the principles of collineation and reciprocity. In fact he develops and applies to plane curves, mainly of the third degree, the methods which he had indicated in the *Entwickelungen* and in various memoirs published in the interim. His discussion of curves of the third order turned mainly on the nature of their asymptotes, and depended on the fact that the equation to every such curve can be put into the form $pqr + \mu s = 0$. He gives a complete enumeration of them, including two hundred and nineteen species. In 1836 Plücker returned to Bonn as ordinary professor of mathematics. Here he published his *Theorie der Algebraischen Curven* which formed a continuation of the *System der Analytischen Geometrie*. The work falls into two parts, which treat of the asymptotes and singularities of algebraical curves respectively; and extensive use is made of the method of counting constants which plays so large a part in modern geometrical researches. Among the results given we may mention the enumeration of curves of the fourth order according to the nature of their asymptotes, and according to the nature of their singularities, and the determination for the first time of the number of double tangents of a curve of the fourth order devoid of single points.

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[1] The independent development of a similar idea by the brilliant young French geometer Bobillier (1797–1832) was cut short by his premature death.

From this time Plücker's geometrical researches practically ceased, only to be resumed towards the end of his life. It is true that he published in 1846 his *System der Geometrie des Raumes in neuer Analytischer Behandlungsweise*, but this contains merely a more systematic and polished rendering of his earlier results. It has been said that this cessation from pure mathematical work was due to the inappreciative reception accorded by his countrymen to his labors, and to their jealousy of his fame in other lands; it seems likely, however, that it was due in some degree to the fact that he was called upon to undertake the work of the physical chair at Bonn in addition to his proper duties. In 1847 he was made actual professor of physics, and from that time his wondrous scientific activity took a new and astonishing turn.

Plücker now devoted himself to experimental physics in the strictest sense as exclusively as he had formerly done to pure mathematics, and with equally brilliant results. His first physical memoir, published in *Poggendorff's Annalen*, vol. lxxii., 1847, contains his great discovery of magnecrystallic action. Then followed a long series of researches, mostly published in the same journal, on the properties of magnetic and diamagnetic bodies, establishing results which are now part and parcel of our magnetic knowledge. It is unnecessary here to analyze these researches, of which an account has been given in the article MAGNETISM (vol. xv. p. 264 *sq.*); it will be sufficient to say that in this work Plücker was the worthy collaborateur, and, had it not been that their fast friendship and mutual admiration renders the word inappropriate, we might have said rival, of Faraday.

In 1858 (*Pogg. Ann.*, vol. ciii.) he published the first of his classical researches on the action of the magnet on the electric discharge in rarefied gases (see ELECTRICITY, vol. viii. p. 69). It is needless now to dilate upon the great beauty and importance of these researches, which remain the leading lights in one of the darkest channels of magnetic science. All the best work that has recently been done on this important subject is simply development of what Plücker did, and in some instances (notably in many of the researches of Crookes) merely reproduction on a larger scale of his results.

Plücker, first by himself and afterwards in conjunction with Hittorf, made many important discoveries in the spectroscopy of gases. He was the first to use the vacuum tube with the capillary part now called a Geissler's tube, by means of which the luminous intensity of feeble electric discharges was raised sufficiently to allow of spectroscopic investigation. He anticipated Bunsen and Kirchhoff in announcing that the lines of the spectrum were characteristic of the chemical substance which emitted them, and in indicating the value of this discovery in chemical analysis. According to Hittorf he was the first who saw the three lines of the hydrogen spectrum, which a few months after his death were recognized in the spectrum of the solar protuberances, and thus solved one of the mysteries of modern astronomy. For a fuller account of the important discoveries regarding the influence of temperature and pressure on the nature of gaseous spectra made in conjunction with Hittorf see SPECTRUM ANALYSIS.

Hittorf, who had good means of knowing, tells us that Plücker never attained great manual dexterity as an experimenter. He had always, however, very clear conceptions as to what was wanted, and possessed in a high degree the power of putting others in possession of his ideas and rendering them enthusiastic in carrying them into practice. Thus he was able to procure from the Sayner Hütte in 1846 the great electromagnet which he turned to such noble use in his magnetic researches; thus he attached to his service his former pupil the skilful mechanic Fessel; and thus he discovered and fully availed himself of the ability of the great glass-blower Geissler, in conjunction with whom he devised many of those physical instruments whose use all over the civilized world has rendered the name of the artificer of Bonn immortal. It was thus also that, when he felt his own want of chemical knowledge and manipulative skill, he sought and obtained the assistance of Hittorf, one of the ablest of German experimenters.

Induced by the encouragement of his mathematical friends in England, Plücker in 1865 returned once more to the field in which he first became known to fame, and adorned it by one more great achievement—the invention of what is now called Line Geometry. A remark containing the fundamentally new idea of this new geometry had, as Clebsch remarks, already been embodied in the *System der Geometrie des Raumes*: "A straight line depends on four linear constants. The four magnitudes which we consider as variables receive for any given line constant values, which may be easily constructed and are the four coördinates of the straight line. A single equation between these four coördinates does not determine a locus for the straight line, but merely a law according to which infinite space is made up of straight lines." Here we have the new idea of the straight line considered as an element of space, and of the "complex," as Plücker afterwards called it, made up of a threefold infinity of straight lines subject to a onefold relation. Space thus becomes as it were four-dimensioned, and we have, instead of the three degrees of freedom of space considered as an aggregate of points, four degrees of freedom according as the linear element is (1) absolutely unconditioned, (2) subject to a onefold, (3) subject to a twofold, or (4) subject to a threefold relation. In the first case we have the complex of straight lines, in the second the congruency of lines, in the third the regulus or ruled surface. The last of these geometrical figures had been considered long before, and even the congruency had been discussed before or independently of Plücker, notably by Hamilton and Kummer. The general conception of the linear complex seems to be entirely due to Plücker. At all events he developed the notion to such an extent that he is entitled to be called the founder of Line Geometry, in which the theory of the complex holds a fundamental position. His first memoir on the subject was published in the *Philosophical Transactions* of the Royal Society of London. It attracted much attention, and almost at once became the source of a large literature in which the new science was developed. Plücker himself worked out the theory of complexes of the first and second order, introducing in his investigation of the latter the famous complex surfaces of which he caused those models to be constructed which are now so well known to the student of the higher mathematics. He was engaged in bringing out a large work embodying the results of his researches in Line Geometry when he died on the 22d May, 1868. The work was so far advanced that his pupil and assistant Klein was able to complete and publish it, thereby erecting the worthiest monument to the genius of his master, whose wonderful scientific activity endured to the very last. Of the very numerous honors bestowed on Plücker by the various scientific societies of Europe it may suffice to mention here the Copley medal, awarded to him by the Royal Society two years before his death.

Most of the facts in the above notice have been taken from Clebsch's obituary notice of Plücker (*Abh. d. Kön. Ges. d. Wiss. z. Göttingen*, xvi., 1871), to which is appended an appreciation of Plücker's physical researches by Hittorf, and a list of Plücker's works by F. Klein. See also Gerhardt, *Geschichte der Mathematik in Deutschland*, p. 282; and Plücker's life by Dronke (Bonn, 1871). (G. CH.)

PLUM (*Prunus*). Our cultivated plums are supposed to have originated from one or other of the species *P. domestica* or *P. insititia*. The young shoots of *P. domestica* are glabrous, and the fruit oblong; in *P. insititia* the young shoots are pubescent, and the fruit more or less globose. A third species, the common sloe or blackthorn, *P. spinosa*, has stout spines; its flowers expand before the leaves; and its fruit is very rough to the taste, in which particulars it differs from the two preceding. These distinctions, however, are not maintained with much constancy. *P. domestica* is a native of Anatolia and the Caucasus, and is considered to be only naturalized in Europe. *P. insititia*, on the other hand, is wild in southern Europe, in Armenia, and along the shores of the Caspian. In the Swiss lake-dwellings stones of the *P. insititia* as well as of *P. spinosa* have been found, but not those of *P. domestica*. Nevertheless, the Romans cultivated large numbers of plums. The cultivated forms are now extremely numerous, some of the groups, such as the green gages, the damsons, and the egg plums being very distinct, and even reproducing themselves from seed. This, however, cannot be depended on, and hence the choice varieties are propagated by budding or by layers. The color of the fruit varies from green, pale yellow, red, up to deep purple, the size from that of a small cherry to that of a walnut; the form is oblong acute or obtuse at both ends or globular; the stones or kernels vary in like manner; and the flavor, season of ripening, and duration are all subject to variation. From its hardihood the plum is one of the most valuable fruit trees for the farmer, as it is not particular as to soil, and the crop is less likely to be destroyed by spring frosts. Prunes and French plums are merely plums dried in the sun. Their preparation is carried on on a large scale in Bosnia and Servia, as well as in Spain, Portugal, and southern France. The cherry plum, *Prunus myrobalana*, is employed chiefly as a stock for grafting upon, and for the sake of its ornamental flowers. See also HORTICULTURE, vol. xii. p. 286.

PLUMBAGO, a name frequently applied to graphite in allusion to its remote resemblance to lead, whence it is popularly called "black lead." When Scheele, in 1779, examined this mineral he regarded it as a compound of carbon and iron, and consequently termed it a "carburet of iron"; but Vanuxem, in 1825, showed that the iron existed in the form of an oxide, and was not essential to the constitution of the mineral—a conclusion also reached about this time by Karsten. It thus became fully established that plumbago is simply an impure form of native carbon. Plumbago is principally used in the manufacture of "black-lead" pencils, for which purpose it was at one time very extensively worked at Borrowdale in Cumberland. It was known locally as "wad," and a grant of the manor of Borrowdale, as far back as the reign of James I., refers to "the wad-holes and wad, commonly called black cawke." The Cumberland plumbago is found in pipes, strings, and irregular masses known as "sops," which occur in a dyke of diorite, associated with a compact blue diabase, penetrating some of the altered ash-beds of the volcanic series. Important mines of plumbago, yielding fine pencil lead, were opened some years ago by M. Alibert in the government of Irkutsk in eastern Siberia. A good deal of plumbago is also worked near Passau in Bavaria. The graphite so largely used, when mixed with fire-clay, in the manufacture of "black-lead" crucibles, is obtained chiefly from Ceylon; and it is notable that, notwithstanding the purity of the Ceylon plumbago, it is not applicable to the manufacture of lead pencils. Large quantities of plumbago occur in the Laurentian limestones of Canada; while in the United States the mineral is worked at Sturbridge, Mass.; at Ticonderoga and Fishkill, N. Y.; at Brandon, Vt.; and at Wake, N. C. It was formerly yielded by the mines of Ashford in Connecticut. Among the minor applications of plumbago may be mentioned its use as a lubricating agent for machinery and for polishing cast iron. In the preamble to an Act for protecting the black-lead mines of Cumberland, 25 Geo. II. c. 10, it is stated that plumbago is necessary "for divers useful purposes, and more particularly in the casting of bomb-shells, round shot, and cannon balls." It was formerly held in repute in medicine, and a writer on the Cumberland plumbago in 1709 asserts—"It's a present remedy for the cholick; it easeth the pain of gravel stone and strangury; and for these and the like uses it's much bought up by apothecaries and physicians." It is notable that plumbago is occasionally found in masses of meteoric iron, and that a substance of similar physical and chemical characters is produced in the blast-furnace during the preparation of cast iron, and is known to the workmen as *kish*. Plumbago bears a strong resemblance to the mineral termed molybdenite, while it resembles to a less extent certain varieties of micaceous iron-ore; the molybdenite, however, is easily distinguished by giving a slightly greenish streak, while the iron-ore yields a red streak.

For the mineralogical characteristics of plumbago or graphite see vol. xvi. p. 397; for its chemical relations, vol. v. p. 77; and for its use in crucible-making, vol. ix. p. 741.

PLUNKET, WILLIAM CONYNGHAM PLUNKET, BARON (1765–1854), an eminent lawyer, orator, and statesman, was born in the county of Fermanagh in July, 1765. He was educated in boyhood by his father, a man of considerable ability and reputation; and in 1779 he became a student of Trinity College, Dublin. Though well versed in regular academic studies, he was most conspicuous in his university career as the acknowledged leader of the Historical Society, the debating club of Trinity College, then full of young men of remarkable promise.

Having entered Lincoln's Inn in 1784, Plunket was called to the Irish bar in 1787. His intellect was exactly that of a jurist or a great master of equity—not too refining or overprone to speculation, and yet capable of the highest legal generalizations, and of applying them to masses of fact, however tedious and complicated. His power of close and rapid argument was very remarkable, his memory equally capacious and exact, and he had enriched an ample store of professional learning with the fruits of assiduous general study. Although at first his progress at the bar was not rapid, he gradually obtained a considerable practice in equity; and, after an apprenticeship of eleven years as a junior, he was raised to the rank of king's counsel in 1798.

In 1798 he entered the Irish parliament as member for Charlemont. His political faith was already settled, and was only slightly modified in after life, at least as regards its cardinal tenets. He was an anti-Jacobin Whig of the school of Burke, not ungracefully filled with a fervent Irish patriotism. He disliked the principles of the French Revolution, and its excesses made such an impression upon him that he always showed the greatest antipathy to merely democratic movements. But he was a sincere admirer of the constitutional government of England as established in 1688; he even justified the ascendency it had given to the Established Church, although he thought that the time had arrived for extending toleration to Roman Catholics and dissenters. To transfer it to Ireland as thus modified, and under an independent legislature, was even in his youth the only reform he sought for his country; and, although he opposed the Union with all his power, this was only because he thought it incompatible with this object.

When Plunket became a member of parliament, the Irish Whig party was almost extinct, and Pitt was feeling his way to accomplish the Union. In this he was seconded ably by Lord Castlereagh, by the panic caused by a wild insurrection, and by the secession of Grattan from politics. When, however, the measure was actually brought forward, it encountered a vehement opposition; and among the ablest and fiercest of all its adversaries was Plunket, whose powers as a great orator were now universally recognized. His speeches in these debates show all the force of reasoning, the admirable arrangement, and the grasp of facts which characterize his later efforts; but they are somewhat disfigured by personal invective, and here and there betray an indecent acrimony. They raised him, however, immediately to the front rank of his party; and, when Grattan re-entered the moribund senate, he took his seat next to Plunket, thus significantly recognizing the place the latter had attained.

After the union of Great Britain and Ireland Plunket returned to the practice of his profession, and became at once a leader of the equity bar. In 1803, after the outbreak of Emmet's rebellion, he was selected as one of the crown lawyers to prosecute the unfortunate enthusiast, and at the trial, in summing up the evidence, delivered a speech of remarkable power which shows his characteristic dislike of revolutionary outbursts. For this speech he was exposed to much unmerited obloquy, and more especially to the abuse of Cobbett, against whom he brought a successful action for damages. In 1804, in Pitt's second administration, he became solicitor-general and then attorney-general for Ireland; and he continued in office when Lord Grenville came into power at the head of the ministry of All the Talents. Plunket held a seat in the imperial parliament during this period, and there made several able speeches in favor of Catholic emancipation, and of continuing the war with France; but, when the Grenville cabinet was dissolved, he returned once more to professional life, and for some years devoted himself exclusively to it.

In 1812, having amassed a considerable fortune, he re-entered parliament as member for Trinity College, and identified himself thoroughly with the Grenville or anti-Gallican Whigs. He was now in the full maturity of his powers, and very soon was acknowledged one of the first orators, if not the first, of the House of Commons. His reverence for the English constitution in church and state, his strong dislike of French principles, his steady advocacy of the war with Napoleon, and his antipathy to anything like democracy made him popular with the Troy party. On the other hand, he was the zealous and most able supporter of Catholic emancipation; he was not averse to some measure of parliamentary reform; and, as generally he was on the side of constitutional progress, he was reckoned a principal ornament of one of the sections of the Whigs.

In 1822 Plunket was once more attorney-general for Ireland, with Lord Wellesley as lord-lieutenant. One of his first official acts was to prosecute for the "bottle riot," an attempt on his part to put down the Orange faction in Ireland. But, though always the advocate of the Catholic claims, he strenuously opposed the Catholic Association, which about this time, under the guidance of O'Connell, began its extraordinary and successful agitation. He struggled vehemently to extinguish it, and in 1825 made a powerful speech against it; and thus the curious spectacle was seen of the ablest champion of an oppressed sect doing all in his power to check its efforts to emancipate itself.

In 1827 Plunket was made master of the rolls in England; but owing to the professional jealousy of the bar, who not unnaturally thought him an intruder, he was obliged to abandon this office. Soon afterwards he became chief justice of the common pleas in Ireland, and was then created a peer of the United Kingdom. In 1830 he was appointed lord chancellor of Ireland, and held the office, with an interval of a few months only, until 1841, when he finally retired from public life. During this period he made some able speeches in favor of parliamentary reform; but they were scarcely equal to his earlier efforts; and his reputation as a judge, though far from low, was not so eminent as might have been expected. He died in 1854, in his ninetieth year. (W. O. M.)

PLUSH (French *Peluche*), a textile fabric having a cut nap or pile the same as fustian or velvet. Originally the pile of plush consisted of mohair or worsted yarn, but now silk by itself or with a cotton backing is used for plush, the distinction from velvet being found in the longer and less dense pile of plush. The material is largely used for upholstery and furniture purposes, and is also much employed in dress and millinery. The most distinctive form of plush is that which has taken the place of the napped beaver felt in the dress hats of gentlemen, which are now consequently known as "silk" hats. That plush, a considerable manufacture, is principally made in Lyons.

PLUTARCH (Πλούταρχος Χαιρωνεύς), a Greek prose writer, born at Chæronea in Bœotia, and a contemporary of Tacitus and the Plinys. The precise dates of his birth and death are unknown; but it is certain that he flourished under the Roman emperors from Nero to Trajan inclusive, so that from 50 to 100 A. D. will probably include the best years of his life. There is some probability that he outlived Trajan,[1] who died in 117. In the *Consolation to his Wife* on the loss of his young daughter, he tells us (§ 2) that they had brought up four sons besides, one of whom was called by the name of Plutarch's brother, Lamprias. We learn incidentally from this treatise (§ 10) that the writer had been initiated in the secret mysteries of Dionysius, which held that the soul was imperishable. He seems to have been an independent thinker rather than an adherent to any particular school of philosophy. His forte, so to say, was learning, and the application of it to the casualties of human existence. His vast acquaintance with the literature of his time is everywhere apparent; and with history especially he was thoroughly conversant, and hardly less so with physics.

The celebrity of Plutarch, or at least his popularity, is mainly founded on his forty-six *Parallel Lives*. He is thought to have written this work in his later years after his return to his native town Chæronea. His knowledge of Latin and of Roman history he must have partly derived from some years' residence in Rome and other parts of Italy,[2] though he says he was too much engaged in lecturing (doubtless in Greek, on philosophy) to turn his attention much to Roman literature during that period. Long observes that "we must expect to find him imperfectly informed on Roman institutions, and we can detect in him some errors. Yet, on the whole, his Roman lives do not often convey erroneous notions; if the detail is incorrect, the general impression is true."

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[1] The scanty evidences of date collected from Plutarch's writings are well discussed by Long in Smiths's *Dict. of Biog.*, iii, p. 429.

[2] *Demosth.*, § 2. Plutarch's orthography of Roman words and names is important as bearing on the question of pronunciation. A curious example (*De Fortun. Rom.*, § 5) is *Virtutis et Honoris*, written Οὐιρτοῦτίς τε καὶ Ὁνῶρις. The Volsci are Οὐολοῦσκοι, *ibid.*

Plutarch's design in writing the *Parallel Lives*—for this is the title which he gives them in dedicating *Theseus* and *Romulus* to Socius Senecio—appears to have been the publication, in successive books, of authentic biographies in pairs, a Greek and a Roman (generally with some approximation to synchronism as well as some well-marked resemblances in political career) being selected as the subject of each. In the introduction to the *Theseus* he speaks of having already issued his *Lycurgus* and *Numa*, viewing them, no doubt, as bearing a resemblance to each other in their legislative character; and so Theseus and Romulus are compared as the legendary founders of states.

In the opening sentence of the life of Alexander he says that "*in this book* he has written the lives of Alexander and Cæsar" (Julius), and in his *Demosthenes*, where he again (§ 1) mentions his friend Sosius, Σόσσιως, he calls the life of this orator and Cicero the fifth book.[1] It may therefore fairly be inferred that Plutarch's original idea was simply to set (παραβάλλειν, *Nic.*, § 1) a Greek warrior, statesman, orator, or legislator side by side with some noted Roman celebrated for the same qualities. In his age, when Rome held the supremacy, but Greece was still looked up to as the centre and source of wisdom and art, such a comparison of the greatest men of both nations had a special propriety and significance, and was more than a mere literary exercise. It was a patriotic theme, to show the superiority of this or that race; and Plutarch, in a sense, belonged to both. Now Alexander and C. Cæsar, Demosthenes and Cicero, Solon and Valerius Publicola, have some fairly obvious resemblances, which are not so conspicuous in some other pairs. But the sequel which follows most (not all) of the *Lives*, entitled σύγκρισις, viz., a comparison in detail, is by modern critics rejected as spurious. It was manifestly added as an appendix from a misapprehension of Plutarch's real motive; the effort to bring out exact points of resemblances which are either forced or fanciful far exceeded the design contemplated by him. Moreover, the marked difference in style between the βίοι and the συγκρίσεις is quite decisive of the question.

Nearly all the lives are in pairs; but the series concludes with single biographies of Artaxerxes, Aratus (of Sicyon), Galba, and Otho. In the life of Aratus, not Socius Senecio, but one Polycrates, is addressed.

It is not to be supposed that Plutarch was content to write merely amusing or popular biographies. On the contrary, the *Lives* are works of great learning and research, and they must for this very reason, as well as from their considerable length, have taken many years in their compilation. For example, in the life of Theseus the following long list of authorities appears: the Megarian historians,[2] Hellanicus, Simonides, Philochoros, Pherecydes, Demo, Pæon of Amathus, Dicæarchus, Herodoros, Bio, Menecrates, Clidemus, Hereas, Ister,[3] Diodorus. For the life of Romulus he refers to "one Promatheo who composed a history of Italy" (§ 2 fin.), Diocles of Peparethus, Fabius Pictor, Herodorus, Varro, Valerius, Juba (Ἰόβας), Zenodotus of Trœzen, Simulus the poet (from whom he quotes eight elegiac verses), Antigonus, "one Butas"[4] and Caius Acilius, and (as a *viva voce* informant) Sextius Sulla of Carthage. In the life of Lycurgus he cites Aristotle, Eratosthenes Apollodorus, Timæus, Xenophon Simonides, Aristocrates the Spartan, Sphærus, Critias, Theophrastus, Dioscorides, Hippias the sophist, Philostephanus, Demetrius Phalereus, Hermippus, Sosibius, Thucydides, Apollothemis, Aristoxenus, Aristocrates. In the life of Alexander, which is a long and elaborate essay, mention is made of Onesicritus, Aristobulus, Duris, Chares, Callisthenes, Eratosthenes, Clitarchus, Polyclitus, Antigenes, Ister, Ptolemæus, Anticlides, Philo of Thebes, Philippus of Theangele, Philippus of Eretria, Hecatæus, Hermippus, Sotion.

It is true that many of the lives, especially of Romans, do not show such an extent of research or such a wealth of authorities. But Plutarch must have possessed or had access to a great store of books, and his diligence as an historian cannot be questioned, if his accuracy is in some points impeached.

His sympathy with Doric characters and institutions is very evident; he delights to record the exploits, the maxims, and the virtues of Spartan kings and generals. This feeling is the key to his apparently unfair and virulent attack on Herodotus, who, as an Ionian, seemed to him to have exaggerated the prowess and the foresight of the Athenian leaders.

The voluminous and varied writings of Plutarch exclusive of the *Lives* are known under the common term *Opera Moralia*. These consist of above sixty essays, some of them long and many of them rather difficult, some too of very doubtful genuineness. Their literary value is greatly enhanced by the large number of citations from lost Greek poems, especially verses of the dramatists, among whom Euripides holds by far the first place. They evince a mind of vast and varied resources, historical as well as philosophical—the mind of an inquirer and a seeker after knowledge, rather than that of an exponent or an opponent of any particular philosophical system.

But Plutarch's Greek is not, like Lucian's, fluent and easy, nor even clear. He uses many words not in the ordinary Greek vocabulary, and he too often constructs long sentences, the thread of which separately, as well as the connection, cannot be traced without close attention. Hence he is unattractive as a writer, so far as style is concerned, and he is often diffuse and carries his discussions to an unnecessary length.

It is certain that to most persons in Britain, even to those who call themselves scholars, the *Opera Moralia* of Plutarch are practically almost unknown. No English translation of them, we believe, has been printed since the bulky folio of Philemon Holland, published at the end of the 17th century, with the exception of a single volume in Bohn's Classical Library, lately added to that series by Mr. C. W. King, M.A. It is therefore the more desirable to devote the remainder of this article to a brief notice of the principal treatises.

On the Education of Children recommends (1) good birth and sobriety in the father; (2) good disposition and good training are alike necessary for virtue; (3) a mother ought to nurse her own offspring, on the analogy of all animals; (4) the *pædagogus* must be honest and trustworthy; (5) all the advantages of life and fortune must be held secondary to education; (6) mere mob-oratory is no part of a good education; (7) philosophy should form the principal study, but not to the exclusion of the other sciences; (8) gymnastics are to be practiced; (9 kindness and advice are better than blows; (10) over-pressure in learning is to be avoided, and plenty of relaxation is to be allowed; (11) self-control, and not least over the tongue, is to be learned; (12) the grown-up youth should be under the eye and advice of his father, and all bad company avoided, flatterers included; (13) fathers should not be too harsh and exacting, but remember that they were themselves once young; (14) marriage is recommended, and without disparity of rank; (15) above all, a father should be an example of virtue to a son.

How a Young Man ought to Hear Poetry is largely made up of quotations from Homer and the tragic poets. The points of the essay are the moral effects of poetry as combining the true with the false, the praises of virtue and heroism with a mythology depraved and unworthy of gods, εἰ θεοί τι δρῶσιν φαῦλον, οὐκ εἰσὶν θεοί (§ 21). "So long as the young man," says Plutarch, "admires what is rightly said and done in the poets, but feels annoyed at the contrary, no harm is done; but if he learns to admire everything which is presented to him under the name of a hero, he will unconsciously become morally deteriorated" (§ 26).

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[1] It is quite evident that the original order of the books has been altered in the series of lives as we now have them.

[2] Οἱ Μεγαρόθεν συγγραφεῖς, referred to in § 10.

[3] Ὁ Ἴστρος ἐν τῇ τρισκαιδεκάτῃ τῶν Ἀττικῶν, § 34.

[4] Βούτας τις αἰτίας μυθώδεις ἐν ἐλεγείοις περὶ τῶν Ῥωμαικῶν [illegible] § 21.

On the Right Way of Hearing (περὶ τοῦ ἀκούειν) advocates the listening in silence to what is being said, and not giving a precipitate reply to statements which may yet receive some addition or modification from the speaker (§ 4). The hearer is warned not to give too much weight to the style, manner or tone of the speaker. (§ 7), not to be either too apathetic or too prone to praise, not to be impatient if he finds his faults reproved by the lecturer (§ 16). He concludes with the maxim, "to hear rightly is the beginning of living rightly," and perhaps he has in view throughout his own profession as a lecturer.

How a Flatterer may be Distinguished from a Friend is a rather long and uninteresting treatise. The ancient writers are full of warnings against flatterers, who do not seem to exercise much influence in modern society. The really dangerous flatterer (§ 4) is not the parasite, but the pretender to a disinterested friendship,—one who affects similar tastes, and so insinuates himself into your confidence. Your accomplished flatterer does not always praise, but flatters by act, as when he occupies a good seat at a public meeting for the express purpose of resigning it to his patron (§ 15). A true friend, on the contrary, speaks freely on proper occasions. A good part of the essay turns on παρρησία, the honest expression of opinion. The citations, which are fairly numerous, are mostly from Homer.

How one may be Conscious of Progress in Goodness is addressed to Sosius Senecio, who was consul in the last years of Nerva, and more than once (99, 102, 107) under Trajan. If, says Plutarch, a man could become suddenly wise instead of foolish, he could not be ignorant of the change; but it is otherwise with moral or mental processes. Gradual advance in virtue is like steady sailing over a wide sea, and can only be measured by the time taken and the forces applied (§ 3). Zeno tested advance by dreams (§ 12); if no excess or immorality presented itself to the imagination of the sleeper, his mind had been purged by reason and philosophy. When we love the truly good, and adapt ourselves to their looks and manners, and this even with the loss of worldly prosperity, then we are really getting on in goodness ourselves (§ 15). Lastly, the avoidance of little sins is an evidence of a scrupulous conscience (§ 17).

How to get Benefit out of Enemies argues that, as primitive man had savage animals to fight against, but learnt to make use of their skins for clothing and their flesh for food, so we are bound to turn even our enemies to some good purpose. One service they do to us is to make us live warily against plots; another is, they induce us to live honestly, so as to vex our rivals, not by scolding them but by making them secretly jealous of us (§ 4). Again, finding fault leads us to consider if we are ourselves faultless, and to be found fault with by a foe is likely to be plain truth, speaking ἀκουστέον ἐστὶ παρὰ τῶν ἐχθρῶν τὴν ἀλήθειαν (§ 6). Jealousies and strifes, so natural to man, are diverted from our friends by being legitimately expended on our enemies (§ 10).

On Having Many Friends, *On Chance*, *On Virtue and Vice*, are three short essays, the first advocating the concentration of one's affections on a few who are worthy (τοὺς ἀξίους φιλίας διώκειν, § 4), rather than diluting them, as it were, on the many; the second pleads that intelligence, φρόνησις, not mere luck, is the ruling principle of all success; the third shows that virtue and vice are but other names for happiness and misery. All these are interspersed with citations from the poets, several of them unknown from other sources.

A longer treatise, well and clearly written, and not less valuable for its many quotations, is the *Consolation addressed to Apollonius*, on the early death of his "generally beloved and religious and dutiful son." Equality of mind both in prosperity and in adversity is recommended (§ 4), since there are "ups and downs" (ὕψος καὶ ταπεινότης) in life, as there are storms and calms on the sea, and good and bad seasons on the earth. That man is born to reverses he illustrates by citing fifteen fine verses from Menander (§ 5). The uselessness of indulging in grief is pointed out, death being a debt to all and not to be regarded as an evil (§§ 10–12). Plato's doctrine is cited (§ 13) that the body is a burden and an impediment to the soul. Death may be annihilation, and therefore the dead are in the same category as the unborn (§ 15). The lamenting a death because it is untimely or premature has something of selfishness in it (§ 19), besides that it only means that one has arrived sooner than another at the end of a common journey. If a death is more grievous because it is untimely, a new-born infant's death would be the most grievous of all (§ 23). One who has died early may have been spared many woes rather than have been deprived of many blessings; and, after all, to die is but to pay a debt due to the gods when they ask for it (§ 28). Examples are given of fortitude and resignation under such affliction (§ 33). If, says the author in conclusion, there is a heaven for the good hereafter, be sure that such a son will have a place in it.

Precepts about Health commences as a dialogue and extends to some length as a lecture. It is technical and difficult throughout, and contains but little that falls in with modern ideas. Milk, he says, should be taken for food rather than for drink, and wine should not be indulged in after hard work or mental effort, for it does but tend to increase the bodily disturbance (§ 17). Better than purges or emetics is a temperate diet, which induces the bodily functions to act of themselves (§ 20). Another wise saying is that idleness does not conduce to health (οὐδ' ἀληθές ἐστι τὸ μᾶλλον ὑγιαίνειν τοὺς ἡσυχίαν ἄγοντας, § 21), and yet another that a man should learn by experience his bodily capabilities without always consulting a physician (§ 26).

Advice to the Married is addressed to his newly-wedded friends Pollianus and Eurydice. It is simply and plainly written, and consists chiefly of short maxims and anecdotes, with but few citations from the poets.

The Banquet of the Seven Wise Men is a longer treatise, one of the several "Symposia" or imaginary conversations that have come down to us. It is supposed to be given by Periander in the public banqueting-room (ἑστιατόριον) near the harbor of Corinth (Lechæum) on the occasion of a sacrifice to Aphrodite. The whole party consisted of "more than twice seven," the friends of the principal guests being also present. Like Plato's *Symposium* this treatise takes the form of a narrative of what was said and done, the narrator being one Diocles, a friend of Periander's, who professes to give Nicarchus a correct account as having been present. The dinner was simple and in contrast with the usual splendor of "tyrants" (§ 4). The conversation turns on various topics; Solon is credited with the remarkable opinion that "a king or tyrant is most likely to become celebrated if he makes a democracy out of a monarchy" (§ 7). There is much playful banter throughout, but neither the wit nor the wisdom seems of a very high standard. Solon delivers a speech on food being a necessity rather than a pleasure of life (§ 16), and one Gorgus, a brother of the host, comes in to relate how he has just shaken hands with Arion brought across the sea on the back of a dolphin (§ 18), which brings on a discussion about the habits of that creature. Among the speakers are Æsop, Anacharsis, Thales, Chilo, Cleobulus and one Chersias, a poet.

A short essay *On Superstition* contains a good many quotations from the poets. It opens with the wise remark that ignorance about the gods, which makes the obstinate man an atheist, also begets credulity in weak and pliant minds. The atheist fears nothing because he believes nothing; the superstitious man believes there are gods, but that they are unfriendly to him (§ 2). A man who fears the gods is never free from fear, whatever he may do or whatever may befall him. He extends his fears beyond his death and believes in the "gates of hell" and its fires, in the darkness, the ghosts, the infernal judges, and what not (§ 4). The atheist does not believe in the gods; the superstitious man wishes he did not, but fears to disbelieve (§ 11). On the whole, this is a most interesting treatise. Mr. King has given a translation of it and of the next five essays.

On Isis and Osiris is a rather long treatise on Egyptian symbolism, interesting chiefly to students of Egyptology. It gives an exposition of the strange myths and superstitions of this ancient solar cult, including a full account of the great antagonist of Osiris, Typhon, or the Egyptian Satan. Plutarch thus lays down the Zoroastrian theory of good and bad agencies (§ 45): "if nothing can happen without cause, and good cannot furnish cause for evil, it follows that the nature of evil, as of good, must have an origin and principle of its own."

On the Cessation of Oracles is a dialogue, discussing the reasons why divine inspiration seemed to be withdrawn from the old seats of prophetic lore. The real reason of their decline in popularity is probably very simple; when the Greek cities became Roman provinces the fashion of consulting oracles fell off, as unsuited to the more practical influences of Roman thought and Roman politics. The question is discussed whether there are such intermediate beings as dæmons, who according to Plato communicate the will of the gods to men, and the prayers and vows of men to the gods.

The possibility of a plurality of worlds is entertained, and of the planets being more or less composed of the essence of the five elements, fire, ether, earth, air, and water (§ 37). The whole treatise is metaphysical, but it concludes with remarks on the exhalations at Delphi having different effects on different people and at different times. The ancient notion doubtless was that the vapor was the breath of some mysterious being sent up from the under-world.

On the Pythian Responses, why no longer given in Verse, is also a dialogue, the first part of which is occupied mainly with conversation and anecdotes about the statues and other offerings at Delphi. It is rather an amusing essay, and may be regarded as a kind of appendix to the last. The theory propounded (§ 24) is that verse was the older vehicle of philosophy, history, and religion, but that plain prose has become the later fashion, and therefore that oracles are now generally delivered "in the same form as laws speak to citizens, kings reply to their subjects, and scholars hear their teachers speak." Discredit too was brought on the verse-oracle by the facility with which it was employed by impostors (§ 25). Moreover, verse is better suited to ambiguity, and oracles now-a-days have less need to be ambiguous (§ 28).

On the E at Delphi is an inquiry why that letter or symbol was written on or in the Delphic temple. Some thought it represented the number five, others that it introduced the inquiry of oracle-seekers, *If* so-and-so was to be done; while one of the speakers, Ammonius, decides that it means Eἶ, "thou art," an address to Apollo containing the predication of existence (§ 17).

On the Face on the Moon's Disk is a long and curious if somewhat trifling speculation, yet not without interest from its calculations of the sizes and the distance from earth of the sun and moon (§ 10), and from the contrast between ancient lunar theories and modern mathematics. The cause of the moon's light, its peculiar color, the possibility of its being inhabited, and many kindred questions are discussed in this dialogue, the beginning and end of which are alike abrupt. Some of the "guesses at truth" are very near the mark, as when it is suggested (§§ 21-2) that the moon, like the earth, contains deep recesses into which the sun's light does not descend, and the appearance of the "face" is nothing but the shadows of streams or of deep ravines.

On the late Vengeance of the Deity is a dialogue consequent on a supposed lecture by Epicurus. An objection is raised to the ordinary dealings of providence, that long delayed punishment encourages the sinner and disappoints the injured, the reply to which is (§ 5) that the god sets man an example to avoid hasty and precipitate resentment and that he is willing to give time for repentance (§ 6). Moreover, he may wish to await the birth of good progeny from erring parents (§ 7). Another fine reflection is that sin has its own punishment in causing misery to the sinner, and thus the longer the life the greater is the share of misery (§ 9). The essay concludes with a long story about one Thespesius, and the treatment which he saw, during a trance, of the souls in the other world.

On Fate discusses the law of chance as against the overruling of providence. This treatise ends abruptly; the point of the argument is that both fate and providence have their due influence in mundane affairs (§ 9), and that all things are constituted for the best.

On the Genius of Socrates is a long essay, and, like so many of the rest, in the form of a dialogue. The experiences of one Timarchus, and his supernatural visions in the cave of Trophonius, are related at length in the Platonic style (§ 22), and the true nature of the δαίμονες is revealed to him. They are the souls of the just, who still retain regard for human affairs and assist the good in their efforts after virtue (§ 28). The dialogue ends with an interesting narrative of the concealment of Pelopidas and some of the Theban conspirators against the Spartans in the house of Charon.

On Exile is a fine essay, rendered the more interesting from its numerous quotations from the poets, including several from the *Phœnissæ*. Man is not a plant that grows only in one soil; he belongs to heaven rather than to earth, and wherever he goes there are the same sun, the same seasons, the same providence, the same laws of virtue and justice (§ 5). There is no discredit in being driven from one's country; Apollo himself was banished from heaven and condemned to live for a time on earth (§ 18).

The Consolation to his Wife, on the early death of their only daughter, Timoxena (§ 7), is a feeling and sensible exhortation to moderate her grief.

Nine books of *Symposiaca* extend to a great length, discussing inquiries (προβλήματα) on a vast number of subjects. The general treatment of these, in which great literary knowledge is displayed, is not unlike the style of Athenæus. It is, of course, impossible here to give any summary of the questions propounded.

The Amorous Man is a dialogue of some length, describing a conversation on the nature of love, held at Helicon, pending a quinquennial feast of the Thespians, who specially worshipped that deity along with the Muses. It is amply illustrated by poetical quotations. In § 24 mention is made of the emperor Vespasian. It is followed by a short treatise entitled *Love Stories*, giving a few narratives of sensational adventures of lovers.

Short Sayings (ἀποφθέγματα), dedicated to Trajan, extend to a great length, and are divided into three parts: (1) of kings and commanders (including many Roman); (2) of Spartans; (3) of Spartan women (a short treatise on Spartan institutions being interposed between the last two). The names of the authors are added, and to some of them a large number of maxims are attributed. Many are terse, shrewd, wise, or pointed with strong common sense; but a good many seem to us now somewhat commonplace.

A rather long treatise *On the Virtues of Women* contains a series of narratives of noble deeds done by the sex in times of danger and trouble, especially from "tyrants." Many of the stories are interesting, and the style is easy and good.

Another long and learned work bears the rather obscure title Κεφαλαίων καταγραφή. It is generally known as *Quæstiones Romanæ* and *Græcæ*, in two parts. In the former, which contains one hundred and thirteen headings, the inquiry (on some matter political, religious, or antiquarian) always commences with διὰ τί, usually followed by πότερον, with alternative explanations. In the *Greek Questions* the form of inquiry is more often τίς or τίνες, not followed by πότερον. This treatise is of great interest and importance to classical archæology; though the inquiries seem occasionally trifling, and sometimes the answers are clearly wrong.

Parallels are a series of similar incidents which occurred respectively to Greeks and Romans, the Greek standing first and the Roman counterpart following. Many of the characters are mythological, though Plutarch regards them as historical.

On the Fortune of the Romans discusses whether, on the whole, good luck or valor had more influence in giving the Romans the supremacy. This is followed by two discourses (λόγοι) on the same question as applicable to the career of Alexander the Great, *Whether the Athenians were more renowned for War or for Wisdom?* The conclusion is (§ 7) that it was not so much by the fame of their poets as by the deeds of their heroes that Athens became renowned.

Gryllus is a most amusing dialogue, in which Circe, Ulysses, and a talking pig take part. Ulysses wishes that all the human beings that have been changed by the sorceress into bestial forms should be restored; but "piggy" is quite opposed to the return, arguing that in moral virtues, such as true bravery, chastity, temperance, and general simplicity of life and contentment, animals are very far superior to man.

Whether Land Animals or Water Animals are the Cleverer is a rather long dialogue on the intelligence of ants, bees, elephants, spiders, dogs, etc., on the one hand, and the crocodile, the dolphin, the tunny, and many kinds of fish, on the other. This is a good essay, much in the style of Aristotle's *History of Animals*.

On Flesh-Eating, in two orations, discusses the origin of the practice, viz., necessity, and makes a touching appeal to man not to destroy life for mere gluttony (§ 4). This is a short but very sensible and interesting argument. *Questions on Plato* are ten in number, each heading subdivided into several speculative replies. The subjects are for the most part metaphysical; the essay is not long, but it concerns Platonists only. *Whether Water or Fire is more Useful* is also short; after discussing the uses of both elements it decides in favor of the latter, since nothing can exceed in importance the warmth of life and the light of the sun. *On Primary Cold* is a physical speculation on the true nature and origin of the quality antithetical to heat. *Physical Reasons* (*Quæstiones Naturales*) are replies to inquiries as to why certain facts or phenomena occur; *e.g.*, "Why is salt the only flavor not in fruits?" "Why do fishing-nets rot in winter more than in summer?" "Why does pouring oil on the sea produce a calm?" *On the Opinions Accepted by the Philosophers*, in five books, is a valuable compendium of the views of the Ionic school and the Stoics on the phenomena of the universe and of life. *On the Ill-nature of Herodotus* is a well-known critique of the historian for his unfairness, not only to the Bœotians and Lacedæmonians, but to the Corinthians and other Greek states. It is easy to say that this essay "neither requires nor merits refutation"; but Plutarch knew history, and he writes like one who thoroughly understands the charges which he brings against the historian. The *Lives of the Ten Orators*, from Antiphon to Dinarchus, are biographies of various length, compiled, doubtless, from materials now lost.

Two rather long essays, *Should a Man Engage in Politics when he is no longer Young*, and *Precepts for Governing* (πολιτικὰ παραγγέλματα), are interspersed with valuable quotations. In favor of the former view the administrations of Pericles, of Agesilaus, of Augustus, are cited (§ 2), and the preference of older men for the pleasures of doing good over the pleasures of the senses (§ 5). In the latter, the true use of eloquence is discussed, and a contrast drawn between the brilliant and risky and the slow and safe policy (§ 10). The choice of friends, and the caution against enmities, the dangers of love, of gain, and of ambition, with many topics of the like kind, are sensibly advanced and illustrated by examples.

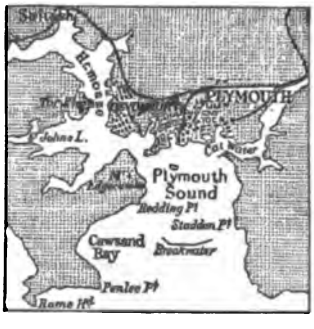
Besides the numerous works that have come down to us, Plutarch speaks of a work called Αἴτια, the same title with the lost poem of Callimachus (*Romulus*, § 15).

The *Lives* have often been translated; the most popular version into English is that by John and William Langhorne; more recently many of the Roman lives have been translated, with notes, by the late Mr. George Long. An excellent and convenient edition of the Greek text, in 5 vols. 12 mo., has been published in the Teubner series by Carl Sintenis. It seems strange that no modern edition of the *Opera Moralia* exists, and that the student has to fall back on the old-fashioned volumes of Wyttenbach (6 vols. 4to. Oxford, also printed in 8 vo.), Reiske (in 12 vols. 8vo.), and Hutten (14 vols. 8 vo.). Whether there is any hope of Rudolph Hercher's single volume (1872) in the Teubner series being followed by others, we have no information. (F. A. P.)

PLUTO, the god of the dead in Greek mythology. His oldest name was Hades (Ἀΐδης, Ἄιδης, ᾍδης), "the Unseen"; the name Pluto (Πλούτων) was given him as the bestower of the riches (πλοῦτος) of the mine, and in ordinary language it ousted the dread name of Hades, which was, however, retained in poetry. He was the son of Cronus and Rhea, and brother of Zeus and Poseidon. Having deposed Cronus, the brothers cast lots for the kingdoms of the heaven, the sea, and the infernal regions, and Pluto obtained the infernal regions, which from their ruler were afterwards known as Hades. The "house of Hades" was a dark and dreadful abode deep down in the earth. How literally the god was supposed to dwell underground is shown by the method of invoking him, which was by rapping on the ground to attract his attention. According to another view the realm of Hades was in a land beyond the ocean in the far west, which to the Greek was always the region of darkness and death, as the east of light and life. This is the view of Hades presented in the *Odyssey*. Ulysses sails all day with a north wind, and at sunset reaches a land at the limits of ocean. Here, wrapped in mist and cloud, dwell the Cimmerians, who never see the sun. He lands, and moving along the shore he calls the ghosts of the departed to meet him. In the description of the Cimmerians we have perhaps a traveller's tale of the long dark winters of the north. Besides this gloomy region, we find in another passage of the *Odyssey* (iv. 561 *sq.*) a picture of Elysium, a happy land at the ends of the earth where rain and snow fall not, but the cool west wind blows and men live at ease. After Homer this happy land, the abode of the good after death, was known as the Island of the Blest, and these in later times were identified with Madeira and the Canary Islands.[1] But in the oldest Greek mythology the "House of Hades" was a place neither of reward nor punishment; it was simply the home of the dead, good and bad alike, who led a dim and shadowy reflection of life on earth. The differentiation of this "home of Hades" into a heaven and a hell was the result of progressive thought and morality. Pluto was himself simply the ruler of the dead; in no sense was he a tempter and seducer of mankind like the devil of Christian theology. Indeed the very conception of a devil, as a principle of evil in continual conflict with God or the principle of good, is totally foreign to Greek mythology, as it was also to Indian and Teutonic mythology. Pluto was certainly depicted as stern and pitiless, but he was so only in discharge of his duty as custodian of the dead. But even Pluto once melted at the music of Orpheus when he came to fetch from the dead his wife Eurydice. The cap of Hades, like the *Nebelkappe* of German mythology, rendered its wearer invisible; as a sort of thick cloud it was the reverse of the nimbus or halo of the heavenly gods. While the victims sacrificed to the latter were white, those offered to Pluto were black. His wife was Proserpine (Persephone), daughter of Demeter (Ceres), whom he carried off as she was gathering flowers at Enna in Sicily. Like the Greeks, the ancient Italians believed that the souls of the dead dwelt underground; in Latin the names for the god of the dead are Orcus and Father Dis, but the Greek name Pluto also frequently occurs. But, while Orcus was rather the actual slayer, the angel of death, Father Dis was the ruler of the dead, and thus corresponded to Pluto. Their names also correspond, Dis being a contraction for Dives, "wealthy." The Etruscan god of death was represented as a savage old man with wings and a hammer; at the gladiatorial games of Rome a man masked after this fashion used to remove the corpses from the arena. In Romanesque folklore Orcus has passed into a forest-elf, a black, hairy, man-eating monster, upon whose house children lost in the woods are apt to stumble, and who sometimes shows himself kindly and helpful. He is the Italian *orco*, the Spanish *ogro*, the English *ogre*.

PLUTUS (πλοῦτος, "wealth"), the Greek god of riches, whom Demeter bore to Iasion "in the fat land of Crete." He enriched every one whom he fell in with. According to Aristophanes, he was blinded by Zeus in order that he might not enrich the good and wise alone. At Thebes there was a statue of Fortune holding the child Plutus in her arms; at Athens he was similarly represented in the arms of Peace; at Thespiæ he was represented standing beside Athene the Worker. Elsewhere he was represented as a boy with a cornucopia. He is the subject of one of the extant comedies of Aristophanes.

PLYMOUTH, a municipal and parliamentary borough and seaport town of Devonshire, England, is picturesquely situated on Plymouth Sound in the southwest corner of the county, at the confluence of the Tamar and Plym, 44 miles southwest of Exeter. With the borough of Devonport and the township of East Stonehouse it forms the aggregate town known as the "Three Towns." There is railway communication by means of the Great Western and Southwestern lines, and by several branch lines connected with these systems. The defences of the town, in addition to the citadel, an obsolete fortification built by Charles II., on the site of an older fort, consist of a most elaborate chain of forts of great strength mounted with guns of the heaviest calibre, and form-



Environs of Plymouth.

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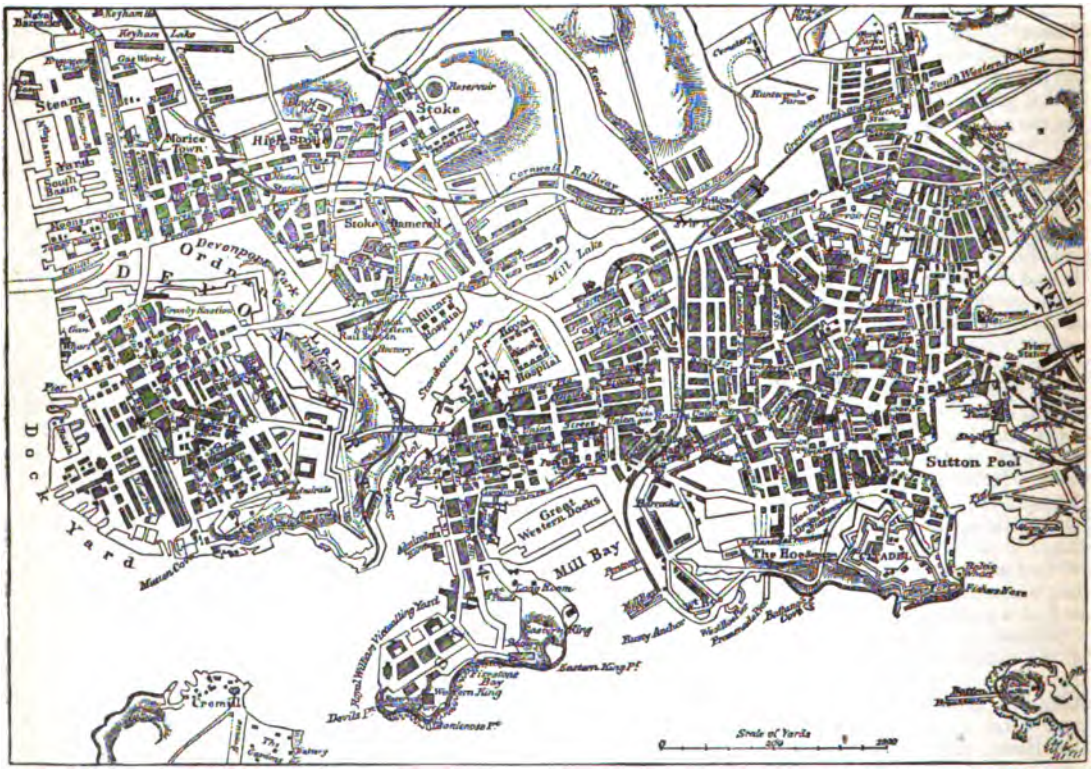
[1] The conception of the land of the dead, whether in the far west or beneath the earth, might be paralleled from the beliefs of many savage tribes. The Samoan Islanders unite the two conceptions; the entrance to their spirit-land is at the westernmost point of the westernmost island, where the ghosts descend by two holes into the under-world. Long ago the inhabitants of the French coast of the English Channel believed that the souls of the dead were ferried across to Britain, and there are still traces of this belief in the folk-lore of Brittany (Tylor, *Primative Culture*, ii. p. 64; Grimm, *Deutsche Mythologie*, ii. p. 694). In classical mythology the underground Hades prevailed over the western. It was an Etruscan custom at the foundation of a city to dig a deep hole in the earth, and close it with a stone; on three days in the year this stone was removed, and the ghosts were then supposed to ascend from the lower world. In Asia Minor caves filled with mephitic vapors or containing hot springs were known as Plutonia or Charonia. The most famous entrances to the under-world were at Tænarum in Laconia, and at the Lake Avernus in Italy

ing a complete line of defence round the whole circumference both landwards and seawards. The streets are for the most part narrow and crooked, and the houses very irregular both in style of architecture and in height. Great improvements have, however, recently taken place. The more ancient part of the town near the water-side has been much altered, and a number of model dwellings have also lately been erected. In the principal thoroughfares there are numerous handsome shops and other imposing business establishments. Among the most important of the public buildings is the Guildhall, completed in 1874 at a cost of £56,000 [$272,160], a fine group in the Gothic style of the 13th century, with a lofty tower, and containing the town-hall with a fine organ and a series of historical windows, a police court and offices, a sessions and other court rooms, and the council chamber and municipal offices. The new post-office in Westwell Street was erected at a cost of £12,000 [$58,320]. The market, dating from 1804, and occupying about three acres in the centre of the town, is in course of reconstruction. A fine clock-tower, erected by the corporation, stands at the junction of George Street and Union Street. The parish church of St. Andrews, some portions of which date from about 1430, has undergone alterations and improvements at different periods, and in 1874–75 was completely restored under the direction of the late Sir G. G. Scott. The tower, built in 1460, contains a fine peal of bells. The church of Charles the Martyr was begun in 1640, when the parish was divided, but owing to the Civil War was not completed till 1657. Of the other more modern parish churches there are none of special interest. The town is the seat of a Roman Catholic bishopric, the cathedral of which, a good building in the Early English style, was opened in 1858 at a cost of £10,000 [$48,600]. Attached to it is the convent of Notre Dame, and several other religious houses and chapels. The Athenæum (1812) is the home of the Plymouth Institution and the Devon and Cornwall Natural History Society. In connection with it there are a lecture hall, a museum, art gallery, and a small but select scientific library. The Plymouth Proprietary Library (1812) has a good selection of books in general literature, and the building also contains the library of the Plymouth Incorporated Law Society and the Cottonian collection, which includes many relics of Sir Joshua Reynolds and a number of his pictures. The Free Public Library, established in 1876, at present occupies the old Guildhall. The principal educational establishments are the Western College for the training of students for the ministry of the Independent denomination; the Plymouth College, a high school for boys; the High School for Girls; the Corporation Grammar School, founded in 1572; the Public School, established in 1809 (one of the largest public schools in England); the Gray Coat School; the Blue Coat School; the Orphan's Aid; Lady Rogers's School; the Orphan Asylum; and the Household of Faith founded by the well known Dr. Hawker. The Plymouth school board has nine schools in full operation; and each of the principal parishes has also its parochial day school. The charitable institutions embrace the South Devon and East Cornwall Hospital, for which a fine range of buildings has lately been erected; the Devon and Cornwall Female Orphan Asylum (1834); the Penitentiary and Female Home (1833); the Royal Eye Infirmary (1821); the South Devon and Cornwall Institution for the Blind (1860, new building erected 1876), and various other philanthropic societies. The only public recreation ground of any extent is the Hoe Park, 18 acres, a fine promenade sloping gradually to the sea, attached to which is a handsome promenade pier. On the Hoe a statue in bronze, by Boehm, of Sir Francis Drake was unveiled in 1884. Smeaton's lighthouse has been removed from the reef on which it stood for one hundred and twenty years, and is now a prominent object on the Hoe. The view from the Hoe includes Mount Edgecumbe with its beautifully wooded slopes, the



Plan of Plymouth.

Cornwall hills, the Dartmoor hills on the northeastern horizon, and Eddystone lighthouse far away over the waters of the Channel.

Plymouth not only holds a leading position in the country as a naval station, but is the centre of the growing trade of Devonshire and Cornwall, and is also becoming a holiday centre and health resort. To the south of the town is the Sound, protected by the magnificent breakwater, within the limits of which and the harbors connected with it the whole British navy might find a safe anchorage. The western harbor, known as the Hamoaze, at the mouth of the river Tamar, is devoted almost exclusively to the requirements of the royal navy, as along its banks are the dockyard, the Keyham factory, the arsenal, and other Government establishments (see DEVONPORT, vol. vii. 120; and DOCKYARDS, vol. vii. 274). The eastern harbor, Cattewater with Sutton Pool, now protected by a new breakwater at Mount Batten, is the anchorage ground for merchant shipping. Commodious dock accommodation is provided at the Great Western Docks, Millbay, between Plymouth and Stonehouse, opened in 1857, and comprehending a floating basin over 13 acres in extent with a depth of 22 feet at spring tides, a tidal harbor of 35 acres, and a graving dock. The port has an extensive trade with America, the West Indies, Mauritius, Africa, and the Baltic ports, as well as an extensive coasting trade. It is the starting point for many of the emigrant ships for Australia, New Zealand and British America. The chief exports are minerals, including copper, lead, tin, granite and marble. There is also some trade in pilchards and other fish. The imports are chiefly agricultural produce and timber. The total number of vessels that entered the port in cargo and in ballast in 1883 was 3852, of 843,227 tons, the number that cleared 3443, of 754,318 tons. Plymouth has few manufactures, the principal being biscuits, black-lead, candles, manures, soap, starch, sugar, lead, and the celebrated Plymouth gin. The principal industries are connected with shipbuilding and the fisheries. According to the Act of 1835, the borough is divided into six wards, and is governed by a mayor, twelve aldermen, and thirty-six councillors. The water-works are under the control of the corporation, but the gas-works are in the hands of a company. The population of the municipal borough (area 1468 acres) in 1871 was 68,758, and in 1881 it was 73,794. The population of the parliamentary borough (area 2061 acres) in the same years was 70,091 and 76,080. It returns two members to parliament.

The Hoe at Plymouth is claimed to be the high rock from which, according to Geoffrey of Monmouth, Corinæus the Trojan hurled the giant Goemagot into the sea, and at an early period there was cut out in the ground at the Hoe the likeness of two figures with clubs in their hands, which for many years was renewed by the corporation, and was in existence till the erection of the citadel about 1671. Both British and Roman remains have been found in the neighborhood, the most important being those of a Romano-British cemetery discovered in 1864 during the construction of Fort Stamford. In Domesday it occurs as Sutone, and afterwards it was divided into the town of Sutton Prior, the hamlet of Sutton Valletort, and the tithing of Sutton Ralph, a part of it having been granted to the Norman family of Valletort, while the greater part belonged to the priory of Plympton. About 1253 a market was established, and in 1292 the town first returned members to parliament. In the 14th century it was frequently the port of embarkation and of disembarkation in connection with expeditions to France. It suffered considerably at the hands of the French in 1338, 1350, 1377, 1400, and 1402, the Bretons on the last occasion destroying six hundred houses. In 1412 the inhabitants petitioned for a charter, but for a long time their application was opposed by the prior and convent of Plympton. In 1439 a charter was, however, at last granted by Henry VI., defining the limits of the town, permitting the erection of walls and defences, allowing the levying of dues on shipping for the purpose of such buildings and their maintenance, and directing the institution of a corporate body under the title of the "mayor and commonalty of the borough of Plymouth." Leland speaks (1540–47) of Plymouth harbor as being chained across in times of necessity, and of an "old 'castel quadrate' between the town and the sea." A small fragment of one of the outer works of this castle still stands at the foot of Lambhay Street. During the rebellion of 1548–49 the town suffered severely at the hands of the insurgents, and according to Westcote the "evidences" of the borough were burnt. Under Elizabeth it rose to be the foremost port of England, and Camden, who visited the town about 1588, states that "though not very large its name and reputation is very great among all nations." In the discovery of the new world it played a part of prime importance. Martin Cockeram, a native of the town, sailed with Sebastian Cabot when he touched the coast of America in 1497. Sir John Hawkins and his father William were natives of the town, and in 1571 Sir John was returned member of parliament for the borough. In 1572 Sir Francis Drake left the port for the West Indies, and in 1577 he set out from it on his voyage "about the earth." He was elected mayor of the town in 1581, and in 1592–93 represented it in parliament. Sir Humphrey Gilbert, who was M.P. for Plymouth in 1571, had in 1578 received from Queen Elizabeth letters patent for a colony in America; but, after setting out in 1579, he was compelled to return with the loss of his principal ship. In 1583 he sailed again from Plymouth (see GILBERT). In 1585 Drake again sailed from Plymouth for the West Indies, bringing back on his return the remnant of Raleigh's Virginian colony. The port supplied seven ships against the Spanish Armada, and it was in the sound that the English fleet of 120 sail awaited the sighting of the Spaniards. In 1590 Drake was successful in the oft attempted task of bringing in a stream of fresh water for the use of the town, from the river Meavy near Sheepstor, Dartmoor. He and Sir John Hawkins sailed from Plymouth on their last voyage in 1595, both dying at sea in the following year. Many other expeditions from Drake's time to the present have been despatched from this port, which was the last at which the Pilgrim Fathers touched when they set sail for America. Plymouth was throughout nearly the whole Civil War closely invested by the Royalists, and was the only town in the west of England which never fell into their hands. The town was one of the first to declare for William of Orange. It was in 1691, during his reign, that the dockyard was commenced. The "local literature" of Plymouth is singularly rich and comprehensive. It has also a connection with many men of great eminence. Sir Joshua Reynolds, born at Plympton, first practiced his art in the town, and its native artists are represented by Sir Charles Lock Eastlake, James Northcote, Benjamin Robert Haydon, and Samuel Prout. Besides Sir John Hawkins and other celebrated seamen, it has also given birth to Sir William Snow Harris, Dr. James Yonge, Dr. John Kitto, Dr. S. P. Tregelles, Dr. Robert Hawker, N. T. Carrington the Dartmoor poet, Mortimer Collins, and Sir R. P. Collier.

See Histories by Worth, 1871, and by Jewett, 1873; Rowe, *Ecclesiastical History of Old Plymouth; The Western Antiquary;* Worth, *The Three Towns Bibliotheca.*

PLYMOUTH, a township and village of the United States, the shire-town of Plymouth county, Massachusetts, and a port of entry on Cape Cod Bay,—the village lying at the terminus of a branch of the Old Colony Railroad, 37 miles south-southeast of Boston. The main interest of Plymouth is historical, and centres in the fact that it was the first settlement of the Pilgrim Fathers of New England, who landed December 21 (N.S.), 1620, on the rock now covered by a handsome granite canopy in Walter Street. Leyden Street, so called in memory of the Dutch town where the exiles had stopped for a season, is the oldest street in New England. The houses and general appearance of Plymouth are, however, thoroughly modern. Pilgrim Hall (which is built of granite and measures 70 feet long by 40 feet wide) was erected in 1824–25 by the Pilgrim Society constituted in 1820; it contains a public library and many relics of the fathers—including Miles Standish's sword and Governor Carver's chair. The corner stone of a national monument to the Pilgrims was laid August 1, 1859, on a high hill near the railroad station; 1500 tons of granite were used for the foundation; and a pedestal 45 feet high is surrounded by statues 20 feet high of Morality, Law, Education, and Freedom, and bears a colossal statue of Faith, 36 feet high, holding a Bible in her right hand (the largest granite statue in the world). Burying Hill was the site of the embattled church erected in 1622, and contains many ancient tombstones and the foundations of the watchtower (1643) now covered with sod. Cole's Hill is the spot where half of the "Mayflower" Pilgrims found their rest during the first winter. Five of their graves were discovered in 1855 while pipes for the town water-works were being laid, and two more (now marked with a granite slab) in 1883. The bones of the first five are deposited in a compartment of the canopy over the "Forefathers' Rock." A town hall (1749), the county court-house, and the house of correction are the main public buildings of Plymouth. The population of the township was 4758 in 1830, 6024 in 1850, 6238 in 1870, 7093 in 1880, and 7500 in 1884. Manufactures of sail-duck, cotton-cloth, tacks, nails, plate-iron, rolled zinc and copper rivets, hammers, etc., are carried on; the cordage factories are among the largest and most complete works of the kind in the world.

PLYMOUTH, a borough of the United States, in Luzerne county, Pennsylvania, on the Bloomsburg division of the Delaware, Lackawanna, and Western Railroad, 8 miles from Wyoming, is a flourishing coal-mining town, which increased its population from 2648 in 1870 to 6065 in 1880. At Plymouth junction, 2 miles to the northeast, a branch line to Wilkesbarre connects with the Central Railroad.

PLYMOUTH BRETHREN (BRETHREN, OR CHRISTIAN BRETHREN) are a sect of Christians who received the name in 1830 when the Rev. J. N. Darby induced many of the inhabitants of Plymouth to associate themselves with him for the promulgation of opinions which they held in common. Although small Christian communities existed in Ireland and elsewhere calling themselves *Brethren* and holding similar views, the accession to the ranks of Mr. Darby so increased their numbers and influence that he is usually reckoned the founder of Plymouthism. Darby (born in Nov. 1800, in London; graduated at Trinity College, Dublin, in 1819; died April 29, 1882 at Bournemouth) was a curate in the Episcopalian Church of Ireland until 1827, when he felt himself constrained to leave the Established Church; betaking himself to Dublin, he became associated with several devout people who refused all ecclesiastical fellowship, met statedly for public worship, and called themselves the Brethren. In 1830 Darby at Plymouth won over a large number of people to his way of thinking, among whom were the Rev. Benjamin Wills Newton, who had been a clergyman of the Established Church of England; the Rev. James L. Harris, a Plymouth clergyman; and the well-known Biblical scholar Dr. Samuel Prideaux Tregelles. The Brethren started a newspaper, *The Christian Witness*, continued under the names *The Present Testimony* (1849) and *The Bible Treasury* (1856), with Harris as editor and Darby as the most important contributor. During the next eight years the progress of the sect was rapid, and communities of the brethren were to be found in many of the principal towns in England.

In 1838 Darby, after a short stay in Paris, went to reside in French Switzerland, and found many disciples. Congregations were formed in Geneva, at Lausanne, where most of the Methodist and other dissenters joined the Brethren, at Vevey, and elsewhere in Vaud. His opinions also found their way into Germany, German Switzerland, Italy, and France; but French Switzerland has always remained the stronghold of Plymouthism on the Continent, and for his followers there Mr. Darby wrote two of his most important tracts, *Le Ministère considéré dans sa Nature* and *De la Presence et de l'Action du S. Esprit dans l'Église.* The revolution in the canton Vaud, instigated by the Jesuits in 1845, brought persecution to the Brethren in the Canton and in other parts of French Switzerland, and Darby felt his own life insecure there.

He returned to England, and his reappearance was accompanied by divisions among the Brethren at home. These divisions began at Plymouth. Mr. B. Wills Newton, at the head of the community there, was accused of departing from the testimony of the Brethren against an official ministry, and of reintroducing the spirit of clericalism. Unable to detach the congregation from the preacher, Darby began a rival and separate assembly. The majority of the Brethren out of Plymouth supported Darby, but a minority kept by Newton. The separation became wider in 1847 on the discovery of supposed heretical teaching by Newton. In 1848 another division took place. The Bethesda congregation at Bristol, where Mr. George Müller was the most influential member, received into communion several of Newton's followers and justified their action. A large number of communities approved of their conduct; others were strongly opposed to it. Out of this came the separation into Neutral Brethren led by Müller, and Exclusive Brethren or Darbyites, who refused to hold communion with the followers of Newton or Müller. The exclusives, who were the more numerous, suffered further divisions. An Irish clergyman named Cluff had adopted the views of Mr. Pearsall Smith, and when these were repudiated seceded with his followers. The most important division among the exclusives came to a crisis in 1881, when Mr. William Kelly and Mr. Darby became the recognized leaders of two sections who separated on some point of discipline. There are therefore at least five official divisions or sects of Plymouthists: (1) the followers of Mr. B. Wills Newton; (2) the Neutrals, who incline to the Congregationalist idea that each assembly should judge for itself in matters of discipline, headed by Mr. George Müller; (3) the Darbyite Exclusives; (4) the Exclusives who follow Mr. Kelly; and (5) the followers of Mr. Cluff. The fundamental principle of the Exclusives, "Separation from evil God's principle of unity," has led to many unimportant excommunications and separations besides those mentioned.

The theological views of the Brethren do not differ greatly from those held by evangelical Protestants (for a list of divergences, see Reid, *Plymouth Brethrenism Unveiled and Refuted*); they make the baptism of infants an open question and celebrate the Lord's Supper weekly. Their distinctive doctrines are ecclesiastical. They hold that all official ministry, anything like a clergy, whether on Episcopalian, Presbyterian, or Congregationalist theories, is a denial of the spiritual priesthood of all believers, and a striving against the Holy Spirit. Hence it is a point of conscience to have no communion with any church which possesses a regular ministry. The gradual growth of this opinion, and perhaps the reasons for holding it, may be traced in Mr. Darby's earlier writings. While a curate in the Church of Ireland he was indignant with Archbishop Magee[1] for stopping the progress of mission work among Roman Catholics by imposing on all who joined the church the oath of supremacy. This led Darby to the idea that established churches are as foreign to the spirit of Christianity as the papacy is ("Considerations addressed to the Archbishop of Dublin, etc." *Coll. Works*, vol. i. 1). The parochial system, when enforced to the extent of prohibiting the preaching of the gospel within a parish where the incumbent was opposed to it, led him to consider the whole system a hindrance to the proper work of the church and therefore anti-Christian ("Thoughts on the present position of the Home Mission," *Coll. Works*, i. 78). And the waste of power implied in the refusal to sanction lay-preaching seemed to him to lead to the conclusion that an official ministry was a refusal of the gifts of the Spirit to the church ("On Lay Preaching," *Coll. Works*, p. 200). These three ideas seem to have led in the end to Plymouthism; and the movement, if it has had small results in the formation of a sect, has at least set churches to consider how they might make their machinery more elastic. Perhaps one of the reasons of the comparatively small number of Brethren may be found in their idea that their mission is not to the heathen but to "the awakened in the churches."

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[1] [William (1766–1831), two years bishop of Raphoe, and ten archbishop of Dublin. His grandson, William Connor Magee (1821–91), was twenty-two years bishop of Peterborough, and four months archbishop of York, England, an eloquent orator.—AM. ED.]

Authorities.—Darby, *Collected Works*, 32 vols., edited by Kelly; Reid, *Plymouth Brethrenism Unveiled and Refuted*, 3d ed., 1880, and *History and Literature of the so-called Plymouth Brethren*, 2d ed., 1876; Miller, *The Brethren, their Rise, Progress and Testimony*, 1879; Teulon, *History and Doctrines of the Plymouth Brethren*, 1883. (T. M. L.).

PNEUMATIC DISPATCH. The transport of written dispatches through long narrow tubes by the agency of air-pressure was introduced in 1853, by Mr. Latimer Clark, between the Central and Stock Exchange stations of the Electric and International Telegraph Company in London. The stations were connected by a tube 1½ inches in diameter and 220 yards long. Carriers containing batches of telegrams, and fitting piston-wise in the tube, were sucked through it (in one direction only) by the production of a partial vacuum at one end. In 1858 Mr. C. F. Varley improved the system by using compressed air to force the carriers in one direction, a partial vacuum being still used to draw them in the other direction. This improvement enables single radiating lines of pipe to be used both for sending and for receiving telegrams between a central station supplied with pumping machinery and outlying stations not so supplied. In the hands of Messrs. Culley and Sabine this radial system of pneumatic dispatch has been brought to great perfection in connection with the telegraphic department of the British post-office. Another method of working, extensively used in Paris and other Continental cities, is the circuit system, in which stations are grouped on circular or loop lines, round which carriers travel in one direction only. In one form of circuit system—that of Messrs. Siemens—a continuous current of air is kept up in the tube, and rocking switches are provided by which carriers can be quickly introduced or removed at any one of the stations on the line without interfering with the movement of other carriers in other parts of the circuit. More usually, however, the circuit system is worked by dispatching carriers, or trains of carriers, at relatively long intervals, the pressure or vacuum which gives motive power being applied only while such trains are on the line. On long circuits means are provided at several stations for putting on pressure or vacuum, so that the action may be limited to that section of the line on which the carriers are travelling at any time.

The following particulars refer to the radial system of pneumatic dispatch as used in the British post office. In London most of the lines connect the central office with district offices for the purpose of collecting and distributing telegrams. Iron tubes were used in some of the earliest lines, but now the tubes are always made of lead, with soldered joints, and are enclosed in outer pipes of iron for the sake of mechanical protection. The bore, which is very smooth and uniform, is normally 2¼ inches, though in a few cases it is as much as 3 inches, and in some only 1½ inches. The greatest single length of any of the existing London lines is 3873 yards, but a more usual length is from 1000 to 2000 yards. In most cases a single tube serves both to send and to receive, but where the traffic is heavy a pair of tubes are used, one to send by pressure and the other to receive by vacuum. The pumps, which supply pressure and vacuum to two mains, are situated in the central office. At the outlying stations the tubes terminate in a glass box, open to the atmosphere. At the central station the end of each tube is a short vertical length, facing downwards, and provided with a double valve, consisting of two sluices, one at the end and the other a little way above the end, the distance between the sluices being somewhat longer than the length of a carrier. The sluices are geared together in such a manner that a single movement of a handle closes one and opens the other, or *vice versa*. To send a carrier from the central station, the carrier is introduced into the tube, the lower sluice being open; a single movement of the handle then successively (1) closes the lower sluice, (2) opens the upper sluice, and (3) opens a valve which admits air behind the carrier from the compressed-air main. As soon as the arrival of the carrier is signalled (electrically) from the out-station, the handle is pushed back, thus (1) cutting off the compressed air, (2) closing the upper sluice, and (3) opening the lower sluice. The tube is then ready for the sending of another carrier. When an electric signal arrives from an out-station that a carrier is inserted there for transmission to the central station the handle is pulled forward far enough to close the lower and open the upper sluice, but not far enough to put on the air-pressure. The vacuum main is then put in connection with the tube by a separate stop-cock. When the carrier arrives the vacuum is shut off and the lower sluice opened to allow it to drop out. This arrangement of double sluices admits of the insertion or removal of a carrier while other carriers are travelling in the same tube, and without sensible disturbance of their motion. But great caution requires to be exercised in allowing two or more carriers to follow one another on a single section of line, especially on lines worked by pressure, since no two carriers travel at precisely the same speed. When the same tube is used alternately for sending and receiving the upper sluice is dispensed with. On some lines there are intermediate stations, and the sections are then worked by a block system like that used on railways. The carriers are cylindrical cases of gutta-percha covered with felt, which is allowed to project loosely at the back, so that the pressure makes it expand and fit the pipe closely. In front the carrier is closed by a buffer or piston composed of disks of felt of the diameter of the pipe. The dispatches are held in by an elastic band at the back. An ordinary carrier weighs 2¾ oz., and holds about a dozen dispatches. During business hours carriers are passing through the London tubes almost incessantly. With a pressure of 10 ℔ per square inch, or a vacuum of 7 ℔, the time of transit, if through a 2¼ inch tube, is 1 minute for a length of nearly 1000 yards, and 5½ minutes for a length of 3000 yards.

The following statistics show the growth of the pneumatic dispatch in the post-office during ten years (the figures for 1875 are taken from a paper by Messrs. Culley and Sabine, cited below, and those for 1885 have been furnished by Mr. W. H. Preece):

	January, 1875.			January, 1885.		
	No. of Tubes.	Total Length.		No. of Tubes.	Total Length.	
		Miles.	Yards.		Miles.	Yards.
London	25	17	1160	82[1]	33	635
Liverpool	4	1	1237	5	2	39
Glasgow	1		242	5	1	1142
Dublin	3		940	5	1	954
Manchester	5	1	266	6	1	294
Birmingham	3		917	4		1235
Newcastle	0		0	1		460
Total	41	21	1242	108	40	1239

In Paris large areas of the city have been covered by pneumatic circuits made up of iron pipes round which omnibus trains of carriers are sent at intervals of fifteen minutes. The trains consist of several carriers much heavier than the English type, linked to one another and to a leading piston. The trains are stopped at the successive stations to take up and deposit dispatches. The pneumatic despatch took root in Paris in 1866, and has been developed there in a way which differs greatly in mechanical details from the English system. An arrangement like that used in Paris has been followed in Vienna and in Berlin, where the Siemens system has also been used. In New York the English system is adopted, but with brass instead of lead tubes.

Interruptions occurring in the pipes can be localized by firing a pistol at one end and registering by a chronograph the interval of time between the explosion and the arrival of the air-wave reflected from the obstacle.

In addition to its use for postal and telegraphic purposes the pneumatic despatch is occasionally employed for internal communication in offices, hotels, etc., and also in shops for the transport of money and bills between the cashier's desk and the counters.

References.—The system as now used in the United Kingdom is fully described in a paper by Messrs. Culley and Sabine (*Min. Proc. Inst. Civ. Eng.*, vol. xliii.). The same volume contains a description of the pneumatic telegraphs of Paris and of experiments on them by M. Bontemps, and also a discussion of the theory of pneumatic transmission by Prof. W. C. Unwin. Reference should also be made to a paper by C. Siemens (*Min. Proc. Inst. Civ. Eng.*, vol. xxxiii.) describing the Siemens circuit system; and to *Les Télégraphes*, by M. A. L. Ternant (Paris, 1881). (J. A. E.).

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[1] Including 29 short "house" tubes.

PNEUMATICS is that department of hydrodynamics which treats of the properties of gases as distinct from liquids. Under HYDROMECHANICS will be found a general discussion of the subject as a branch of mathematical physics; here we shall limit our attention mainly to the experimental aspect.

The gaseous fluid with which we have chiefly to do is our atmosphere. Though practically invisible, it appeals in its properties to other of our senses, so that the evidences of its presence are manifold. Thus we feel it in its motion as wind, and observe the dynamical effects of this motion in the quiver of the leaf or the momentum of the frigate under weigh. It offers resistance to the passage of bodies through it, destroying their motion and transforming their energy—as is betrayed to our hearing in the whiz of the rifle bullet, to our sight in the flash of the meteor. In its general physical properties air has much in common with other gases. It is advisable therefore first to establish these general properties, and then consider the characteristic features of the several gases.

Solid and fluid distinguished.

Matter is conveniently studied under the two great divisions of solids and fluids. The practically obvious distinction between these may be stated in dynamical language thus: solids can sustain a longitudinal pressure without being supported by a lateral pressure; fluids cannot. Hence any region of space enclosed by a rigid boundary can be easily filled with a fluid, which then takes the form of the bounding surface at every point of it. But here we distinguish between fluids according as they are gases or liquids. The gas will always completely fill the region, however small the quantity put in. Remove any portion and the remainder will expand so as to fill the whole space again. On the other hand it requires a definite quantity of liquid to fill the region. Remove any portion and a part of the space will be left unoccupied by liquid. Part of the liquid surface is then otherwise conditioned than by the form of the wall or bounding surface of the region; and if the portion of the wall not in contact with the liquid is removed the form and quantity of the liquid are in no way affected. Hence a liquid can be kept in an open vessel; a gas cannot so be.

Stress.

The mutual action between any two portions of matter is called the stress between them. This stress has two aspects, according as its effect or tendency is considered with reference to the one or the other body. Thus between the earth and moon there is a stress which is an attraction. The one aspect is the force which attracts the moon to the earth; the other is the force which attracts the earth to the moon. According to Newton's third law of motion these are equal and opposite. Similarly the repulsive stress between the like poles of two magnets has its two aspects, which are equal but oppositely directed forces. In the case of a mass hanging by a cord, the stress is a tension at every point of the cord. At any given point this tension has two equal and opposite aspects, one of which is the weight of the mass and the portion of the cord below the given point. Finally, the stress between any body and the horizontal table on which it rests is a two-faced pressure, being downwards as regards the table, upwards as regards the body. The total pressure upon the table over the whole surface of contact is clearly the weight of the body. If the total pressure is supposed to be uniformly distributed, the measure of the pressure on unit surface is the quotient of this weight by the area of the surface. When we speak of pressure at a point, it is this pressure on unit surface that is meant. When the pressure varies from point to point over a surface, the pressure at any point is defined to be the limit of the ratio of the total pressure over any small element of surface around that point to the area of the element as the element is diminished indefinitely.

Ideal perfect fluid defined.

The stress which exists between the contiguous portions of a fluid is of the nature of a pressure. The ideal or perfect fluid is a substance in which this stress between contiguous portions is always perpendicular to the common interface. In other words there is no stress tangential to the interface at any point. Hence if the contiguous portions are at relative rest, or have a relative motion parallel to the interface, neither state can be affected by the mutual stress. This condition is perfectly fulfilled in the case of any known fluid in equilibrium; but for a fluid in motion it is not even approximately fulfilled. For, any visible relative motion set up among the parts of a fluid rapidly decays in virtue of viscosity, which even for the subtlest gases is quite appreciable in its effects.

In a fluid at rest, then, the pressure over any surface which we may imagine to be drawn is perpendicular (or normal) to the surface at every point of it; and from this it follows at once, as has been proved in HYDROMECHANICS, vol. xii. p. 455, that *the pressure at any point of a fluid at rest has the same value in all possible directions.*

Level surfaces.

The pressure at two contiguous points in a fluid may either differ or not. If they differ, the change of pressure must be balanced by some extraneous force acting on the fluid in the direction in which the pressure increases. Any direction in which no such force acts must be a direction in which there is no change of pressure; otherwise, equilibrium will be destroyed. Suppose now the resultant force at every point in a fluid at rest to be given. In directions at right angles to the force at any given point the pressure will not vary. Hence we can pass to an infinite number of contiguous points at which the pressure is the same as at the given point. By making each of these in turn the starting-point, we can pass on to another set of points, and so gradually trace out within the fluid a surface at every point of which the pressure is the same. Such a surface is called a surface of equal pressure, or briefly a level surface; and we see from the mode of its construction that it is at every point of it perpendicular to the resultant force at that point.

Imagine any two contiguous level surfaces to be drawn, at every point of the one of which the pressure is p, at every point of the other $p + \delta p$. Consider the equilibrium of a small column of average density ρ, bounded at its ends by these surfaces. Let A be the area of each end, and δr the length of the column or perpendicular distance between the level surfaces. If R is the average resultant force per unit mass acting on the column, then we have, for equilibrium of the column,

$$A\delta p = A\delta r \, . \, \rho R ,$$

or

$$\delta p = R\rho\delta r .$$

or *the rate of increase of the pressure at any point per unit of length at right angles to the level surface is equal to the resultant force per unit of volume at that point.*

If the applied forces belong to a conservative system, for which V is the potential (see MECHANICS), we may write the equation in the form

$$\delta p = -\rho\delta V .$$

Equipotential surfaces.

Hence over an equipotential surface, for which $\delta V = 0$, p is constant, and is therefore a function of V. Consequently ρ also is a function of V. For a fluid in equilibrium, therefore, and under the influence of a conservative system of forces, the pressure and density are constant over every equipotential surface, that is, over every surface cutting the lines of force at right angles.

Now in the case of gases, to which our attention is at present confined, the density (temperature remaining constant) varies with every change of pressure; in mathematical language ρ is a function of p. Thus, before we can solve the equation of equilibrium for a gas, we must be able to express this function mathematically; in other words, we must know the exact relation between the density of a gas and the pressure to which it is subject. This problem, which can only be settled by experiment, was solved for the case of air within a certain range of pressures by Robert Boyle (1662). Before discussing his results and the later results of other investigators, we shall first consider the general properties of our atmosphere as recognized before Boyle's day.

It is evident that, for a fluid situated as our atmosphere is, the pressure must diminish as we ascend. The equipotential surfaces and consequently the surfaces of equal pressure and of equal density will be approximately spheres concentric with the earth. At any point there will be a definite atmospheric pressure, which is equal numerically to the weight of the superincumbent vertical column of air of unit cross-section. The effect of this pressure, as exemplified in the action of the common suction-pump, seems to have been first truly recognized by Galileo, who showed that the maximum depth from which water can be pumped is equal to the height of the water column which would exert at its base a pressure equal to the atmospheric pressure. As an experimental verification, he suggested filling with water a long pipe closed at the upper end, and immersing it with its lower and open end in a reservoir of the same liquid. The liquid surface in the pipe would, if the pipe were long enough, stand at a definite height, which would be the same for all longer lengths of pipe. The practical difficulty of constructing a long enough tube (33 feet at least) prevented the experiment being really made till many years later.

Torricelli's experiment.

Torricelli, however, in 1642, by substituting mercury for water, produced the experiment on a manageable scale. As mercury is denser than water in the ratio of about 13.6:1, the mercury column necessary to balance by its weight the atmospheric pressure will be less than the water column in the inverse ratio, or a little under 30 inches. Torricelli's experiment is exhibited in every mercurial barometer (see BAROMETER and METEOROLOGY). By this experiment he not only gave the complete experimental verification of Galileo's views relating to atmospheric pressure, but provided a ready means of measuring that pressure.

The most obvious applications of the barometer are these: (1) to measure the variation in time of atmospheric pressure at any one locality on the earth's surface (the existence of this variation was discovered soon after the date of Torricelli's experiment by Pascal, Descartes, Boyle, and others); (2) to measure the variation of atmospheric pressure with change of height above the earth's surface (Descartes mentions this application in the *Principia Philosophiæ*, 1644; but to Pascal is the honor due of having first carried the experiment into execution, 1647); and (3) to compare pressures at different localities which are on the same level (if the pressures are equal, the air is in equilibrium; if they are not, there must be flow of air from the place of higher pressure to that of lower—in other words, there must be wind, whose direction of motion depends on the relative position of the places, and whose intensity depends on the distance between the places and the difference of pressures). The first and last of these measurements are of the greatest importance in meteorology. The second is a valuable method for measuring attainable heights, and is intimately connected with the problem as to the relation between the pressure and density of the air. Thus it would be possible, by barometric observations at a series of points in the same vertical line, to obtain a knowledge of this relation—more and more truly approximate the closer and more numerous the points of observation taken. At best, however, such a method could give the law connecting density with pressure, for those pressures only which are less than the normal atmospheric pressure. The problem is better solved otherwise.

Relation between height and pressure in our atmosphere.

Assuming Boyle's law that *the density of air is directly as the pressure*, we can now integrate the equation of equilibrium

$$\delta p = -\rho\delta V,$$

and put it in the form

$$p = p_0\epsilon^{-V/K},$$

where p_0 is the pressure at zero potential and K is the constant ratio of the pressure to the density.

For all attainable heights in our atmosphere we may assume the force of gravity to be the same. Hence we may write $V = gh$, where g is the force acting on unit mass at height h. If we put $K = gH$, the equation becomes

$$p = p_0\epsilon^{-h/H},$$

where H is obviously the height of a fluid of uniform density p_0/K which would give at its base the pressure p_0—in other words, the *height of the homogeneous atmosphere*, as it is called. Its value is readily found, since it bears to the height of the mercurial barometric column the same ratio which the density of mercury bears to the density of the atmosphere at the sea-level. For dry air at 0° C. and with g taken as equal to 981 dynes (= 32.2 poundals nearly), the value of H is 7.9887×10^5 centimetres, or 26,210 feet. Hence the formula giving the height above the sea-level in terms of the pressure may be written

$$h = 7.9887 \times 10^5 \times \text{Nap. log.}\ (p_0/p)$$

In practice this formula must be modified to suit regions where g is other than 981, and where the temperature is other than 0°. The effect of the water-vapor present must also be taken into account, and the constants involved carefully tested by observation. The subject is treated in detail under BAROMETER.

Boyle's experiment.

In an appendix to the *New Experiments, Physico-Mechanical, etc., touching the Spring of Air* (1660), Robert Boyle states that the density of air is directly as the pressure. His apparatus and method of experiment are as follows. A U-shaped tube is taken, one of whose limbs is considerably longer than the other. The shorter limb is closed at the end; and the whole apparatus is set vertically with the open end pointing upwards. A small quantity of mercury fills the bend, so that at the beginning of the experiment the two mercury surfaces are at the same level. Hence the air confined in the shorter limb is subjected to a pressure along its lower surface equal to the atmospheric pressure, or one atmosphere as it is commonly called. As the height of the air column in the closed tube is small, the pressure and density are practically the same throughout. Now let mercury be poured into the longer limb. The free mercury surface will be observed to rise in the shorter limb, so that the air confined there becomes compressed into smaller bulk. Since the mass of air has not altered, the density is obviously inversely as the bulk, and can therefore be easily measured. Again, the pressure to which the confined air is now subjected is equal to the pressure over that surface in the mercury in the open limb which is at the same level as the free mercury surface in the closed limb. But this pressure is clearly the sum of the atmospheric pressure and the pressure due to the superincumbent column of mercury, which latter can be readily expressed in atmospheres if the height of the barometer is known. In other words, divide the vertical distance between the two mercury surfaces by the height of the barometer column. The quotient added to unity gives the required pressure in atmospheres.

Mariotte's experiments.

Fourteen years after the date of the publication of Boyle's results, Mariotte,[1] working independently, discovered the same law, which is still widely known on the Continent as Mariotte's law. He supplemented Boyle's experiments by investigating the effect of pressures less than that of the atmosphere, and proved that the same law held at these diminished pressures. His method was essentially as follows. A barometer tube is filled in the ordinary way with mercury and fixed up as in the

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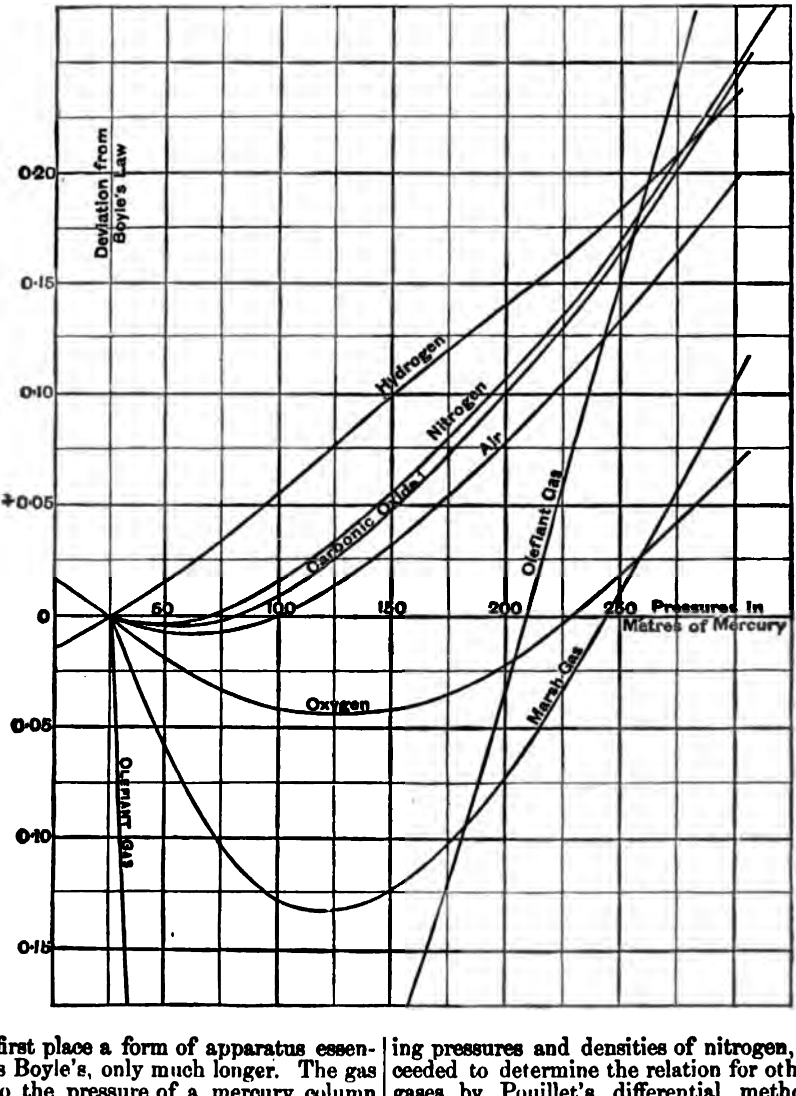
[1] *Traité de la Nature de l' Air*, 1676.

Torricellian experiment. A little air is then introduced at the lower end of the tube which is dipping in the reservoir of mercury. This air travels up the tube and fills the Torricellian vacuum at the top, thereby depressing to a slight extent the barometer column. The amount of depression divided by the true height of the barometer gives the pressure in atmospheres which acts upon the air in the tube. The tube, always kept truly vertical, dips in a reservoir of mercury sufficiently deep to admit of its complete immersion. For a certain position of the tube the free surfaces of mercury in the tube and reservoir are at the same level. For that position the confined air is at the atmospheric pressure; and for any higher position of the tube the pressure in the confined mass of air is less than the atmospheric pressure by the pressure due to the column of mercury between the free surfaces. Recent experiments by Kraevitch and Petersen (*Journal of the Russian Chemical Society*, vol. xvi.) seem to show that very rarefied air is very far from obeying Boyle's law. At such low pressure, the condensation of the gas upon solid surfaces is an important factor.

Boyle's law only approximate.

For most ordinary purposes Boyle's law—that, at constant temperature, the density of a gas varies directly as the pressure—may be assumed to be true, at least for moderate ranges of pressure; but the careful investigations of later experimenters, such as Oersted, Despretz, Dulong, Regnault, Andrews, Cailletet, and Amagat, have proved that the law is only approximate for every known gas, and that the deviation from correspondence with the law is different for each gas. The most recent investigations are those of Cailletet and Amagat, who have carried the results to much higher pressures than former experimenters employed. Both adopted in the first place a form of apparatus essentially the same as Boyle's, only much longer. The gas was subjected to the pressure of a mercury column enclosed in a strong narrow steel tube; and, as oxygen acts vigorously upon mercury at high pressures, nitrogen was used. In this way Cailletet[2] attained to a pressure of 182 metres of mercury, and Amagat[3] to a pressure of nearly 330.



Amagat's experiments.

Having thus determined accurately the corresponding pressures and densities of nitrogen, Amagat proceeded to determine the relation for other gases by Pouillet's differential method. That is, the pressure to which the new gas was subjected was made to act simultaneously upon a given mass of nitrogen, whose volume could be readily measured and pressure estimated. Oxygen, hydrogen, carbonic oxide, dry air, olefiant gas, and marsh gas were investigated in this way. The general results obtained by Amagat are exhibited in the subjoined chart taken from his paper. For all gases except hydrogen the product *pv* (pressure into volume), instead of being constant, as Boyle's law would re-

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[1] [The chart should read carbonic acid.—Am. Ed.]

[2] *Journal de Physique*, vol. viii. 1879.

[3] *Annales de Chimie et de Physiqu*, vol. xix., 1880.

quire, diminishes at first as the pressure is increased. At a certain pressure, however, different for each gas, the diminution ceases, and if the pressure is still further increased the product *pv* begins to increase also, and continues so to do to the greatest pressure used. In the case of hydrogen the product increases from the very beginning.

On the diagram, abscissæ represent pressures in metres of mercury, and the ordinates represent the deviations from the Boylean law. It will be observed that all the curves pass through the point on the pressure axis which represents a pressure of 24 metres of mercury. If π represents the product *pv* for any gas at this pressure, and π' the corresponding product for any other pressure, then we may write

$$\pi/\pi' = 1+\delta,$$

where δ represents the deviation from Boyle's law. All the curves except that for hydrogen show a well-marked minimum, at and near the pressure corresponding to which the particular gas obeys Boyle's law. For the several gases these positions occur at the pressures as given in the following table:

Nitrogen	50 m.	Carbonic acid	50 m.
Oxygen	100 m.	Marsh gas	120 m.
Air	65 m.	Olefiant gas	65 m.

For olefiant gas δ is so great, and varies so rapidly, that only portions of the curve are represented. The value of δ for its minimum point is -1.3, while the corresponding value for oxygen is -0.05. In these experiments the temperature of the gases varied between 18° and 22° C.

Amagat[1] has extended his researches to higher temperatures up to 100° C. The general characters of the curves obtained for hydrogen, nitrogen, olefiant gas and marsh gas remain the same as at the ordinary temperature; that is, with the exception of hydrogen, the product *pv* decreases to a minimum and then increases indefinitely.

The position of the minimum changes with the temperature. Thus for olefiant gas and carbonic acid gas whose properties were also studied at these higher temperatures), the pressure at which the minimum occurs increases with the temperature, while in the case of nitrogen and marsh gas this critical pressure decreases as the temperature rises, Probably at some temperature higher than 100° olefiant gas and carbonic acid gas would begin to behave like nitrogen. and all would appear to tend more and more, as the temperature rises, to the condition of which hydrogen is the type. That is, the deviation from the Boylean law up to the minimum point would steadily decrease until finally the curve would cease to have a marked minimum. For any one gas, the higher the temperature the less the curvature at the minimum point; and the comparison of different gases seems to indicate that the curvature is greater for the more easily liquefiable gas. At sufficiently high temperatures the law of compressibility for all gases approximates to the relation

$$P(V-a)=\text{constant},$$

where P is the pressure, V the volume, and a a constant. Hydrogen follows this law very closely at the ordinary temperature of the air, as the straightness of its representative curve shows at a glance.

Charles's law.

Amagat has further discussed by means of his results the law of dilatation of gases. This law is named Charles's law, after the discoverer of it. Stated simply, it is that *at constant pressure every gas expands by the same fraction of itself* for a given rise from a given temperature. Charles did not publish his results; and it was not till fifteen years later, when Dalton and Gay-Lussac, working independently, rediscovered it, that the law became generally known. Their results were published in 1801[2] and 1802[3] respectively; and it is upon the authority of the latter, who accidentally became acquainted with the fact, that the law is now named after Charles. The careful measurements of Magnus,[4] Regnault,[5] Jolly, and others have established that there is an appreciable difference in the coefficients of expansion for the different gases. The difference is slight for the so-called permanent gases—air, nitrogen, oxygen, hydrogen, and marsh gas; but for the more easily liquefiable gases it is quite marked. The mean coefficient of expansion for air between 0° C. and 100° C. and at the ordinary atmospheric pressure is .003665 per degree, and the value for any one of the gases just mentioned does not certainly differ from this by one-half per cent.[6] This may be expressed by the formula

$$v=KT,$$

where K is a constant and T the temperature measured from absolute zero, which is 274° C. below the freezing point of water (see HEAT). When T is constant, we have by Boyle's law the product *pv* also constant. Hence we may combine the two laws in the form

$$pv=RT,$$

where R is a constant. We thus see that, Boyle's law being assumed to be true at all temperatures, Charles's law, if true for any given pressure, is true for every other pressure. Further, if v is kept constant the rate of increase of log p with temperature will be expressed by the same number as the rate of increase of log v when p is kept constant. Experiment has fully verified this conclusion to as close an approximation as Boyle's and Charles's laws themselves are fulfilled. The rate of increase of log v with temperature, or, what is the same thing, the ratio of the rate of increase of the volume to the original volume, is given by the formula

$$\frac{1}{v}\frac{dv}{dT}=\frac{1}{T};$$

and this is the measure of the coefficient of expansion at temperature T. Hence the coefficient of expansion diminishes as the temperature rises, a conclusion also in accordance with experiment so long as we are dealing with gases which nearly obey Boyle's and Charles's laws.

Amagat's results.

We have seen, however, that even in the case of hydrogen the departure from Boyle's law is very marked at the higher pressures; and therefore we cannot expect a closely numerical agreement between the results of experiment and the results of calculation from the above formula. Thus, it is not surprising that practically the coefficient of expansion should be affected by the pressure, as Amagat's experiments clearly show,—although in the equation deduced above the pressure does not enter. In the following table given by Amagat, the second column contains the mean coefficients of expansion of hydrogen between 17° and 60° C. at the pressures given in the first column; and the third column contains the corresponding mean coefficients between 60° and 100° C.

Pressure in Metres of Mercury.	17°-60°.	60°-100°.
40	.0033	.0029
100	.0033	.0028
180	.0031	.0027
260	.0030	.0025
320	.0028	.0024

The temperature effect upon the coefficient of expansion, as shown by these numbers, is approximately that indicated above, viz., that at constant pressure the coefficient of expansion is inversely as the absolute temperature. A glance down each column shows at once the marked effect of pressure. In this steady decrease of the coefficient of expansion with increase of pressure, hydrogen stands alone amongst the substances discussed by Amagat. His conclusions are given in these words:

1. The coefficient of expansion of gases increases with

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[1] *Annales de Chemie et de Physique*, vol. xxii., 1881.
[2] *Memoirs of the Philosophical Society of Manchester*, vol. v.
[3] *Annales de Chimie*, xliii., An X.
[4] *Pogg. Ann.*, lv., 1841.
[5] *Mém. de l'Acad.*, xxi.

[6] The first who really gave accurate values of these quantities was Rudberg.

the pressure to a maximum, after which it decreases indefinitely.

2. This maximum occurs at the pressure for which at constant temperature the product pv is a minimum, that is, the pressure at which the gas follows for the instant Boyle's law.

3. With increasing temperature this maximum becomes less and less sensible, finally disappearing with the minimum characteristic of the compressibility curve.

Thus, as hydrogen does not show this minimum characteristic, its coefficient of expansion has no maximum value. Possibly at lower temperatures hydrogen may, however, possess these characteristics.

It thus appears that the simple gaseous laws established by Boyle and Charles are most nearly fulfilled by those gases which are difficult to liquefy, and are better fulfilled by all the higher the temperature is. When a gas is near its point of liquefaction the density increases more rapidly than the pressure, or in other words the volume diminishes more quickly than Boyle's law requires. When the point of liquefaction is actually reached, the slightest increase of pressure condenses the whole of the gas into a liquid; and in this state the alteration of volume is very small even for a large increase of pressure.

Isotherms.

The transition from the gaseous to the liquid state is conveniently studied by the help of isothermal lines, which may be generally defined as curves showing the relation between two mutually dependent variables for given constant temperatures. Such variables are the pressure and volume of a mass of gas. Let the numbers representing the volumes be measured from a chosen origin along a horizontal axis, and the numbers representing the pressures similarly along a vertical axis passing through the same origin. If we consider a mass of gas at a given temperature, for any volume that can be named there will be a definite pressure corresponding, and *vice versa.* Hence the point whose coördinates are the corresponding volume and pressure is completely determined if either coördinate is given. The temperature always being kept constant, let now the volume change continuously. The pressure will also alter according to a definite law; and the point whose coördinates are at any instant the corresponding volume and pressure will trace out a curve. This curve is an isothermal curve, or simply an *isotherm.* If Boyle's law were fulfilled, the equation to the isotherm for any given temperature would be of the form

$$pv = \text{constant}.$$

The isotherm would be a rectangular hyperbola, whose asymptotes are the coördinate axes. For any gas not near its point of liquefaction the isotherm will not deviate greatly from the hyperbolic form.

Let now the pressure be kept constant, and the gas raised somewhat in temperature. The volume of course increases, and the corresponding point on the diagram moves off the original isotherm. Through this point in its new position we can draw a second isotherm corresponding to the new temperature. And thus the whole field may be mapped out by a series of isotherms, each one of which corresponds to a definite temperature. The higher the temperature the farther does the isotherm lie from the origin. Such a mapped out diagram or chart shows at a glance the relations between the volume, pressure, and temperature of a given mass of gas, so that if any two of these are given the third can be found at once.

Isotherms for water substance.

So long as the substance is in the gaseous form, the isotherm remains approximately hyperbolic; but at the pressure at which liquefaction takes place a marked change occurs in the form of the curve. For greater definiteness consider the case of a gramme of steam at 100° C. and at a pressure somewhat below one atmosphere. As the pressure is increased, the volume diminishes appreciably faster than Boyle's law requires, but still in such a way as to give an approximately hyperbolic form to the isotherm. When the pressure reaches one atmosphere, however, any further increase is accompanied by the liquefaction of the whole; that is, the volume suddenly diminishes from 1647.5 cubic centimetres to 1 cubic centimetre. Between these extremes of volume, the isotherm is a straight line parallel to the horizontal axis. The pressure remains constant until the whole of the gas is liquefied. In other words, *the pressure of a gas in presence of its liquid does not alter provided the temperature is kept constant.* This is a partial statement of the more general law that the temperature of the liquid surface alone determines the maximum pressure which its vapor or gas in contact therewith can exert (see HEAT). After the whole has been liquefied, any increase of pressure is accompanied by a very minute diminution of volume. Hence the isotherm rises abruptly from the point whose coördinates are 1 cubic centimetre and 1 atmosphere, becoming nearly but not quite vertical. Thus, the isotherm for water-substance at 100° consists of three parts: an approximately hyperbolic portion for pressures less than one atmosphere, the substance being then wholly gaseous; a horizontal portion, corresponding to the state in which the substance is partly liquid partly gaseous; and a nearly vertical portion for pressures higher than one atmosphere, the substance being then wholly liquid. If we trace out the isotherm for some higher temperature, say 150° C., we obtain the same general characteristics. The straight line portion, however, is not so long, for two reasons: the steam must be reduced to a smaller volume before liquefaction begins; and the volume of the liquid when condensed is greater. The pressure corresponding to the transition state is in this case 4.7 atmospheres, and the range of volumes is from 384.4 cubic centimetres in the gaseous state to 1.038 cubic centimetres in the liquid state. It thus appears that the positions of the two points of abrupt change on an isotherm draw nearer the higher the temperature, coming together finally when the temperature has reached a certain critical value. In other words, at and above a certain temperature a liquid and its vapor cannot co-exist. This temperature for water-substance is very high, somewhere about the point of fusion of zinc, and is therefore difficult to measure.

Andrew's results for carbonic acid gas.

Dr. Andrew's, however, in his classical researches on carbonic acid gas,[1] to which we owe most of what is said above, has discussed the whole subject in a very complete manner. This substance, at a temperature of 13.1° C., begins to liquefy at a pressure of 47 atmospheres. During the process of liquefaction there is a perfectly visible liquid surface separating the two coexisting states of the substance; and the isotherm has a corresponding straight line portion. At a temperature of 21.5° C. liquefaction occurs at a pressure of 60 atmospheres. The horizontal portion of the isotherm, which marks the co-existence of the gaseous and liquid states, is considerably shorter than at the former temperature. The isotherm for 31.1° C., however, has no such rectilinear characteristic; and at this and higher temperatures the substance is never during the whole compression in two distinct conditions at once. It is impossible to say when the dense gaseous condition passes into the light liquid condition. The two states are absolutely continuous. The critical temperature—that is, the temperature below which there is a distinct separation between the liquid and the gas—is fixed by Dr. Andrews at 30.92° C. for carbonic acid gas. Above this temperature it is impossible to obtain a free liquid surface in a closed vessel. This conclusion had already been arrived at by Faraday in 1826, when he considered himself entitled to state that above a certain temperature no amount of pressure will produce the phenomenon known as condensation.

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[1] *Phil. Trans.*, 1869.

Cagniard-Latour's experiments.

Andrews's results also give the true explanation of the observations made by Cagniard-Latour[1] in 1822 upon the effect of high temperature on liquids enclosed in glass tubes which they nearly filled. He found that at a certain temperature the free liquid surface disappeared, and the tube became filled with a substance of perfectly uniform appearance throughout. He concluded that the whole had become gaseous. In reality he had reached the critical temperature at which the liquid and gaseous conditions pass continuously the one into the other. The following are Cagniard-Latour's estimated values for the temperature and pressure of various substances at the critical point:

	Temperature.	Pressure.
Ether........................	175° C.	38 atmospheres.
Alcohol........................	248° "	119 "
Bisulphide of carbon...	258° "	71 "

Avenarius[2] and Drion[3] have studied the critical temperature of other substances, such as sulphuric acid, aceton, and carbon tetrachloride. The substances, however, which can be so studied are comparatively few, since the greater number of those which are liquid under ordinary conditions have their critical temperatures very high, while the majority of those which are gaseous have theirs very low.

The liquefaction of gases.

The necessity for a very low temperature long prevented the obtaining in a liquid form of the standard gases—hydrogen, oxygen, nitrogen, etc.—which were accordingly distinguished by the name *permanent gases*. Faraday[4] proved that these could not be liquefied at a temperature of — 110° C., even when subjected to a pressure of 27 atmospheres. Natterer[5] likewise failed to reduce these gases to the liquid state, even at a pressure of 3000 atmospheres. His means for reducing the temperature were not satisfactory. In 1877 Cailletet and Pictet, working independently, first successfully effected their approximate liquefaction. The former compressed each of the gases oxygen, nitrogen, and carbonic oxide to 300 atmospheres in a glass tube, which was cooled to — 29° C.[6] When the gas was allowed to escape, it did so in the form of a cloud, condensing for the moment to the liquid state under the influence of the extreme cold produced by the rapid expansion of the gas. Pictet in a similar way obtained an issuing stream of liquid oxygen. Von Wroblewski and Olzewski[7] have more recently obtained oxygen, nitrogen, and carbonic oxide in a more evident liquid state. They used Cailletet's form of apparatus, and cooled the gas by means of the evaporation of liquid ethylene. Under this extreme cold they observed these substances forming a well-defined liquid in the bottom of the tube. The following table gives the results of five different observations at slightly different temperatures.

Temp., C...	—129.6°	—131.6°	—133.4°	—134.8°	—135.8°
Pressure, in atmos.......	27.02	25.85	24.4	23.18	22.2

At slightly higher temperatures, the pressure necessary for the liquefaction increased very rapidly. Nitrogen and carbonic oxide were not so easily reduced, remaining still gaseous at — 136° C., and under a pressure of 150 atmospheres. By a sudden diminution of the pressure to 50 atmospheres there was obtained under the influence of the reduced temperature a rapidly evaporating liquid. The critical point of oxygen has been experimentally fixed by Von Wroblewski[8] at — 113° C. and 50 atmospheres pressure. With the date given by Amagat's researches, Sarrau[9] has calculated from a formula of Clausius's the following values of the critical temperature and pressure for oxygen, nitrogen, hydrogen:

	Critical Temperature.	Critical Pressure.
Oxygen......................	—105.4° C.	48.7 atmospheres.
Nitrogen....................	—123.8°	42.1 "
Hydrogen..................	—174.2°	98.9 "

It will be observed that Von Wroblewski's observed values for oxygen are in remarkably close agreement with the calculated values given here. Apparently oxygen is just at the limit fixed by Faraday.

Manometer.

The behavior of a gas under varying pressure is a phenomenon of great practical importance, and gives a valuable method for measuring pressures (see MANOMETER).

A modification of the ordinary mercury manometer is used for measuring volumes, and is especially valuable in estimating the densities of substances which cannot be put into water, such for example as liquids or powders. The closed end of the manometer tube, which by means of a stop-cock may be opened to the air at will, is fitted to a flask with which it may be put into connection when required. Two fiducial marks are then made upon it—one at the position where the mercury surfaces in the two limbs of the tube are co-level, and the other somewhat higher at a convenient spot. Between the two marks the tube expands into a bulb, thereby increasing the intervening volume and minimizing the effect of any slight error in bringing the mercury surface to the higher mark. Let the volume of the flask and tube down to the higher mark be v, and the volume of the rest of the tube down to the lower mark V. At first the volume of air in the flask and tube is $V+v$, at the atmospheric pressure P. Now pour mercury into the open end till the liquid surface in the closed end reaches the higher mark. The air has been compressed to volume v; and the corresponding pressure, as measured by the balanced mercury column, is $p+P$. Hence

$$(p+P)v = P(V+v).$$

Let now a volume x be placed in the flask, and let the same succession of operations be made. Then, if p' be the increase of pressure necessary to bring the mercury surface from the lower to the higher fiducial mark, we have

$$(p'+P)(v-x) = P(V+v-x).$$

As V can be readily determined by gauging the tube, and as P, p, p' are all known, the quantities v and x can be at once found from these equations.

Air-pumps.

In many experiments on the properties of gases it is necessary to have an efficient and rapid means for altering the density. Instruments for this purpose are called air-pumps, and their function may be either to rarefy or condense the air—usually the former.

Invented by Von Guericke.

Otto Von Guericke of Magdeburg constructed the first air pump about the year 1652. It was simply a spherical glass vessel opening below by means of a stop-cock and narrow nozzle into the cylinder of an "exhausting syringe," which inclined upwards from the extremity of the nozzle. The cylinder, in which a well-fitting piston worked, was provided at its lower end with two valves. One of these opened from the nozzle into the cylinder, the other from the cylinder into the outside air. During the down-stroke of the piston the former was pressed home, so that no air entered the nozzle and vessel, while the latter was forced open by the air which so escaped from the cylinder. During the return stroke the latter was kept closed in virtue of the partial vacuum formed within the cylinder, while at the same time the former was forced open by the pressure of the denser air in the vessel and nozzle. Thus, at every complete stroke of the piston, the air in the vessel or receiver was diminished (nearly) by that fraction of itself which is expressed by the ratio of the volume of the available cylindrical space above the outward opening valve to the whole volume of receiver, nozzle, and cylinder.

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[1] *Annales de Chimie*, 2d ser., xxi., xxii.

[2] *Poggendorff's Annalen*, cli., 1874.

[3] *Ann. de Chimie et de Physique*, 3d séries, lvi.

[4] *Phil. Trans.*, 1845.

[5] *Wienische Berichte*, 1850, 1851, 1854; and *Pogg. Ann.*, xciv., 1855.

[6] *Ann. de Chimie et de Physique*, 1878; *Comptes Rendus*, 1882.

[7] *Comptes Rendus*, 1882-83; *Wiedemann's Annalen*, 1883; and *Annales de Chimie et de Physique*, 1884.

[8] *Comptes Rendus*, 1884.

[9] *Comptes Rendus*, 1882.

Improvements by Boyle, Hooke, Papin, etc.

Boyle, on hearing of Von Guericke's success in applying the expansive properties of air as a means to its rarefaction, constructed a machine essentially the same as Von Guericke's, of which no description had then been published, Boyle, however, made the exhausting cylinder a continuation of the nozzle, which was thus considerably reduced in size, and worked the piston by means of a wheel and racket work. He also employed a transparent glass receiver with removable cover, so that the operator could observe what was going on inside, and more easily alter the contents, Other modifications and improvements followed rapidly; and in the carrying out of these Boyle was greatly aided by Hooke, who conceived the happy idea of using two syringes opening into the same duct from the receiver. This improvement has recently been credited to Papin.[1] In this form the pistons are worked by the same toothed wheel, and are so adjusted that the one rises as the other falls. This arrangement not only doubles the rate of exhaustion per stroke, but vastly increases the ease of working. In the single-barrelled form the piston is drawn back against a pressure of air which is greater the more complete the exhaustion is within; but in the double-barrelled form the downward pressures upon the two pistons to a certain extent counteract each other, producing opposite rotational effects on the toothed wheel and driving handle. Boyle also early adopted the flat plate, on which could be set receivers of various shapes and sizes. The junction of the plate and receiver he made tolerably air-tight by covering the plate with wet leather and having the receiver rim ground flat. According to Gerland, the invention of the plate is due to Huygens, who constructed the first air-pump so provided in 1661, shortly after a visit to London, where his interest in the subject was awakened by Boyle. To Huygens, probably in conjunction with Papin, is also due the application of the mercury manometer to measure the pressure in the receiver—an indispensable equipment in all serviceable air-pumps. The form of the piston plugs and valves received the special attention of Papin, who by his refined and detailed improvements did much to increase the efficiency of the apparatus.

The important characteristics of an efficient air-pump are as follows. The piston must work smoothly and easily. The valves must act precisely, and be when closed absolutely air-tight. The plate on which the receivers rest must be smooth and plane, so that the ground edges of the receivers may be in close contact all round. This perfect fitting is beyond the powers of the best workmanship, so that it is necessary to press between the receiver and plate a thin layer of lard, which renders the junction air-tight. Somewhere in the duct leading from the receiver to the piston cylinders, a stop-cock must be fixed, so that it may be possible to shut off the receiver completely from these. Then a second stop-cock is required as a ready means for admitting air to the receiver, whenever the need should arise. A combination three-way stop-cock is a very usual form. And, finally, the apparatus should be provided with a pressure gauge—a mercury manometer communicating by means of a duct with the main duct and receiver.

Bianchi's air-pump.

The double-barrelled form of reciprocating air-pump, as finally employed by Boyle, is still much in use; but it is gradually being superseded by Bianchi's, which has but one cylinder and piston. The piston is, however, double-acting, as the cylinder communicates both above and below by suitable valves with the main duct which leads to the receiver. Hence, during both the up and down strokes of the piston, exhaustion is being effected, the gas which is in the *diminishing* chamber being driven out through a suitable valve to the open air. The chief merit of Bianchi's machine, however, as compared with the older form, lies in the mechanism by which the piston is driven. The end of the piston rod is attached by a crank to a rotating horizontal axle, which is in gearing with the axle of a fly-wheel. The piston cylinder is capable of a reciprocating oscillatory motion about its lower end, which pivots on a horizontal axis. Thus, as the crank rotates, the piston rises and falls in the cylinder, and oscillates along with it from side to side. The driving power is applied to a handle fixed to the fly-wheel. This substitution of a continuous rotatory motion for a reciprocating motion greatly facilitates rapid exhaustion.

Complete exhaustion impossible.

At every complete stroke of the piston the pressure of air in the receiver is reduced by a definite fraction of itself, which depends upon the relative volumes of the receiver and piston cylinder. Hence the absolute change of pressure per stroke is smaller as the pressure is smaller; and the rate of exhaustion at very low pressures becomes practically inappreciable. There is, in fact, a practical limit to exhaustion, the particular value of which depends upon the special characteristics of the instrument. The best air-pumps of the type described above cannot reduce the pressure to less than what would balance one or two millimetres of mercury—that is, to what is technically called a pressure of one or two millimetres. To obtain a lower pressure or a *higher vacuum*, as it is commonly termed, requires the use of a different principle.

Mercurial air-pump.

In a well-constructed barometer the region above the mercury contains no air. It is not an absolute vacuum, but is filled with vapor of mercury at a very low pressure—according to Regnault, .0372 mm. at 20° C., and .02 mm. at 0° C. The way in which the Torricellian vacuum has been applied to give a practical air-pump has been described in MERCURIAL AIR-PUMP. So long as mercury vapor is permitted to pass freely through the exhausting tubes, it is impossible to obtain by the mercurial air-pump pressures lower than the fortieth of a millimetre. If, however, there is placed somewhere in the duct leading from the mercury pump to the receiver, a non-volatile substance which absorbs mercury vapor, the mercury vapor will be arrested. With similar precautions for the absorption of water vapor or other vapor which may be present, it is possible to obtain very low pressures indeed. Thus Crookes[2] in his radiometer experiments obtained pressures as low as .00015 mm. or the .2 millionth of an atmosphere. The form of pump used was of Geissler's type. The water vapor was absorbed by phosphoric anhydride. Sulphur was used to absorb the mercury vapor; and on the further side metallic copper was placed to absorb any sulphur vapor which might tend to pass.

Test of a good vacuum.

The best test of a good vacuum is the electrical test. Disruptive discharge through a long tube filled with gas is possible only when the gas is very rare, but there is a point in the rarefaction of a gas at which the discharge passes most easily. In other words, the dielectric strength of a gas reaches a minimum as its pressure is diminished, and it is possible to obtain such a high vacuum that electric discharge will not take place through any considerable length of the exhausted space (see ELECTRICITY). In this connection we may notice a simple but instructive experiment of Dewar's. He carefully exhausted a vacuum tube, in which he had previously inserted a piece of carbon. In the last stages of the exhaustion the carbon was strongly heated so as to drive off most of the gas which is always condensed on its surface. After the completion of the exhaustion, the tube was sealed up and the carbon allowed to cool. As it cooled, it condensed over its surface the greater portion of the small quantity of gas left in the vacuum tube. The vacuum was thus vastly improved, so that it was impossible to pass an electric spark between two platinum electrodes which had been previously fused into the glass. A gentle heat applied to the carbon, however, was sufficient to drive off from its surface enough of the occluded gas to raise the pressure to the point necessary for the passage of the electricity. As the carbon cooled again, the high vacuum was restored and the discharge ceased.

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[1] See Gerland, in *Wiedemann's Annalen*, 1877. 1882.

[2] See his Bakerian lecture, *Phil. Trans.*, 1878, clxix. 300.

Condensing air-pumps.

It is hardly necessary to do more than mention the other class of air-pumps. Let the essential valves in an exhausting pump have their actions reversed, and the apparatus will become a condensing pump. The condensing syringe is the usual form of such a pump; but, compared to the exhausting instrument, it has very limited applications. For the mere obtaining of high pressures hydraulic means are preferable, being at once more manageable and less dangerous. Besides, even moderately slow compression of a gas is accompanied by considerable rise of temperature, just as rarefaction of a gas is accompanied by appreciable lowering of temperature. In the former case work is done in compressing the gas against its own pressure, and this energy appears as heat which raises the temperature of the gas. In the latter case the gas in expanding draws upon its own energy and so cools.

Thermal properties, kinetic theory, etc.

The thermal properties of gases are treated as a branch of mathematical physics under HEAT and THERMODYNAMICS, where also will be found discussed such experimental details as bear intimately upon the theory. The article ATOM contains a concise statement of the modern kinetic theory of gases; and in CONSTITUTION OF BODIES and DIFFUSION certain more special aspects of the same theory are regarded. For the mathematical theory see MOLECULE. The principles embodied in these articles have been assumed throughout the present article.

Aitken's experiments.

The cooling of a gas by its own expansion may be observed in one of its effects during exhaustion in an ordinary receiver. Frequently a cloud of minute drops of water—a veritable fog—forms in the exhausted air. The reason simply is that the air has become cooled below its dew-point, or the temperature corresponding to the pressure of water vapor present. If the receiver is first filled with dry air and then exhausted, no cloud forms. Also if the air is carefully filtered through cotton wool, no cloud forms, even though the air be thoroughly saturated with water vapor. This latter fact was established by Mr. Aitken in his beautiful series of experiments on dust, fogs, and clouds.[1] It thus appears that the formation of fog and cloud depends not only upon the humidity of the air but also upon the amount of dust in the air. The little particles of dust are necessary as nuclei upon which the vapor can begin to condense. The more numerous the dust particles the finer are the drops which form on them. As these coalesce into larger drops and fall, they bring down the dust nuclei with them; and hence the tendency of rain is to clear the atmosphere, and make conditions less favorable for the formation of more cloud and rain. Thus rain, fog, and dew all require for their formation a free solid surface, colder than the temperature of saturation, on which to condense. In a dustless atmosphere no cloud can ever form.

Fluid friction.

It has been already pointed out that when a fluid is in motion it can no longer be regarded as even approximately possessing the properties of the ideal perfect fluid. The postulate that the stress between contiguous portions is perpendicular to the common interface cannot be for a moment admitted. A few examples will make this clear. Thus, if a vessel filled with a liquid be set in rotation, the liquid will soon be found to be rotating with the vessel; and if the motion of the vessel be stopped, the motion of the liquid inside will gradually subside. These phenomena show the existence of a stress tangential to the fluid elements, whereby the relative motion of the different parts of the system is gradually destroyed, until the vessel and its contents behave as one solid body. Again, a fluid stream flowing along a tube or canal moves fastest in the middle, slowest at the bounding walls, and with all possible intermediate speeds at intermediate places. This retardation, due in the first instance to the action of the walls upon the fluid in direct contact therewith, and then to the *friction* between the successive contiguous sheets of fluid, plainly implies the existence of tangential stress. The action of the wind in causing waves on the smooth surface of a sheet of water is a further illustration.

In the discussion of fluid motion, however, it is customary to consider first the properties of the ideal fluid in this respect. Under HYDROMECHANICS, and especially under ATOM, will be found the mathematical theory treated in full so far as the motion of a non-viscous fluid is concerned.

General effects of viscosity.

The possibility of setting up vortex-motion in a fluid depends upon its imperfection, upon the property of viscosity or fluid friction which is possessed by all known fluids. Some of the more obvious effects of this property have been already noticed. Its effects indeed are conspicuous whereever there is relative motion of the contiguous parts of a fluid. A current of air moving through a mass of air at rest soon loses its momentum; a solid body moving through still air likewise has its motion retarded. The loss of energy which a meteoric stone so suffers as it speeds through the atmosphere appears in the form of heat, which is sufficient to make the stone glow to incandescence or to the temperature of rapid combustion. The waves of rarefaction and condensation, which constitute sound physically, gradually decay in virtue of viscosity. It appears that the rate of this decay is quickest for the shortest waves; so that a sound after travelling through a long distance may lose its shriller constituents and so be modified and mellowed. It is viscosity also which supports the minute dust particles and cloud-forming drops of water in our atmosphere. These are bulk for bulk heavier than the atmosphere, and in tranquil air are slowly sinking. The slowness of their downward motion is directly due to the effect of fluid friction.

Fluid friction depends on diffusion.

The term fluid friction is applied because of the similarity of its effects to the effects of friction between solid masses. Otherwise there need be no further resemblance. The true nature of friction between solid surfaces is not known; possibly, as suggested by Sir W. Thomson, it may be in great measure electrical. In the case of gases, however, the origin of friction is more apparent. Its laws can be deduced from the kinetic theory, and depend directly upon the principle of diffusion. According to the kinetic theory of gases, the molecules of a gas are in constant motion amongst themselves. Compared to their own dimensions, they are by no means closely packed, so that any individual molecule travels a comparatively large space between its encounters with other molecules. Any two contiguous regions are continually interchanging molecules. This diffusion of a gas into itself we have no means of measuring experimentally, as we cannot deal with the individual molecule. Suppose, however, that we have two contiguous layers of a gas flowing in parallel directions with different speeds. The general drift of molecules in the one layer is faster than in the other. But this difference will not prevent the individual molecules diffusing across the interface between the layers. Diffusion will go on freely. The result will be that the slower moving layer will on the whole gain momentum in the direction of its motion and the faster moving layer lose momentum. Thus, diffusion tends to the equalization of momentum between two contiguous regions, and the rate at which this takes place across unit area is the measure of the viscosity. Maxwell has proved[2] that the viscosity so measured is independent of the density of the gas when the temperature is constant;

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[1] *Trans. Roy. Soc. Edin.*, 1880–81.

[2] *Phil. Mag.*, 1860, and *Phil. Trans.*, 1867.

whereas the relation between the viscosity and temperature depends upon the particular mode of action between the molecules when they approach each other.

The above definition of viscosity is not one which can be used in experimental determinations, since we cannot take account of the individual molecules of a gas. The coefficient of viscosity must be defined in terms of directly measurable quantities.

Viscosity defined physically.

Maxwell has defined viscosity in these words: the viscosity of a substance is measured by the tangential force on unit of area of either of two horizontal planes at the unit of distance apart, one of which is fixed, while the other moves with unit of velocity, the space between being filled with the viscous substance. This is the dynamical definition. When the effects of viscosity on the internal motions of a fluid itself are being considered it is often more convenient to use the kinematical definition. It is given in terms of μ, the coefficient of viscosity, by the equation

$$\mu = \rho\nu,$$

where ρ is the density of the substance, and ν the kinematic viscosity.

Experiments on viscosity.

The viscosity of fluids has been determined experimentally in three distinct ways—by flow of the fluid through tubes, by motion in the fluid of pendulums or vibrating disks, and by the oscillations of spheres filled with the fluid. The last was employed by Helmholtz and Von Piotrowski in their investigation of liquids,[1] but it is not applicable to the case of gases. Experiments on the flow through capillary tubes have been carried out by Poiseuille[2] for liquids, and by Graham,[3] Meyer,[4] Springmühl,[4] and Puluj[5] for gases. This, the transpiration method, is the most effective for comparing viscosities, which are directly proportional to the times of transpiration of the respective gases. There is, however, a little uncertainty as to the effect of the capillary tube,—so that, for measuring absolutely the viscosity for any one gas, the method is not so trustworthy as the second method. Here we may use either pendulums swinging through small arcs or disks oscillating in their own plane under the action of torsion. In both the measurement depends upon the rate at which the amplitude of oscillation diminishes.

Stokes, who first satisfactorily discussed the true nature of viscosity, tested the theory by a discussion[6] of the pendulum experiments of Dubuat (1786), Bessel (1826), and Baily (1832). From Baily's results he calculated .000104 (in metric units) as the coefficient of viscosity of air. Meyer[7] similarly deduced from Bessel's and Girault's[8] experiments the values .000275 and .000384. It is not in the least surprising that these are all pretty wide of the true value, seeing that the experimenters had not the special problem of finding the viscosity before them.

Meyer, to whom we owe a very complete series of valuable memoirs on the subject, has more recently experimented[9] with three different-sized pendulums. The values deduced for the viscosity were .000232, .000233, and .000184. The last number, given by the shortest pendulum, Meyer considers to be the best.

Maxwell[10], Meyer, and Kundt[11] and Warburg [12] have experimented with oscillating disks. The methods of Maxwell and Meyer were so far similar that each used an arrangement of three horizontal circular disks, fixed centrally to the same vertical axis, and suspended by a torsion wire inside a receiver. The pressure and temperature of the air or gas inside could be adjusted to any desired values within certain limits. In Maxwell's apparatus, which Meyer adopted in his later researches, the moving disks vibrated between parallel fixed disks, which were perforated in the centre so as to allow the vertical suspended axis to pass freely through them. Each disk thus oscillated in its own plane between two parallel fixed surfaces. After the disks were set in position, and the air in the receiver brought to the desired temperature and pressure, the suspended disks were set in oscillation. This was effected magnetically, a small magnet fixed to the end of the suspended axis being acted upon by an external magnet suitably adjusted. Each disk, in its oscillations, dragged after it the layer of air in immediate contact with it; and in virtue of viscosity this oscillation was transmitted with diminishing amplitude from layer to layer until the fixed disks were reached. In thus setting and sustaining in motion a mass of gas, the disk was doing work; and, if left to itself and to the action of the torsion suspension, it oscillated with gradually diminishing range until it came to rest. The viscosity of the air was not the only retarding influence. The torsion wire had also a coefficient of viscosity; and then there was a possible resistance due to the slipping of the fluid at the surfaces of the disks. These various effects were discriminated by suitable modifications. Thus by placing the oscillating disks in contact with each other, and setting two of the fixed disks at measured distances above and below, Maxwell reduced the number of surfaces in contact with the fluid, and so increased the relative importance of the effect due to the wire's viscosity. Again, by diminishing the distances between the fixed and oscillating disks, he made the conditions more favorable to the effect (if any) due to the slipping. This latter effect was found to be so small as to be almost within the errors of observation; consequently Maxwell felt himself warranted in calculating the coefficient of viscosity on the assumption that there was no slipping.

Maxwell's final result in metric (C. G. S.) units for the coefficient of viscosity of dry air is

$$\mu = .0001878(1+.00365\theta),$$

where θ is the temperature in degrees Centigrade. Meyer's result is

$$\mu = .000190(1+.0025\theta).$$

Maxwell found the effect of pressure to be inappreciable down to a pressure of 12 mm., and thus verified the deduction from theory.

Kundt and Warburg, in their experiments, used only one disk, which oscillated under the influence of a bifilar suspension between two fixed disks. They carried the pressure down to as low as 0.6 mm. At 20 mm. pressure the viscosity was the same as at the atmospheric pressure; but at lower pressures a slight diminution began to show itself. According to Crookes's later researches, this diminution becomes more and more marked at the higher exhaustions. The manner in which the viscosity then diminishes coincides remarkably with the manner in which the free path increases. It could not be expected that in such modified circumstances Maxwell's law would continue to apply. When the gas becomes so far rarefied that the mean free path of a molecule is not small compared to the space in which the gas is confined, the motion of the molecules cannot be treated statistically. Hence the deductions from a theory based upon the statistic method will no longer hold good.

Maxwell, Kundt and Warburg, and Crookes investigated by the disk method the viscosities of other gases, the values for which are compared below with the transpiration times of the same gases through capillary tubes. Maxwell also found that damp air, at 100 mm. pressure, and over water at about 20° C., was one-sixtieth less viscous than dry air at the same temperature. Kundt and Warburg found for water vapor, at 21° C. and 16 mm. pressure, the value

$$\mu = .0000975,$$

a little more than half that of air.

The results obtained by Meyer and Springmühl and by Puluj from their transpiration experiments agree well with those already given. In such experiments, however, the slipping of the gas over the solid surface has in certain circumstances a measurable effect. This slipping is measured by a certain coefficient, called the *Gleitungs-Coefficient* by Helmholtz and Von Piotrowski. When this coefficient becomes appreciable, the gas in contact with the solid surface, instead of being at rest relatively to that surface, will be gliding over it with a finite velocity v. The circumstances of the motion will be very nearly the same if we remove a layer of the solid surface and replace it by fluid, the new surface of fluid in contact with the new solid surface being at rest. The thickness which must be so removed is the measure of the coefficient of slipping. Kundt and Warburg,[13] in their experiments with glass tubes, found this coefficient for dry air at about 20° C. to be

$$8/p \text{ centimetres},$$

where p is the pressure in dynes per square centimetre, which is nearly the same as in millionths of an atmosphere. The value for hydrogen on glass is $15/p$. Hence at ordinary pressures and moderate exhaustions this coefficient is very small, becoming appreciable only at low pressures.

The relation between viscosity and temperature is indicated at once by Maxwell's and Meyer's formulæ given above. According to Maxwell, the viscosity is proportional to the absolate temperature. If in the kinetic theory the forces between the molecules are disregarded, that is, if the molecules are assumed to rebound after collision like elastic spheres, the relation deduced is that the viscosity varies as the square root of the absolute temperature. Hence the mutual molecular forces must be taken into account. Maxwell's experimental law would require any two molecules to repel each other with a force varying inversely as the fifth power of the distance. According to Meyer, however, the viscosity varies according to a power of the absolute temperature less than unity, but greater than one-half. His results in this respect are corroborated by those of Kundt and Warburg, Puluj, and other later experimenters. The .77 power is probably not far from the truth.[1] Hence we may give as the final value for the viscosity of dry air the expression

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[1] *Sitzungsber. der Wiener Akad.*, 1860.

[2] *Mém. des Savants Etrangers*, 1846.

[3] *Phil. Trans.*, 1846, 1849.

[4] *Poggendorff's Ann.*, cxlviii., 1873.

[5] *Sitzungsber. d. Wiener Akad.*, lxix., 1878.

[6] *Cam. Phil. Trans.*, ix., 1850.

[7] *Poggendorff's Ann.*, cxxv., 1865.

[8] *Mém. de l'Acad., etc., de Caen*, 1860.

[9] *Poggendorff's Ann.*, cxlii., 1871.

[10] *Phil. Trans.*, clvi., 1866.

[11] *Poggendorff's Ann.*, cxcili., 1871, and cxlviii., 1873.

[12] *Poggendorff's Ann.*, clv. clvi., 1875.

[13] *Poggendorff's Ann.*, 1876.

$$\mu = .000185\,(1 + .0028\theta).$$

The following table gives the values for the different gases, as determined by the different investigators, the viscosity of air being taken as unity.

	Graham.	Maxwell.	Meyer.	Kundt and Warburg.	Crookes.
Air..............	1.000	1.000	1.000	1.000	1.000
Oxygen........	1.112	...	1.095	...	1.119
Nitrogen......	.971	...	...	...	.972
Carbonic oxide.....	.968	...	...	...	.972
Carbonic acid	.840	.859	.851	.806	.920
Hydrogen....	.488	.516	.601	.488	.444

We do not here enter into the question of the thermodynamics of gases; enough to say that the relations between viscosity, diffusion, and thermal conductivity deduced by Maxwell from the kinetic theory have received remarkable corroboration from the experiments of Loschmicht, Stefan, Kundt and Warburg, and others. A discussion of the dynamical properties of gases would not, however, appear complete without mention of Crookes's so-called radiometer, even though these phenomena of high vacua are ultimately thermodynamic.

Crookes's radiometer.

The typical form of the radiometer is a glass bulb, in which is hung a delicately poised arrangement of vanes. These, usually four in number, are fixed at the extremities of two light horizontal cross-rods, which are supported so as to be capable of easy rotation about a central vertical axis. The vanes or disks are set in vertical planes passing through the axis; and each has its one side bright, and the other blackened. For any rotation the motion of each vane is exactly alike; that is, either the bright faces all move first, or the dark faces do so. If the pressure of the gas inside the bulb is reduced to a very low exhaustion, the vanes under the action of light or heat will begin to rotate. The mere bringing the radiometer out of a dark region into daylight is enough to set up this rotation. In ordinary circumstances the dark faces are apparently repelled, and the vanes move round with their bright faces in advance.

The phenomenon is really a thermal one, as was demonstrated experimentally by Tait and Dewar.[2] Further, although it is most evident in high vacua (provided they are not too high), it can be produced in very moderate exhaustions by a suitable arrangement, as was long ago pointed out by Fresnel. Thus, if under the receiver of an ordinary air-pump a light disk be delicately poised near a parallel fixed surface, it will be apparently strongly repelled by this surface if the opposing surfaces are brought to different temperatures. This may be effectively done by means of a ray of sunlight. In this experiment, the essential condition is (as shown by Tait and Dewar) that the surfaces be at a distance comparable to the mean free path of the gaseous molecules. In Crookes's radiometer the free path is very long, and hence there is apparent repulsion between the blackened surfaces and the walls of the bulb. The reason simply is that, under the action of the radiant energy directed in upon the vanes, the dark faces, absorbing more energy, become warmer than the bright faces. Hence an inequality of temperature is produced in the highly rarefied gas, and this brings into existence a stress which displaces the vanes.

Liquid in the spheroidal state illustrates the same principle. That a drop of water may be supported over a hot surface without touching it requires an upward pressure. In other words, the vertical stress in the vapor and gas which separate the drop from the surface must be greater than the ordinary gaseous pressure all round the drop. This stress exists because of the difference of temperature between the drop and the surface, so that the pressure in the thin layer of vapor and gas is slightly greater in the vertical than in any horizontal direction.

A general notion of the manner in which this stress is sustained may be obtained from the following consideration: According to the kinetic theory of gases, the mean speed of the molecules is a function of the temperature—the higher the temperature the greater the speed. Hence molecules, impinging upon a surface at a higher temperature, and in a direction more nearly perpendicular to it, will rebound from that surface with increased momentum. The simultaneous motion of the surface, as if repelled, is then somewhat analogous to the recoil of a cannon when fired. The whole investigation of the question is, however, by no means simple. Maxwell has discussed it with characteristic lucidity in his latest contribution[3] to the dynamical theory of gases. He finds that, when inequalities of temperature exist at a given point in a gas, the pressure is not the same in all directions. Its value in any given direction, in so far as it depends upon the temperature inequality, is proportional to the space-rate of change of the space-variation of the temperature in that direction—that is, to the second differential coefficient of the temperature with respect to the given direction. Hence the pressure will be greatest along the line for which this differential coefficient is a maximum. It appears that the pressure so called into existence by a possible temperature inequality is very minute at ordinary hydrostatic pressures, but becomes considerable when the pressure of the gas is made very small. If the inequality of temperature throughout the gas is due to the presence of small bodies, whose temperatures differ from the temperature of the gas at a distance from them, then the small bodies will be acted upon by the stresses set up, provided they are of the same order of smallness as the mean free path of the molecules. In the case of two such small bodies, there will be apparent repulsion between them if the bodies are warmer than the air at a distance from them, and attraction if they are colder, If one is warmer and the other colder, the action may be either attractive or repulsive, according to the relative sizes of the bodies and their exact temperatures. These results are obtained by considering only the stresses normal to the solid surfaces. When the tangential stresses are taken into account, then it appears that inequality of temperature, when the flow of heat becomes steady, cannot produce other than equilibrium in the material system immersed in the gas. Hence Maxwell believes that the explanation of Crookes's phenomenon must depend ultimately upon the slipping of the gas over the solid surface. If such slipping be permitted, its effect will be to diminish the tangential stresses acting on the solid surface without affecting the normal stresses; and hence the equilibrium will be destroyed. In attempting to express the conditions to be satisfied by the gas at the solid surface, Maxwell is led to the consideration of the phenomenon discovered by Osborne Reynolds[4] and named thermal transpiration. This phenomenon consists of a sliding of the gas over the surface of an unequally heated solid from the colder to the hotter parts. Maxwell considers the particular case of the slow steady flow of gas along a capillary tube of circular section, the temperature of which varies steadily from point to point. The amount of gas which passes through any section depends both upon the rate of change of pressure and the rate of change of temperature in passing along the axis of the tube. If the pressure is uniform there will be a flow of gas from the colder to the hotter end. If there is no flow of gas, the pressure will increase from the colder to the hotter end. The case of uniform temperature is the ordinary case of transpiration through capillary tubes, as discussed experimentally by Graham, Meyer, Puluj, and Kundt and Warburg. The experimental investigation of the first two cases seems at present hopeless, on account of the minuteness of the quantities to be measured. Reynolds experimented, not on capillary tubes, but on the passage of the gas through a porous plate, the temperatures being different on the two sides. (C. G. K.)

PNEUMONIA, or inflammation of the substance of the lungs, manifests itself in several forms which differ from each other in their nature, causes, and results,—viz., (1) Acute Croupous or Lobar Pneumonia, the most common form of the disease, in which the inflammation affects a limited area, usually a lobe or lobes of the lung, and runs a rapid course; (2) Catarrhal Pneumonia, Broncho-Pneumonia, or Lobular

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[1] [Professor P. E. Chase's theoretical estimate is .75—AM. ED.]

[2] *Proc. Roy. Soc. Edin.*, and *Nature*, 1875.

[3] *Phil. Trans.*, 1879.

[4] *Proc. Roy. Soc.*, 1879.

Pneumonia, which occurs as a result of antecedent bronchitis, and is more diffuse in its distribution than the former; (3) Interstitial Pneumonia or Cirrhosis of the lung, a more chronic form of inflammation, which affects chiefly the framework or fibrous stroma of the lung and is closely allied to phthisis.

Acute Croupous or Lobar Pneumonia.—This is the disease commonly known as inflammation of the lungs. It derives its name from its pathological characters, which are well marked. The changes which take place in the lung are chiefly three. (1) *Congestion*, or engorgement, the bloodvessels being distended and the lung more voluminous and heavier than normal, and of dark red color. Its air cells still contain air. (2) *Red Hepatization*, so called from its resemblance to liver tissue. In this stage there is poured into the air cells of the affected part an exudation consisting of amorphous fibrin together with epithelial cells and red and white blood corpuscles, the whole forming a viscid mass which occupies not only the cells but also the finer bronchi, and which speedily coagulates, causing the lung to become firmly consolidated. In this condition the cells are entirely emptied of air, their bloodvessels are pressed upon by the exudation, and the lung substance, rendered brittle, sinks in water. The appearance of a section of the lung in this stage has been likened to that of red granite. It is to the character of the exudation, consisting largely of coagulable fibrin, that the term croupous is due. (3) *Gray Hepatization.* In this stage the lung still retains its liver-like consistence, but its color is now gray, not unlike the appearance of gray granite. This is due to the change taking place in the exudation, which undergoes resolution by a process of fatty degeneration, pus formation, liquefaction, and ultimately absorption,—so that in a comparatively short period the air vesicles get rid of their morbid contents and resume their normal function. This is happily the termination of the majority of cases of croupous pneumonia, yet it occasionally happens that this favorable result is not attained, and that further changes of a retrograde kind take place in the inflamed lung in the form of suppuration and abscess or of gangrene. In such instances there usually exists some serious constitutional cause which contributes to give this unfavorable direction to the course of the disease. Further, pneumonia may in some instances become chronic, the lung never entirely clearing up, and it may terminate in phthisis. Pneumonia may be confined to a portion or the whole of one lung, or it may be double, affecting both lungs, which is a serious and often fatal form. The bases or middle of the lungs are the parts most commonly inflamed, but the apex is sometimes the only part affected. The right lung is considerably more frequently the seat of pneumonia than the left lung.

Many points in the pathology of this form of pneumonia remain still to be cleared up. Thus, there is a growing opinion that it is not a simple lung inflammation, as was formerly supposed, but that, as regards its origin, progress, and termination, it possesses many of the characters of a fever or of a constitutional affection. An interesting and important fact in this connection is the recent discovery by Friedländer and others of a micro-organism or bacillus in the blood, lungs, and other tissues in cases of pneumonia, which, when inoculated into certain lower animals, is followed by the symptoms and appearances characteristic of that disease. While it must be confessed that such inoculation experiments carried on in rabbits, guinea pigs, or mice are scarcely sufficient by themselves to settle the question of the specific and infectious nature of pneumonia as it affects the human subject, yet they are of distinct value as evidence pointing in that direction. Further, there are numerous instances on record in which this disease has appeared to spread as an epidemic in localities or in families in such a way as strongly to suggest the idea of infectiveness. Cases of this kind, however, are open to the question as to whether there may not coexist some other disease, such as a fever, of which the pneumonia present is but a complication. The whole subject of the pathology of pneumonia is still under investigation, and all that can in the meantime be affirmed is that it presents many features which render its phenomena unlike those of an ordinary inflammation, while on the other hand it has strong analogies to some of the specific fevers. As regards known causes, in the vast majority of instances, an attack of pneumonia comes on as the result of exposure to cold as the exciting agent, while such conditions as fatigue and physical or mental depression are often traceable as powerful predisposing influences.

The symptoms of acute pneumonia are generally well marked from the beginning. The attack is usually ushered in by a rigor (or in children a convulsion), together with vomiting and the speedy development of the febrile condition, the temperature rising to a considerable degree —101° to 104° or more. The pulse is quickened, and there is a marked disturbance in the respiration, which is rapid, shallow, and difficult, the rate being usually accelerated to some two or three times its normal amount. The lips are livid and the face has a dusky flush, pain in the side is felt, especially should any amount of pleurisy be present, as is often the case. Cough is an early symptom. It is at first frequent and hacking, and is accompanied with a little tough colorless expectoration, which soon, however, becomes more copious and of a rusty brown color, either tenacious or frothy and liquid. Microscopically this consists mainly of epithelium, casts of the air cells, and fine bronchi, together with granular matter and blood and pus corpuscles.

The following are the chief physical signs in the various stages of the disease. In the stage of congestion fine crackling or crepitation is heard over the affected area; sometimes there is very little change from the natural breathing. In the stage of red hepatization the affected side of the chest is seen to expand less freely than the opposite side; there is dulness on percussion, and increase of the vocal fremitus; while on auscultation the breath sounds are tubular or bronchial in character, with, it may be, some amount of fine crepitation in certain parts. In the stage of gray hepatization the percussion note is still dull and the breathing tubular, but crepitations of coarser quality than before are also audible. These various physical signs disappear more or less rapidly during convalescence. With the progress of the inflammation the febrile symptoms and rapid breathing continue. The patient during the greater part of the disease lies on the back or on the affected side. The pulse, which at first was full, becomes small and soft owing to the interruption to the pulmonary circulation. Occasionally slight jaundice is present, due probably to a similar cause. The urine is scanty, sometimes albuminous, and its chlorides are diminished. In favorable cases, however severe, there generally occurs after six or eight days a distinct crisis, marked by a rapid fall of the temperature accompanied with perspiration and with a copious discharge of lithates in the urine. Although no material change is as yet noticed in the physical signs, the patient breathes more easily, sleep returns, and convalescence advances rapidly in the majority of instances. In unfavorable cases death may take place either from the extent of the inflammatory action, especially if the pneumonia is double, from excessive fever, from failure of the heart's action or general strength at about the period of the crisis, or again from the disease assuming from the first a low adynamic form with delirium and with scanty expectoration of greenish or "prune juice" appearance. Such cases are seen in persons worn out in strength, in the aged, and especially in the intemperate. Death may also take place later from abscess or gangrene of the lung; or again recovery may be imperfect and the disease pass into a chronic pneumonia.

The treatment of acute pnuemonia, which at one time was conducted on the antiphlogistic or lowering principle, has of late years undergone a marked change; and it is now generally held that in ordinary cases very little active interference is called for, the disease tending to run its course very much as a specific fever. The employment of blood-letting once so general is now only in rare instances resorted to; but, just as in pleurisy, pain and difficulty of breathing may sometimes be relieved by the application of a few leeches to the affected side. In severe cases the cautious employment of aconite or antimony at the outset appears useful in diminishing the force of the inflammatory action. Warm applications in the form of poultices to the chest give comfort in many cases. Cough is relieved by expectorants, of which those containing carbonate of ammonia are especially useful. Any tendency to excessive fever may often be held in check by quinine. The patient should be fed with milk, soups, and other light forms of nourishment. In the later period of the disease stimulants may be called for, but most reliance is to be placed on nutritious aliment. After the acute symptoms disappear counter-irritation by iodine or a blister will often prove of service in promoting the absorption of the inflammatory products. After recovery is complete the health should for some time be watched with care.

When pneumonia is complicated with any other ailment or itself complicates some pre-existing malady, it must be dealt with on principles applicable to these conditions as they may affect the individual case.

Catarrhal or Lobular Pneumonia (Broncho-Pneumonia) differs from the last in several important pathological and clinical points. Here the inflammation is more diffuse and tends to affect lobules of lung tissue here and there, rather than one or more lobes as in croupous pneumonia. At first the affected patches are dense, non-crepitant, with a bluish red appearance tending to become gray or yellow. Under the microscope the air vesicles and finer bronchi are crowded with cells, the result of the inflammatory process, but there is no fibrinous exudation such as is present in croupous pneumonia. In favorable cases resolution takes place by fatty degeneration, liquefaction, and absorption of the cells, but on the other hand they may undergo caseous degenerative changes, abscesses may form, or a condition of chronic interstitial pneumonia be developed in both of which cases the condition passes into one of phthisis. Evidence of previous bronchitis is usually present in the lungs affected with catarrhal pneumonia. In the great majority of instances catarrhal pneumonia occurs as an accompaniment or sequel of bronchitis either from the inflammation passing from the finer bronchi to the pulmonary air vesicles, or from its affecting portions of lung which have undergone collapse. It occurs most frequently in children, and is often connected with some pre-existing acute ailment in which the bronchi are implicated, such as measles or hooping cough. It likewise affects adults and aged people in a more chronic form as the result of bronchitis. Sometimes a condition of catarrhal pneumonia may be set up by the plugging of one or more branches of the pulmonary artery, as may occur in heart disease, pyæmia, etc.

The symptoms characterizing the onset of catarrhal pneumonia in its more acute form are the occurrence during an attack of bronchitis of a sudden and marked elevation of temperature, together with a quickened pulse and increased difficulty in breathing. The cough becomes short and painful, and there is little or no expectoration. The physical signs are not distinct, being mixed up with those of the antecedent bronchitis; but, should the pneumonia be extensive, there may be an impaired percussion note with tubular breathing and some bronchophony.

Acute catarrhal pneumonia must be regarded as a condition of serious import. It is apt to run rapidly to a fatal termination, but on the other hand a favorable result is not unfrequent if it is recognized in time to admit of efficient treatment. In the more chronic form it tends to assume the characters of chronic phthisis (see PHTHISIS). The treatment is essentially that for the more severe forms of bronchitis (see BRONCHITIS), where, in addition to expectorants, together with ammoniacal, ethereal, and alcoholic stimulants, the maintenance of the strength by good nourishment and tonics is clearly indicated. The breathing may often be relieved by light warm applications to the chest and back. Convalescence is often prolonged, and special care will always be required in view of the tendency of the disease to develop into phthisis.

Chronic Interstitial Pneumonia or Cirrhosis of the Lung is a slow inflammatory change affecting chiefly one portion of the lung texture, viz., its fibrous stroma.

The changes produced in the lung by this disease are marked chiefly by the growth of nucleated fibroid tissue around the walls of the bronchi and vessels, and in the intervesicular septa, which proceeds to such an extent as to invade and obliterate the air cells. The lung, which is at first enlarged, becomes shrunken, dense in texture, and solid, any unaffected portions being emphysematous; the bronchi are dilated, the pleura thickened, and the lung substance often deeply pigmented, especially in the case of miners, who are apt to suffer from this disease. In its later stages the lung breaks down, and cavities form in its substance as in ordinary phthisis.

This condition is usually present to a greater or less degree in almost all chronic diseases of the lungs and bronchi, but it is specially apt to arise in an extensive form from pre-existing catarrhal pneumonia, and not unfrequently occurs in connection with occupations which necessitate the habitual inhalation of particles of dust, such as those of colliers, flax-dressers, stonemasons, millers, etc.

The symptoms are very similar to those of chronic phthisis (see PHTHISIS), especially increasing difficulty of breathing, particularly on exertion, cough either dry or with expectoration, sometimes copious and fetid. In the case of coal-miners the sputum is black from containing carbonaceous matter.

The physical signs are deficient expansion of the affected side—the disease being mostly confined to one lung—increasing dulness on percussion, tubular breathing, and moist sounds. As the disease progresses retraction of the side becomes manifest, and the heart and liver may be displaced. Ultimately the condition both as regards physical signs and symptoms takes the characters of the later stages of phthisis with colliquative symptoms, increasing emaciation, and death. Occasionally dropsy is present from the heart becoming affected in the course of the disease. The malady is usually of long duration, many cases remaining for years in a stationary condition and even undergoing temporary improvement in mild weather, but the tendency is on the whole downward.

The treatment is conducted on similar principles to those applicable in the case of phthisis. Should the malady be connected with a particular occupation, the disease might be averted or at least greatly modified by early withdrawal from such source of irritation. (J. O. A.)

PNOM-PENH, the capital of CAMBODIA (see vol. iv. p. 641).

PO, the largest river of Italy, traverses the whole length of the great plain between the Alps and the Apennines, which was in the Miocene period an arm of the sea connecting the Adriatic with the Mediterranean by what is now the Col d'Altare or Col di Cadibona and has gradually been filled by detritus from the surrounding highlands. That its course lies much nearer the Apennines than the Alps is evidently due to the fact that the tributaries from the loftier range on the north, whether in the form of glacier or stream, have all along been much more powerful than the tributaries from the south. The total length of the river from its conventional source to the mouth of the principal channel is 417½ miles, and the area of its basin, which includes portions of Switzerland and Austria, is estimated at 26,798 square miles. The general course of the river has been already described in Italy (vol. xiii. p. 444).

The Po forms a very extensive delta, and is probably one of the most active of all rivers in the work of denudation. Prony has calculated that between 1200 and 1600 the delta advanced at the rate of 80 feet per annum; and between 1600 and 1804 the rate is said to have been as much as 230 feet. This advance has naturally been attended by great changes in the course and size of the several channels. Ravenna, for example, once a great port, now stands on dry land 4 miles from the sea. The modern lagoons of Comacchio, which stretch southwards from the delta, are being artificially reclaimed by the help of the alluvial deposits.

In its ordinary condition the Po has a depth between Pancalirei and the mouth of the Ticino of from 6 to 10 feet. and between the mouth of the Lambro and that of the Adda of about 14 or 15 feet. Lower down the depth occasionally exceeds 40 feet. Permanent fords exist only in the upper Po, and between the mouths of the Ticino and the Lambro. In times of great drought the bed is quite dry at Rovello, and fords appear below Casalmaggiore and at Borgoforte, where the French and Germans crossed in 1796, 1807, 1813, and 1814; but in general the river forms a complete barrier both to foot and horse. The principal points where crossing is effected by ferries or bridges are *Moncalieri, Turin, *Casale Monferrato, Frassinato, *Valenza, *Mezzana Corti, *Piacenza, Cremona, *Casalmaggiore, Brescello, *Borgoforte, San Benedetto, Ostiglia, *Occhiobello, Pontelagoscuro, Francolino. Railway bridges exist at the places distinguished by an asterisk.

The river in general is at its fullest in May and June, and at its lowest in January (see details in Lombardini's elaborate study on the lower Po in *Memorie del Reale Istituto Lombardo*, Milan, 1870). The ordinary floods on the Po are attended with little danger; but at intervals sometimes of a few, sometimes of many years, they become events of the gravest national concern. Those of 1651 and 1705 are among the most destructive recorded in history, and in the present century the more memorable are those of 1839, 1846, 1855, 1857, 1868, 1872, and 1879. In 1872, 1150 square miles of country between the Reno and the Adige were submerged, the district about Modena was turned into a lake, the people of Revere saved the rest of the town only by sacrificing the front row of houses to form a temporary embankment, and it was only by the wisely conducted energy of its inhabitants that Ostiglia was kept from destruction. During April and May, 1879, the rainfall was exceptionally heavy, the quantity for May alone being equal to more than a third of the annual total. The result was a rise in all the tributaries of the Po, and on May 30 the flood in the main river was 21 feet above low water at Mezzana Corti. A breach 720 feet long in the embankment between Bonizzo and Borgofranco caused the submergence of 155 square miles in the provinces of Mantua, Modena, and Ferrara, and involved in its repair a national expenditure of £53,460.

Of the £5,902,981 ($28,688,487.66) devoted by the government to the regulation of the rivers of Italy in the twenty years 1861-1880, £2,257,872 ($10,793,257.90) had to be appropriated to the Po and its tributaries. Nowhere in Europe except in Holland has the system of embankment been carried to such perfection on so extensive a scale. A wide bed for the river at its height is enclosed for long distances by a massive master-dyke or *froldo*, and in the space between this and the ordinary channels suitable areas are often enclosed by secondary dykes or *golene*. The following figures show the extent of the system in 1880:

	Length of Embankment.	Froldo.	Golena.
	Miles.	Miles.	Miles.
Po	509.97	71.93	438.03
Adige	156.12	109.81	46.30
Tartaro and Po di Levante	148.30	35.62	112.68
Reno	146.72	33.68	113.04
Panaro	100.34	48.26	52.07
Secchia	89.75	28.21	61.54

Recent researches (see Helbig, *Die Italiker in der Po-Ebene*, Leipsic, 1879) show that the lower valley of the Po was at an early period occupied by people of the Palæolithic and Neolithic stages of civilization, who built houses on piles along the swampy borders of the streams. It is possible that even they may have begun by crude dykes the great system by which the waters are now controlled; at least it is certain that these works date their origin from pre-Roman antiquity. Pliny refers them to the Etruscans, who occupied the country before the arrival of the Gauls. The reclaiming and protecting of the riparian lands went on rapidly under the Romans, and in several places the rectangular divisions of the ground, still remarkably distinct, show the military character of some of the agricultural colonies. During the time of the barbarian invasion much of the protective system was allowed to fall into decay; but the later part of the Middle Ages saw the works resumed and carried out with great energy, so that the main features of the present arrangement were in existence by the close of the 15th century.

The usual name for the Po among Greek and Latin authors was Padus (Πάδος); but the Greek writers of the empire began to apply to it the poetic name of Eridanus, familiar in the Phaethon myth.

POCHARD, **POCKARD**, or **POKER**,[1] names properly belonging to the male of a species of Duck (the female of which is known as the Dunbird), the *Anas ferina* of Linnæus, and *Fuligula* or *Æthyia ferina* of later ornithologists—but names very often applied by writers in a general way to most of the group or Subfamily *Fuligulinæ*, commonly called Diving or Sea-Ducks (*cf.* DUCK, vii. p. 436). The Pochard in full plumage is a very handsome bird, with a coppery-red head, on the sides of which sparkle the ruby irides of his eyes, relieved by the grayish-blue of the basal half of his broad bill, and the deep black of his gorget, while his back and flanks appear of a light gray, being really of a dull white closely barred by fine undulating black lines. The tail-coverts both above and below are black, the quill feathers brownish-black, and the lower surface of a dull white. The Dunbird has the head and neck reddish-brown, with ill-defined whitish patches on the cheeks and chin, the back and upper tail-coverts dull brown, and the rest of the plumage, except the lower tail-coverts, which are brownish-gray, much as in the Pochard. This species is very abundant in many parts of Europe, northern Asia, and North America, generally frequenting in winter the larger open waters, and extending its migrations to Barbary and Egypt, but in summer retiring northward and inland to breed, and is one that certainly seems to have profited by the legislative protection lately afforded to it in Britain, for, whereas during many years it had but a single habitual breeding-place left in England, it is now known to have several, to some of which it resorts in no inconsiderable numbers. American examples seem to be slightly larger and somewhat darker in color, and hence by some writers have been regarded as specifically distinct under the name of *Fuligula americana*; but America has a perfectly distinct though allied species in the celebrated Canvas-back Duck, *F. vallisneriana*, a much larger bird, with a longer, higher, and narrower bill, which has no blue at the base, and, though the plumage of both, especially in the females, is very similar, the male Canvas-back has a darker head, and the black lines on the back and flanks are much broken up and further asunder, so that the effect is to give these parts a much lighter color, and from this has arisen the bird's common though fanciful name. Its scientific epithet is derived from the freshwater plant, a species of *Vallisneria*, usually known as "wild celery," from feeding on which its flesh is believed to acquire the delicate flavor that is held in so great a repute. The Pochard and Dunbird, however, in Europe are in much request for the table (as the German name of the species, *Tafelente*, testifies), though their quality in this respect depends almost wholly on the food they have been eating, for birds killed on the sea-coast are so rank as to be almost worthless, while those that have been frequenting fresh water are generally well-tasted.[2]

Among other species nearly allied to the Pochard that frequent the northern hemisphere may be mentioned the Scaup-Duck, *F. marila*, with its American representative *F. affinis*, in both of which the male has the head black, glossed with blue or green; but these are nearly always uneatable from the nature of their food, which is mostly gathered at low tide on the "scaups" or "scalps,"[3]—as the banks on which mussels and other marine molluscs grow are in many places termed. Then there are the Tufted Duck, *F. cristata*—black with a crest and white flanks—and its American equivalent *F. collaris*, and the White-eyed or Castaneous Duck, *F. nyroca*, and the Red-crested Duck, *F. rufina*—both peculiar to the Old World, and the last, conspicuous for its red bill and legs, well known in India. In the southern hemisphere the genus is represented by three species, *F. capensis*, *F. australis*, and *F. novæ-zealandiæ*, whose respective names indicate the country each inhabits, and in South America exists a somewhat divergent form which has been placed in a distinct genus as *Metopiana peposaca*.

Generally classed with the *Fuligulinæ* is the small group known as the Eiders,[4] which differ from them in several respects: the bulb at the base of the trachea in the male, so largely developed in the members of the genus *Fuligula*, and of conformation so similar in all of them, is here much smaller and wholly of bone; the males take a much longer time, two or even three years, to attain their full plumage, and some of the feathers on the head, when that plumage is completed, are always stiff, glistening, and of a peculiar pale-green color. This little group of hardly more than half a dozen species may be fairly considered to form a separate genus under the name of *Somateria*. Many authors indeed have—unjustifiably, as it seems to the present writer—broken it up into three or four genera. The well-known Eider, *S. Mollissima*, is the largest of this group, and, beautiful as it is, is excelled in beauty by the King-Duck, *S. spectabilis*, and the little *S. stelleri*. Space fails here to treat of the rest, but the sad fate which has overtaken one of them, *S. labradoria*, has been before mentioned (Birds, vol. iii. p. 637); and only the briefest notice can be taken of a most interesting form generally, but obviously in error, placed among them. This is the Logger-head, Racehorse, or Steamer-Duck, *Micropterus* (or more properly *Tachyeres*) *cinereus* of the Falkland Islands and Straits of Magellan—nearly as large as a tame Goose, and subject to the, so far as known, unique peculiarity of losing its power of flight after reaching maturity. Its habits have been well described by Darwin in his *Journal of Researches*, and its anatomy is the subject of an excellent paper in the Zoological Society's *Transactions* (vii., pp. 493–501, pls. lviii.–lxii.) by Prof. R. O. Cunningham. (A. N.)

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[1] The derivation of these words, in the first of which the *ch* is pronounced hard, and the *o* in all of them generally long, is very uncertain. Cotgrave has *Pocheculier*, which he renders "Shoueler," now-a-days the name of a kind of Duck, but in his time meaning the bird we commonly call SPOONBILL (*q.v.*). Littré gives *Pochard* as a popular French word signifying drunkard. That this word would in the ordinary way become the English Pochard or Poker may be regarded as certain; but then it is not known to be used in French as a bird's name.

[2] The plant known in some parts of England as "willow-weed"—not to be confounded, as is done by some writers, with the willow-wort (*Epilobium*)—one of the many species of *Polygonum*, is especially a favorite food with most kinds of Ducks, and to its effects is attributed much of the fine flavor which distinguishes the birds that have had access to it.

[3] Cognate with *scallop*, and the Dutch *schelp*, a shell.

[4] Icelandic, *Ædur*.

POCOCK, Edward (1604–1691), one of the most eminent of English Oriental and Biblical scholars, was born in 1604, the son of a Berkshire clergyman, and received his education up to his fourteenth year at the free school of Tame in Oxfordshire and then at Oxford, where he became scholar of Corpus Christi College in 1620 and fellow in 1628. The foundation of his Eastern learning was laid at Oxford under Matthias Pasor, son of the better known George Pasor, who had been driven to England by the troubles in the Palatinate, and he subsequently received instruction from the learned W. Bedwell. The first fruit of his studies was an edition from a Bodleian MS. of the four New Testament epistles which were not in the old Syriac canon, and were not contained in European editions of the Peshito. This was published at Leyden at the instigation of G. Vossius in 1630, and in the same year Pocock sailed for Aleppo as chaplain to the English factory. At Aleppo he made himself a profound Arabic scholar and collected many valuable MSS. At this time Laud was busy with the learned collections with which he afterwards enriched his university, and Pocock became known to him as one who could help his schemes. A correspondence ensued, and ultimately Laud resolved to set up an Arabic chair at Oxford and to invite Pocock home to fill it. The invitation was accepted, and the lecturer entered on his duties on August 10, 1636, but next summer sailed again for Constantinople with the archbishop's consent to prosecute further studies and collect more books, and remained there for about three years. When he returned to England Laud was in the Tower; and, though he had taken the precaution to place the Arabic chair on a permanent footing, a time soon followed in which to have been a protegé of the archbishop was a dangerous distinction. Pocock does not seem to have been an extreme churchman or to have meddled actively in politics, but his views were decided enough to make him objectionable to the Parliamentary party, and to bring on him many troubles not only at Oxford but in his parish of Childrey, where he accepted a college living in 1643. On the other hand his rare scholarship and personal qualities raised him up influential friends even among men of the opposite party in church and State, foremost among these being Selden. Through the offices of these friends he was even advanced in 1648 to the chair of Hebrew, though as he could not take the engagement of 1649 he lost the emoluments of the place very soon after, and did not recover them till the Restoration. All these cares seriously hampered Pocock in his studies, as he complains in the preface to his *Eutychius;* he seems to have felt most deeply the attempts to remove him from Childrey, where he attended to his parochial work with the same modest and diligent zeal that marks him as a scholar. But he continued to work hard; in 1649 he published the *Specimen Historiæ Arabum*, that is, a short account of the origin and manners of the Arabs, taken from Barhebræus (Abulfaraj), with a mass of learned notes from a vast number of MS. sources which are still highly valuable to the student of Oriental history. This was followed in 1655 by the *Porta Mosis*, extracts from the Arabic commentary of Maimonides on the Mishna, with translation and very learned notes;[1] and in 1656 by the annals of *Eutychius* in Arabic and Latin, a work of great value which has not found an editor since. He also gave assistance to Walton's polyglott, and the preface to the various readings of the Arabic Pentateuch is from his hand. After the Restoration Pocock's political and pecuniary troubles were removed, but the reception of his complete edition of the Arabic history of Barhebræus (*Greg. Abulfaragii Historia Dynastiarum*), which he dedicated to the king in 1663, showed that the new order of things was not very favorable to profound scholarship. After this his most important works were his English commentaries on Micah (1677), Malachi (1677), Hosea (1685), Joel (1691)—admirable in every way, and still thoroughly worth reading. An Arabic translation of Grotius *De Veritate* which appeared in 1660 may also be mentioned as a proof of Pocock's interest in the propagation of Christianity in the East. This was an old plan which he had talked over with Grotius at Paris on his way back from Constantinople.

Pocock married in 1646 and died in 1691. One of his sons, Edward, published several contributions to Arabic literature—a fragment of Abdullatif's description of Egypt and the *Philosophus Autodidactus* of Ibn Tofail.

The theological works of Pocock were collected in 2 vols. folio, in 1740, with a tedious but curious account of his life and writings by L. Twells.

POCOCKE, Richard (1704–1765), distantly related to the preceding, was the son of Richard Pococke, head master of the free school at Southampton, where he was born in the year 1704. He received his school learning under his father, and his academical education at Corpus Christi College, Oxford, where he took his various degrees. He commenced his travels in the East in 1737, and returned in 1742. In 1743 he published his *Observations on Egypt*, under the general title of *A Description of the East and Some Other Countries*. In 1744 he was made precentor of Waterford; and in 1745 he printed the second volume of his travels, under the title of *Observations on Palestine, or the Holy Land, Syria, Mesopotamia, Cyprus, and Candia*. In 1756 Pococke was promoted to the bishopric of Ossory; in July, 1765, he was translated to the see of Meath, and in September following he died suddenly of apoplexy, whilst engaged in visiting his diocese.

PODIEBRAD, George of (1420–1471), king of Bohemia, was the son of Herant of Podiebrad, a Bohemian nobleman, and was born 6th April, 1420. After the death of the emperor Sigismund he took up arms against Albert of Austria, who was finally compelled to raise the siege of Tabor and retreat to Prague. On the death of Patzek in 1444 George of Podiebrad became the recognized head of the Calixtines or Utraquists, and was chosen to represent them as one of the two governors of Bohemia during the minority of Ladislaus the son of Albert. After some years of conflict with the Catholic party he was in 1451 recognized as sole governor. Following a policy of conciliation, he made no opposition to the accession of Ladislaus in 1453, who repeated to the Bohemians the promises made by Sigismund. The Catholic predilections of Ladislaus rendered him in a great measure blind to the obligations into which he had entered, but the result was silently to strengthen the influence of George of Podiebrad, who on the death of Ladislaus in 1457 was chosen king of Bohemia (March, 1458), and on May 7, 1459, was crowned by Catholic bishops, promising on his part due obedience to the church. This effort at a reconciliation was, however, soon seen to be futile. In 1462 Pope Pius II. refused the ratification of the *compactata*, agreed upon in 1433, and still no basis of a settlement had been found when Pius died in November, 1464. The new pope, Paul II., at once brought matters to a crisis by issuing against George of Bohemia the ban of excommunication, and a summons for a crusade to crush his authority. To this George replied by a letter of grievances to kings and princes, and an appeal to a general council. The summons of Paul II. did not awaken any general response, and, although Matthias of Hungary was proclaimed king of Bohemia, George successfully resisted all attempts to wrest from him his dominion, and in July, 1470, Matthias agreed to an armistice. George died March 22, 1471, and was succeeded by Ladislaus, eldest son of Casimir IV.

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[1] Pocock was justly impressed with the fact that the best parts of Rabbinic literature belong to the Jews who wrote in Arabic.

See Markgraf, *Ueber das Verhältniss des Königs Georg von Böhmen zu Papst Pius II.*, 1867; Richter, *Georg von Podiebrad's Bestrebungen*, 1863; Jordan, *Das Königthum Georgs von Podiebrad*, 1867; Bachmann, *Ein Jahr böhmischer Geschichte*, 1876.

PODOLIA, a government of southwestern Russia, having Volhynia on the N., Kieff and Kherson on the E. and S., Bessarabia on the S.W., and Galicia (Austria) on the W., from which last it is separated by the Zbrutch, or Rodvotcha, a tributary of the Dniester. It has an area of 16,223 square miles, extending for 200 miles from northwest to southeast on the left bank of the Dniester. In the same direction two ranges of hills, nearly parallel, and separated by the Bug, traverse the government; they are ramifications of the so-called "Avratynsk heights." One of these ranges runs parallel to the Dniester at a distance of some 40 miles, and reaches a maximum elevation of 1185 feet in the northern districts, sending a lateral branch to the Dniester at Kamenets. The other range, entering also from the northwest, follows the boundaries of the government of Kieff on the left bank of the Bug; its highest eminences do not exceed 1050 feet. The geological structure of Podolia is in accordance with the above-mentioned orographical features; a strip of land to the east of the Bug belongs to the Huronian granitic region of the Dnieper, granites and aplites (granulites) appearing also in the bed of the Bug, and being covered with Quaternary deposits only, while the remainder of the province, towards the west, is covered with Tertiary (Miocene). In the deep valleys of the rivers, older formations—the cretaceous and Silurian, as also sometimes the granites—appear from beneath the Tertiary. The whole is covered with a boulder-clay, mostly containing débris of the local rocks, and with loess, the origin of both still being a subject of controversy among Russian geologists. Two large rivers, with numerous tributaries, water the government,—the Dniester, which forms its boundary with Bessarabia and is navigable throughout its length, and the Bug, which flows almost parallel to the former in a higher, sometimes swampy valley, and is broken at several places by strong rapids. The Dniester is an important channel for trade, no less than 30,000 tons of corn, spirits, and timber being exported every year from its eighteen ports, the chief of which are Moghileff, Kalus, Zhvanets, and Porog. The rapid smaller tributaries of the Dniester supply numerous flour-mills with motive power. The soil is almost throughout "black-earth," and Podolia is one of the most fertile provinces of Russia. Forests cover about 245,000 acres. Marshes occur only on the Bug. The climate is moderate, the average temperature of the year at Kamanets being 48.3° (24.5° in January, 69° in July).

The population, which was 2,242,650 in 1881, and is now estimated at 2,335,000, consists chiefly of Little Russians, Poles (about 12 per cent,), and Jews (about 13 per cent.), of whom some 9000 are agriculturists. There are besides about 300 Armenians, some 2500 Germans, and nearly 45,000 Moldavians. There are many Nonconformists among the Russians, Tultchin being the seat of their bishops and a centre of propaganda. The chief occupation is agriculture, 56 per cent. of the surface being under crops, and the average harvests of recent years reaching 3,382,000 qrs. [27,056,000 bu.] of corn and 453,000 qrs. [3,624,000 bu.] of potatoes. The chief crops are wheat, Indian corn, oats, rye, potatoes, and beetroot. No less than 2,500,000 qrs. [20,000,000 bu.] of corn are exported every year to Austria or to Odessa. Gardening is in a flourishing condition, and fruit is largely exported to the interior; the vine is cultivated, mostly for grapes, but partly also for wine; the culture of tobacco is a considerable source of income. Cattle-breeding is less developed, owing to a want of grazing grounds and meadows. Horned cattle—a mixture of the Hungarian and Bessarabian breeds—are, however, exported to Moscow and to Austria. Finer breeds of sheep are raised in the proportion of two-fifths of the whole number. In 1881 Podolia had 169,000 horses, 432,000 horned cattle, 513,000 sheep, and 307,000 swine. Bees are kept throughout the territory, and honey is exported. Sericulture has developed considerably of late years, and will probably take an important position, owing to the climate. Agriculture and cattle-breeding are on the whole declining. Lately manufactures have grown rapidly. In 1865 they already employed 14,450 hands, but produced only to the value of 5,334,000 roubles [$4,107,180]. Fourteen years later they employed more than 20,000 hands, and their yearly production was valued at 29,411,000 roubles [$22, 646,470]. The first place is taken by beetroot sugar works (15,800 hands; £1,038,000 [$5,044,680]), after which come distilleries (£1,372,000 [$6,667,920]), sugar refineries (£287,100 [$1,395,306]), flour-mills (£134,500 [$653,670]), tobacco manufacture (£32,200 [$156,492]), the woollen cloth industry, and several smaller manufactures spirits, leather, soap, candles, machinery, and agricultural implements. An active trade is carried on with Austria, especially through the Isakovets and Gusyatin custom-houses,—corn, cattle, horses, skins, wool, linseed, and hemp seed being exported, in exchange for wooden wares, linen, woollen stuffs, cotton, glass, and agricultural implements. The trade with the interior is also carried on very briskly, especially at the twenty-six fairs, the aggregate returns of which exceed 3,000,000 roubles [$2,310,000]; the chief are at Balta and Yarmolintsy. Podolia is traversed by a railway which runs parallel to the Dniester, from Lemberg to Odessa, and has two branch lines to Kieff (from Zhmerinka) and to Poltava (from Balta). Primary schools are better than in many central provinces of Russia, and Kamanets-Podolsk has of late years begun to show some development of intellectual life. The publications of the provincial assembly and the memoirs of the historical and statistical committee of the government are especially worthy of notice. Podolia is divided into twelve districts, the chief towns of which are—Kamanets-Podolsk, capital of the government (22,650), Balta (22,450), Bratslaff (5550), Gaysin (9450), Letitcheff (4800), Litin (7100), Moghileff-on-Dniester (18,150), Novaya Ushitsa (4500), Olgopol (6950), Proskuroff (11,750), Vinnitsa (18,800), and Yampol (4300). The following towns have municipal institutions:—Bar (7800), Khmelnik (7800), Nemiroff (5450, has a lyceum), Salnitsa (3300), Staraya Ushitsa (3700), Verbovets (2150), and Tultchin (11,220), besides many *myestetchki*, having Polish municipal institutions.

History.—The country has been inhabited since the beginning of the Neolithic period. In the 5th century B.C. it was already known to geographers, and Herodotus mentions it as the seat of the Alazones and Neuri, who were followed by the Dacians and Getæ. The Romans left traces of their rule in the Wall of Trajan, which stretches through the modern districts of Kamanets, Ushitsa, and Proskuroff. Many nationalities passed through this territory, or settled within it for some time, during the great migrations, leaving traces in numerous archæological remains. The annals of Nestor mention that the Slavonians, Bujanes, and Dulebes occupied the Bug, while the Tivertsi and Uglitches were settled on the Dniester. They were conquered by the Avars in the 7th century. Oleg extended his rule over this territory—the *Ponizie*, or lowland, which became later a part of the principalities of Volhynia, Kieff, and Galicia. In the 13th century the Ponizie was plundered by the Mongols; a hundred years afterwards Olgerd freed it from this rule, annexing it to Lithuania under the name of *Podolia*, a word which has the same meaning as Ponizie. After the death of Witowt Podolia was annexed to Poland, with the exception of its eastern part—the province of Bratslaff—

which remained under Lithuania until its union with Poland. The Poles retained Podolia until the third division of Poland in 1793, when it was taken by Russia, which instituted the present government of Podolia in 1796.

PODOLSK, a district-town of Russia, in the government of Moscow, is situated 23 miles to the south of the capital, at the junction of the two main roads going from Moscow to the Crimea and to Warsaw, and within a mile from the Podolsk railway station. It is picturesquely built on the hilly banks of the Pakhra, here crossed by an elegant suspension bridge for carriages as well as by the railway bridge. Down to 1781, when it became a district town, the wealthy village of Podol was a dependency of the Daniloff monastery of Moscow, and it still maintains many of the features of a suburb of that city. The numberless caravans of cars and sledges which before the opening of the southern railway carried on the entire transport of merchandise to and from Moscow (as they still to some extent continue to do) had their chief halting place at Podolsk before setting out on a long journey, or before entering the capital; the principal occupation of the inhabitants was accordingly to keep inns and taverns, and to supply the caravans with provisions and other necessaries of travel. The merchants of Podolsk prefer to carry on their trade at Moscow, and in itself the town has no commercial importance. Still, notwithstanding the recent modifications in traffic produced by the railway system, the population of Podolsk (11,000 in 1881) is increasing. The limestone quarries in the neighborhood, at the confluence of the Desna and Pakhra, supply the capital with a good building material, while a steam factory of cement, lime, and bricks employs 900 hands and has an annual production of about £20,000 [$97,200]. A paper-mill close to Podólsk has an annual production of about £15,000 [$72,900].

PODOPHYLLIN, a popular remedy which is much used by those who are averse to the employment of calomel and other mercurial preparations, and hence has been called vegetable mercury. The drug, as used in medicine, is obtained from the rhizome of the American mandrake or May apple, *Podophyllum peltatum*, L., an herbaceous perennial belonging to the natural order *Berberidaceæ*, indigenous in woods in Canada and the United States. The plant is about a foot high, bearing two peltate, deeply-divided leaves, which are about five inches in diameter, and bear in the axil a solitary, stalked, white flower about the size and shape of the garden anemone, with six or more petals and twice as many hypogynous stamens. The fruit is ripe in May, and is an oval, yellowish, fleshy berry containing twelve or more arillate seeds. The rhizome, as met with in commerce, occurs in cylindrical pieces two or three inches long and about ¼ inch in diameter, of a chocolate or purplish brown color, smooth and slightly enlarged where the juncture of the leafy stem is indicated by a circular scar on the upper and a few broken rootlets on the under side. The odor is heavy and disagreeable, and the taste acrid and bitter.

Podophyllin is a resinous powder obtained by precipitating an alcoholic tincture of the rhizome by means of water acidulated with hydrochloric acid. It varies in color from grayish to bright yellow or greenish brown, the first-named being the purest. The drug has been the subject of numerous chemical investigations, the most recent of which (Podwyssotzki, in *Ztschr. f. Russland*, xx. 777) indicates that its activity is due to a definite resinous compound which has been named by its discoverer *podophyllotoxin*; another constituent named *podophylloquercetin* has neither emetic nor purgative properties, but appears to be the cause of the griping pains which sometimes accompany the action of podophyllin; a third substance, *podophyllic acid* has no medicinal action. *Podophyllotoxin* is a bitter amorphous principle soluble in weak alcohol and in hot water, ether, and chloroform, but insoluble in petroleum spirit. It is split up by the action of alkalies into a resin-acid named picropodophyllic acid, which is inert, and a very active substance, picropodophyllin, which crystallizes in delicate silky needles. Picropodophyllin is insoluble in water, and almost insoluble in spirit of less than 80 per cent., but is rendered soluble when united to the picropodophyllic acid. *Podophylloquercetin* crystallizes in short needles of a yellow color and metallic lustre. It is soluble in ether and alcohol, and forms a compound with acetate of lead which is soluble in acetic acid and can be sublimed in shining yellow crystals, and which on exposure to the air gradually becomes green. *Podophyllic acid* is insoluble in water and in ether, but soluble in alcohol. In medicine podophyllin is employed for torpor of the liver and obstinate constipation, arising from sedentary employment, imprudence in diet, and irregularity of habits. In small doses it acts as a slow and gentle laxative, especially if combined with henbane and belladonna, but in large doses it is an irritant hydragogue cathartic, the action of which persists for some time. The usual dose as a laxative and mild hepatic stimulant is about ⅛ of a grain, but the samples met with in commerce vary considerably in strength, and act with varying effect upon different individuals. Specimens having a greenish tint should be avoided, since they probably contain podophylloquercetin and tend to cause severe griping. In large doses it appears to lose its stimulant action on the liver. Podophyllin is official in the pharmacopœias of Great Britain, India, France, Russia, and the United States.

POE, EDGAR ALLAN (1809–1849), is the most interesting figure in American literature, and his life furnishes the most extraordinary instance on record of systematic misrepresentation on the part of a biographer. The greater part of his short working life was passed in intense and unremitting literary toil, and no poems or romances were ever produced at greater expense of brain and spirit than his. Yet, till lately, when Mr. J. H. Ingram, the careful editor of Poe's works, undertook to collect the plain facts of the poet's life, the current statement and belief were that his strange tales and poems were flung off from a distempered imagination in the intervals of degraded debauchery. This myth was studiously floated by his first biographer, Griswold, and found readier acceptance with the public owing to the weird and horrible character of much of his imaginative work. Griswold's story of a life wayward and irregular from hapless beginning to disgraceful close was just what people were prepared to believe about a genius so eccentric and with such a turn for dark mysteries, horrible crimes, inhuman doings and sufferings. That the author of such works should have been expelled from the university and from the army, and from situation after situation when he tried to make a living by literature, all owing to the gross irregularity of his habits, and should finally have died in a hospital in a fit of intoxication, seemed credible enough when affirmed by a self-constituted biographer. Many of Griswold's allegations were denied at the time, but the denials were local and isolated, and the truth had no chance against the systematic libel, repeated as it was in many editions, till Mr. Ingram prepared a regular and authoritative memoir.[1]

There was a sufficient mixture of truth with falsehood to make Griswold's story plausible. It was not quite correct to describe Poe as the son of strolling players, but his father, a man of good family, had married an actress and taken to the stage as a profession. Their son was born in Baltimore, February 19, 1809,[2] and father and mother died in 1811 when he was a child. The orphan was adopted by his godfather, Mr. Allan, a wealthy merchant, and from his eighth till his thirteenth year (1816–1821) was placed at school in England. Thence he was transferred to an academy at Richmond, Virginia, and thence at the age of seventeen to the university of Virginia at Charlottesville. Mr. Allan was childless, and apparently treated his adopted son as his own child. Why Poe left the university after one session is not clearly explained, but it has been ascertained that he was not expelled, but on the contrary was honorably distinguished as a student, although it is admitted that he had contracted debts and had "an ungovernable passion for card-playing." These debts may have been sufficient cause for a quarrel with Mr. Allan. Poe disappeared for two years, setting out for Europe to join the Greeks in their fight for independence. Reappearing at Richmond in 1829, he stayed at home for a year, and then was entered as a military cadet at West Point. But all his ambitions by this time were towards literature; he neglected his duties, disobeyed orders, and was dismissed from the service of the United States. What he did for two years after is not ascertained, but in 1833 he reappeared as the successful competitor for a prize offered by a Baltimore newspaper for a prose story. From that time he subsisted by literature. Mr. Allan had married again, and died soon afterwards, leaving an heir by his second wife, and "not a mill," as Griswold puts it, to Poe.

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[1] See his *Works of Edgar Allan Poe*, 4 vols., 1874–75.

[2] [R. H. Stoddard's edition of Poe's Poems, N. Y., 1875, gives Boston as the place of the poet's birth, as does Woodberry's Life, Boston, 1885.—AM. ED.]

It is chiefly in his account of Poe's literary career that Griswold has been guilty of slandering the subject of his biography, representing him as rendered incapable of permanent employment by his intemperate habits. There would seem to be not the slightest foundation for this coarse slander. During the fifteen years of his literary life Poe was connected with various newspapers and magazines in Richmond, New York, and Philadelphia, and there is unanimous testimony that so far from being an irregular contributor, he was a model of punctuality and thoroughness, and took a pride in these homely virtues. His connection was not in any one case "severed by his irregularities." He wrote first for the *Southern Literary Messenger* in Richmond, and edited it for some time; then in 1837, he removed to New York, and wrote criticisms and did editorial work for the *New York Quarterly Review*; then, after a year, with a prospect of more lucrative employment, he removed to Philadelphia, and for four years was the mainstay of *Graham's Magazine*. His literary work was poorly paid for, though some of his most powerful tales—*Hans Pfaal*, *Arthur Gordon Pym*, *Ligeia*, *The House of Usher*, *The Murders in the Rue Morgue*, *Marie Roget*, *The Descent into the Maelström*—were among Poe's contributions to these periodicals. Not unnaturally he conceived the idea of starting a magazine of his own as the most hopeful way of living by his work, but he had no capital and was obliged to abandon the project and return to New York and miscellaneous journalism. To add to his troubles, his wife, a cousin of his own, whom he had married in 1836 and to whom he was passionately attached, was in very delicate health, and during a lingering illness of eight years gave him constant anxiety. We have only to look at the character of Poe's work and the condition of such literature commercially, to see why it was that the most popular writer of his generation in America had to struggle so hard for a bare subsistence. His short stories were an easy prey for the newspaper pirate, and when thousands were reading them the author received nothing but the few dollars paid him by the publication in in which they first appeared. The *Raven* was published first in 1845, and in a few months was being read and recited and parodied wherever the English language was spoken; but the half-starved poet, who had to live by his genius, received only two pounds for the production. And, fertile and active as his imagination was, these short works of his, which served for the passing sensation of the newspaper reader, were far from being extempore effusions. His *Philosophy of Composition* is sometimes, indeed generally, regarded as half serious half a jest in the author's peculiar way of mystification. But to any one who examines Poe's work closely by the light of this essay it is obvious that the disclosure of his method is only too seriously true. It would have been well for his own powers of endurance if he had composed on a less exacting and exhausting system. The most fantastic of Poe's creations are not the product of the imagination abandoned to the impulses of a dominant mood; the effects are deliberately calculated, as he says they were, step by step and point by point to a prearranged culmination. A man writing on such a system, with the wolf at the door and affections daily on the rack, could hardly have endured the strain if he had had a constitution of iron. It was no wonder that Poe's health became distempered, or that, during the last years of his wife's illness and the two remaining years through which he survived her, he had recourse to the dangerous help of stimulants. Not only did he subject his imagination to exhausting conditions, but he wasted his force in doing with superfluous thoroughness what a ready journalist would have dismissed with a few easy sentences of commonplace. When we read his criticisms, which are full of insight and suggestion, we see that in reviewing a book or a poem he was never satisfied till he had thought out what could be done with the subject. His famous feat in anticipating the plot of *Barnaby Rudge* from the opening chapters was only a sample of the thoroughness with which he threw himself into whatever he undertook. Poe failed to make a living by literature, not because he was an irregular profligate in the vulgar sense, but because he did ten times as much work as he was paid to do—a species of profligacy, perhaps, but not quite the same in kind as that with which he was charged by his malignant biographer.

The current story about his breaking off his engagement with Mrs. Whitman by presenting himself at her house in a state of violent drunkenness has been proved to be a fabrication, and many other stories about him have been exploded by Mr. Ingram. His wife died in 1847 and he followed her in 1849, dying under painful circumstances at Baltimore. For a critical estimate of Poe's writings the reader may be referred to Professor Nichol's *American Literature*. There are few English writers of this century whose fame is likely to be more enduring. The feelings to which he appeals are simple but universal, and he appeals to them with a force that has never been surpassed. (W. M.)

POERIO, CARLO (1803–1867), Italian statesman, born in 1803, was descended from an old Calabrian family and was the son of Giuseppe Poerio, a distinguished lawyer of Naples. In 1815 he accompanied his father into political exile, but, a pardon having been obtained in 1818, he returned to Naples where he afterwards adopted the profession of advocate. From 1837 to 1848 he was frequently arrested and imprisoned, but, when Ferdinand, moved by the demonstration of 27th January of the latter year, promulgated a constitution, he was at once raised to honor, being made prefect of police and shortly afterwards minister of public instruction. Discovering, however, that the king was only temporizing, he resigned office in April of the same year and was returned for Naples to Parliament, where he led the constitutional opposition. On 19th July, 1849, he was arrested and, after trial on the charge of belonging to the sect denominated the "Italian Unity," was condemned to irons. Chained in pairs, he and other fifteen political prisoners were confined in one small room in the bagno of Nisida near the lazaretto. The eloquent exposure of the horrors of the Neapolitan dungeons by Mr. Gladstone in 1851, who emphasized especially the case of Poerio, awakened the universal indignation of Europe, but he did not obtain his liberty till 1858. He and other exiles were then placed on board a ship bound for the United States, but they compelled the crew to land them at Cork, whence Poerio made his way to London. In the following year he returned to Italy, and in 1860 he was elected deputy to the parliament of Turin, of which he was chosen vice-president in 1861. He died at Florence, 28th April, 1867.

See Baldachinni *Della Vita e de' Tempi di Carlo Poerio*, 1867; W. E. Gladstone, *Two Letters to the Earl of Aberdeen*, 1851; *Carlo Poerio and the Neapolitan Police*, London, 1858; Colletta, *History of Naples*.

POETRY.

Poetry as an energy and as an art.

IN modern criticism the word poetry is used sometimes to denote any expression (artistic or other) of imaginative feeling, sometimes to designate one of the fine arts.

As an expression of imaginative feeling, as the movement of an energy, as one of those great primal human forces which go the development of the race, poetry in the wide sense has played as important a part as science. In some literatures (such as that of England) poetic energy and in others (such as that of Rome) poetic art is the dominant quality. It is the same with individual writers. In classical literature Pindar may perhaps be taken as a type of the poets of energy; Virgil of the poets of art. With all his wealth of poetic art Pindar's mastery over symmetrical methods never taught him to "sow with the hand," as Corinna declared, while his poetic energy always impelled him to "sow with the whole sack." In English poetical literature Elizabeth Barrett Browning typifies, perhaps, the poets of energy; while Keats (notwithstanding all his unquestionable inspiration) is mostly taken as a type of the poets of art. In French literature Hugo, notwithstanding all his mastery over poetic methods, represents the poets of energy.

In some writers, and these the very greatest—in Homer, Æschylus, Sophocles, Dante, Shakespeare, Milton and perhaps Goethe—poetic energy and poetic art are seen in something like equipoise. It is of poetry as an art, however, that we have mainly to speak here; and all we have to say upon poetry as an energy is that the critic who, like Aristotle, takes this wide view of poetry—the critic who, like him, recognizes the importance of poetry in its relations to man's other expressions of spiritual force, claims a place in point of true critical sagacity above that of a critic who, like Plato, fails to recognize that importance. And assuredly no philosophy of history can be other than inadequate should it ignore the fact that poetry has had as much effect upon human destiny as that other great human energy by aid of which, from the discovery of the use of fire to that of the electric light, the useful arts have been developed.

With regard to poetry as an art, in the present work most of the great poems of the world have been or will be examined either in connection with the names of the writers or with the various literatures to which they belong; consequently these remarks must be confined to general principles. To treat historically so vast a subject as poetry, would be obviously impossible here.

Divisions of the subject.

All that can be attempted is to inquire briefly—(1) What is poetry? (2) What is the position it takes up in relation to the other arts? (3) What is its value and degree of expressional power in relation to these? and, finally, (4) What varieties of poetic art are the outcome of the two great kinds of poetic impulse, dramatic imagination and lyric or egoistic imagination?

What is poetry.

1. *What is Poetry?*—Definitions are for the most part alike unsatisfactory and treacherous; but definitions of poetry are proverbially so. Is it possible to lay down invariable principles of poetry, such as those famous "invariable principles" of the Rev. Mr. Bowles, which in the earlier part of the century awoke the admiration of Southey and the wrath of Byron? Is it possible for a critic to say of any metrical phrase, stanza, or verse, "This is poetry," or "This is not poetry"? Can he, with anything like the authority with which the man of science pronounces upon the natural objects brought before him pronounce upon the qualities of a poem? These are questions that have engaged the attention of critics ever since the time of Aristotle.

Byron, in his rough and ready way, has answered them in one of those letters to the late John Murray, which, rich as they are in nonsense, are almost as rich in sense. "So far are principles of poetry from being invariable," says he, "that they never were nor ever will be settled. These principles mean nothing more than the predilections of a particular age, and every age has its own and a different from its predecessor. It is now Homer and now Virgil; once Dryden and since Sir Walter Scott; now Corneille and now Racine; now Crébillon and now Voltaire." This is putting the case very strongly—perhaps too strongly. But if we remember that Sophocles lost the first prize for the *Œdipus Tyrannus;* if we remember what in Dante's time (owing partly, no doubt, to the universal ignorance of Greek) were the relative positions of Homer and Virgil, what in the time of Milton were the relative positions of Milton himself, of Shakespeare, and of Beaumont and Fletcher; again, if we remember Jeffrey's famous classification of the poets of his day, we shall be driven to pause over Byron's words before dismissing them. Yet some definition, for the purpose of this essay, must be here attempted; and, using the phrase "absolute poetry" as the musical critics use the phrase "absolute music," we may, perhaps, without too great presumption submit the following:

Absolute poetry defined.

Absolute poetry is the concrete and artistic expression of the human mind in emotional and rhythmical language.

This at least will be granted, that no literary expression can properly speaking be called poetry that is not in a certain deep sense emotional, whatever may be its subject matter, concrete in its method, and its diction, rhythmical in movement, and artistic in form.

It is concrete in method.

That the expression of all real poetry must be concrete in method and diction is obvious, and yet this dictum would exclude from the definition much of what is called didactic poetry. With abstractions the poet has nothing to do, save to take them and turn them into concretions; for, as artist, he is simply the man who by instinct embodies in concrete forms that "universal idea" which Gravina speaks of—that which is essential and elemental in nature and in man; as poetic artist he is simply the man who by instinct chooses for his concrete forms metrical language. And the questions to be asked concerning any work of art are simply these—

Is that which is here embodied really permanent, universal, and elemental? and Is the concrete form embodying it really beautiful—acknowledged as beautiful by the soul of man in its highest moods? Any other question is an impertinence.

Examples are always useful in discussions such as this.

As an example of the absence of concrete form in verse take the following lines from George Eliot's *Spanish Gypsy:*

> "Speech is but broken light upon the depth
> Of the unspoken; even your loved words
> Float in the larger meaning of your voice
> As something dimmer."

Without discussing the question of blank verse cadence and the weakness of a line where the main accent falls upon a positive hiatus, "of the unspoken," we would point out that this powerful passage shows the spirit of poetry without its concrete form. The abstract method is substituted for the concrete. Such an abstract phrase as "the unspoken" belongs entirely to prose.

As to what is called ratiocinative poetry, it might perhaps be shown that it does not exist at all. Not by syllogism, but *per saltum*, must the poet reach in every case his conclusions. We listen to the poet—we allow him to address us in rhythm or in rhyme—we allow him to sing to us while other men are only allowed to talk, not because he argues more logically than they, but because he feels more deeply and perhaps more truly. It is for his listeners to be knowing and ratiocinative; it is for him to be gnomic and divinely wise.

It is rhythmic in movement.

That poetry must be metrical or even rhythmical in movement, however, is what some have denied. Here we touch at once the very root of the subject. The difference between all literature and mere "word-kneading" is that, while literature is alive, word-kneading is without life. This literary life, while it is only bipartite in prose, seems to be tripartite in poetry; that is to say, while prose requires intellectual life and emotional life, poetry seems to require not only intellectual life and emotional life but rhythmic life, this last being the most important of all according to many critics, though Aristotle is not among these. Here indeed is the "fork" between the old critics and the new. Unless the rhythm of any metrical passage is so vigorous, so natural, and so free that it seems as though it could live, if need were, by its rhythm alone, has that passage any right to exist? and should it not, if the substance is good, be forthwith demetricized and turned into prose? Thoreau has affirmed that prose, at its best, has high qualities of its own beyond the ken of poetry; to compensate for the sacrifice of these, should not the metrical gains of any passage be beyond all cavil?

Importance of metrical questions.

But this argument might be pressed further still. It might seem bold to assert that, in many cases, the mental value of poetry may actually depend upon form and color, but would it not be true? The mental value of poetry must be judged by a standard not applicable to prose; but, even with regard to the different kinds of poetry, we must not compare poetry whose mental value consists in a distinct and logical enunciation of ideas, such as that of Lucretius and Wordsworth, and poetry whose mental value consists partly in the suggestive richness of passion or symbol latent in rhythm (such as that of Sappho sometimes, Pindar often, Shelley always), or latent in color, such as that of some of the Persian poets. To discuss the question, Which of these two kinds of poetry is the more precious? would be idle, but are we not driven to admit that certain poems whose strength is rhythm, and certain other poems whose strength is color, while devoid of any logical statement of thought, may be as fruitful of thoughts and emotions too deep for words as a shaken prism is fruitful of tinted lights? The mental forces at work in the production of a poem like the *Excursion* are of a very different kind from the mental forces at work in the production of a poem like Shelley's "Ode to the West Wind." In the one case the poet's artistic methods, like those of the Greek architect, show, and are intended to show, the solid strength of the structure. In the other, the poet's artistic methods, like those of the Arabian architect, contradict the idea of solid strength—make the structure appear to hang over our heads like the cloud pageantry of heaven. But, in both cases, the solid strength is, and must be, there, at the base. Before the poet begins to write he should ask himself which of these artistic methods is natural to him; he should ask himself whether his natural impulse is towards the weighty iambic movement whose primary function is to state, or towards those lighter movements which we still call, for want of more convenient words, anapæstic and dactylic, whose primary function is to suggest. Whenever Wordsworth and Keats pass from the former to the latter they pass at once into doggerel. Nor is it difficult to see why English anapæstic and dactylic verse must suggest and not state, as even so comparatively successful a *tour de force* as Shelley's "Sensitive Plant" shows. Conciseness is a primary virtue of all statement. The moment the English poet tries to "pack" his anapæstic or dactylic line, as he can pack his iambic line, his versification becomes rugged, harsh, pebbly—becomes so of necessity. Nor is this all: anapæstic and dactylic verse must in English be obtrusively alliterative, or the same pebbly effect begins to be felt. The anapæstic line is so full of syllables that in a language where the consonants dominate the vowels (as in English), these syllables grate against each other, unless their corners are artfully bevelled by one of the only two smoothing processes at the command of an English versifier—obtrusive alliteration, or an obtrusive use of liquids. Now these demands of form may be turned by the perfect artist to good account if his appeal to the listener's soul is primarily that of suggestion by sound or symbol, but if his appeal is that of direct and logical statement the diffuseness inseparable from good anapæstic and dactylic verse is a source of weakness such as the true artist should find intolerable.

But enough has been said to show that in discussing poetry questions of versification touch, as we have said, the very root of the subject.

It is artistic in form.

Using the word "form" in a wider sense still, a sense that includes "composition," it can be shown that poetry to be entitled to the name must be artistic in form. Whether a poem be a Welsh *triban* or a *stornello* improvised by an Italian peasant girl, whether it be an ode by Keats or a tragedy by Sophocles, it is equally a work of art. The artist's command over form may be shown in the peasant girl's power of spontaneously rendering in simple verse, in her *stornello* or *rispetto*, her emotions through nature's symbols; it may be shown by Keats in that perfect fusion of all poetic elements of which he was such a master, in the manipulation of language so beautiful both for form and color that thought and words seem but one blended loveliness; or it may be shown by Sophocles in a mastery over what in painting is called composition, in the exercise of that wise vision of the artist which, looking before and after, sees the thing of beauty as a whole, and enables him to grasp the eternal laws of cause and effect in art and bend them to his own wizard will. In every case, indeed, form is an essential part of poetry; and, although George Sand's saying that "L'art est une forme" applies perhaps more strictly to the plastic arts (where the soul is reached partly through mechanical means), its application to poetry can hardly be exaggerated.

Owing, however, to the fact that the word ποιητής (first used to designate the poetic artist by Herodotus) means maker, Aristotle seems to have assumed that the indispensable basis of poetry is invention. He appears to have thought that a poet is a poet more on account of the composition of the action than on account of the composition of his verses. Indeed he said as much as this. Of epic poetry he declared emphatically that it produces its imitations either by mere articulate words or by metre superadded. This is to widen the definition of poetry so as to include all imaginative literature, and Plato seems to have given an equally wide meaning to the word ποίησις. Only, while Aristotle considered ποίησις to be an imitation of the facts of nature, Plato considered it to be an imitation of the dreams of man. Aristotle ignored, and Plato slighted, the importance of versification (though Plato on one occasion admitted that he who did not know rhythm could be called neither musician nor poet). It is impossible to discuss here the question whether an imaginative work in which the method is entirely concrete and the expression entirely emotional, while the form is unmetrical, is or is not entitled to be called a poem. That there may be a kind of unmetrical narrative so poetic in motive, so concrete in diction, so emotional in treatment, as to escape altogether from those critical canons usually applied to prose, we shall see when, in discussing the epic, we come to touch upon the Northern sagas.

Perhaps the first critic who tacitly revolted against the dictum that substance, and not form, is the indispensable basis of poetry was Dionysius of Halicarnassus, whose treatise upon the arrangement of words is really a very fine piece of literary criticism. In his acute remarks upon the arrangement of the words in the sixteenth book of the *Odyssey*, as compared with that in the story of Gyges by Herodotus, was perhaps first enunciated clearly the doctrine that poetry is fundamentally a matter of style. The Aristotelian theory as to invention, however, dominated all criticism after as well as before Dionysius. When Bacon came to discuss the subject (and afterwards) the only division between the poetical critics was perhaps between the followers of Aristotle and those of Plato as to what poetry should, and what it should not, imitate. It is curious to speculate as to what would have been the result had the poets followed the critics in this matter. Had not the instinct of the poet been too strong for the schools, would poetry as an art have been lost and merged in such imaginative prose as Plato's? Or is not the instinct for form too strong to be stifled? By the poets themselves metre was always considered to be the one indispensable requisite of a poem, though, as regards criticism, so recently as the time of the appearance of the *Waverley Novels*, the *Quarterly Review* would sometimes speak of them as "poems"; and perhaps even now there are critics of a very high rank who would do the same with regard to romances so concrete in method and diction, and so full of poetic energy, as *Wuthering Heights* and *Jane Eyre*, where we get absolutely all that Aristotle requires for a poem. On the whole, however, the theory that versification is not an indispensable requisite of a poem seems to have become nearly obsolete in our time. Perhaps, indeed, many critics would now go so far in the contrary direction as to say with Hegel (*Aesthetik*, iii. p. 289) that "metre is the first and only condition absolutely demanded by poetry, yea even more necessary than a figurative picturesque diction." At all events this at least may be said that in our own time the division between poetical critics is not between Aristotelians and Baconians; it is now of a different kind altogether. While one group of critics may still perhaps say with Dryden that "a poet is a maker, as the name signifies," and that "he who cannot make, that is, invent, has his name for nothing," another group contends that it is not the invention but the artistic treatment, the form, which determines whether an imaginative writer is a poet or a writer of prose,—contends, in short, that emotion is the basis of all true poetic expression, whatever be the subject matter, that thoughts must be expressed in an emotional manner before they can be brought into poetry, and that this emotive expression demands even yet something else, viz., style and form.

The poetic atmosphere.

But, although many critics are now agreed that "L'art est une forme," that without metre and without form there can be no poetry, there are few who would contend that poetry can exist by virtue of any one of these alone, or even by virtue of all these combined. Quite independent of verbal melody, though mostly accompanying it, and quite independent of "composition," there is an atmosphere floating around the poet through which he sees everything, an atmosphere which stamps his utterances as poetry; for instance, among all the versifiers contemporary with Donne there was none so rugged as he occasionally was, and yet such songs as "Sweetest love, I do not go for weariness of thee," prove how true a poet he was whenever he could master those technicalities which far inferior poets find comparatively easy. While rhythm may to a very considerable degree be acquired (though, of course, the highest rhythmical effects never can), the power of looking at the world through the atmosphere that floats before the poet's eyes is not to be learned and not to be taught. This atmosphere is what we call *poetic imagination*, a subject which will have to be fully discussed further on. But first it seems necessary to say a word or two upon that high temper of the soul which in truly great poetry gives birth to this poetic imagination.

The poetic temper.

The "message" of poetry must be more unequivocal, more thoroughly accentuated, than that of any of the other fine arts. With regard to modern poetry, indeed, it may almost be said that if any writer's verse embodies a message, true, direct, and pathetic, we in modern Europe cannot stay to inquire too curiously about the degree of artistic perfection with which it is delivered, for Wordsworth's saying "That which comes from the heart goes to the heart" applies very closely indeed to modern poetry. The most truly passionate poet in Greece was no doubt in a deep sense the most artistic poet; but in her case art and passion were one, and that is why she has been so cruelly misunderstood. The most truly passionate nature, and perhaps the greatest soul, that in our time has expressed itself in English verse is Elizabeth Barrett Browning; at least it is certain that, with the single exception of Hood in the "Song of the Shirt," no writer of the century has really touched our hearts with a hand so powerful as hers,—and this notwithstanding violations of poetic form, notwithstanding defective rhymes, such as would appal some of the contemporary versifiers of England and France "who lisp in numbers for the numbers [and nothing else] come." The truth is that in order to produce poetry the soul must for the time being have reached that state of exaltation, that state of freedom from self-consciousness, depicted in the lines—

> "I started once, or seemed to start, in pain,
> Resolved on noble things, and strove to speak,
> As when a great thought strikes along the brain,
> And flushes all the cheek."

Whatsoever may be the poet's "knowledge of his art," into this mood he must always pass before he can write a truly poetic line. For, notwithstanding all that we have said and are going to say upon poetry as a fine art, it is in the deepest sense of the word an "inspiration" indeed. No man can write a line of genuine poetry without having been "born again" (or, as the true rendering of the text says, "born from above"); and then the mastery over those highest reaches of form which are beyond the ken of the mere versifier comes to him as a result of the change. Hence, with all Mrs. Browning's metrical blemishes, the splendor of her metrical triumphs at her best.

For what is the deep distinction between poet and prose-man? A writer may be many things besides a poet; he may be a warrior like Æschylus, a man of business like Shakespeare, a courtier like Chaucer, or a cosmopolitan philosopher like Goethe; but the moment the poetic mood is upon him all the trappings of the world with which for years he may perhaps have been clothing his soul—the world's knowingness, its cynicism, its self-seeking, its ambition—fall away, and the man becomes an inspired child again, with ears attuned to nothing but the whispers of those spirits from the Golden Age, who, according to Hesiod, haunt and bless the degenerate earth. What such a man produces may greatly delight and astonish his readers, yet not so greatly as it delights and astonishes himself. His passages of pathos draw no tears so deep or so sweet as those that fall from his own eyes while he writes; his sublime passages overawe no soul so imperiously as his own; his humor draws no laughter so rich or so deep as that stirred within his own breast.

Sincerity and conscience.

It might almost be said, indeed, that Sincerity and Conscience, the two angels that bring to the poet the wonders of the poetic dream, bring him also the deepest, truest delight of form. It might almost be said that by aid of sincerity and conscience the poet is enabled to see more clearly than other men the eternal limits of his own art—to see with Sophocles that nothing, not even poetry itself, is of any worth to man, invested as he is by the whole army of evil, unless it is in the deepest and highest sense good, unless it comes linking us all together by closer bonds of sympathy and pity, strengthening us to fight the foes with whom fate and even nature, the mother who bore us, sometimes seem in league—to see with Milton that the high quality of man's soul which in English is expressed by the word virtue is greater than even the great poem he prized, greater than all the rhythms of all the tongues that have been spoken since Babel—and to see with Shakespeare and with Shelley that the high passion which in English is called love is lovelier than all art, lovelier than all the marble Mercuries that "await the chisel of the sculptor" in all the marble hills. So much for our first inquiry—"What is poetry?"

The position of poetry in relation to the other arts.

2. *What Position does Poetry take up in Relation to the other Arts?*—Notwithstanding the labors of Lessing and his followers, the position accorded by criticism to poetry in relation to the other arts was never so uncertain and anomalous as at the present moment. On the one hand there is a class of critics who, judging from their perpetual comparison of poems to pictures, claim her as a sort of handmaid of painting and sculpture. On the other hand the disciples of Wagner, while professing to do homage to poetry, claim her as the handmaid of music. To find her proper place is therefore the most important task the critic can undertake at this time, though it is one far beyond the scope of a paper so brief as this. With regard to the relations of poetry to painting and sculpture, however, it seems necessary to glance for a moment at the saying of Simonides, as recorded by Plutarch, that poetry is a speaking picture and that painting is a mute poetry. It appears to have had upon modern criticism as much influence since the publication of Lessing's *Laocoon* as it had before. Perhaps it is in some measure answerable for the modern vice of excessive word-painting. Beyond this one saying, there is little or nothing in Greek literature to show that the Greeks recognized between poetry and the plastic and pictorial arts an affinity closer than that which exists between poetry and music and dancing. Understanding artistic methods more profoundly than the moderns, and far too profoundly to suppose that there is any special and peculiar affinity between an art whose medium of expression is marble and an art whose medium of expression is a growth of oral symbols, the Greeks seem to have studied poetry not so much in its relation to painting and sculpture as in its relation to music and dancing. It is matter of familiar knowledge, for instance, that at the Dionysian festival it was to the poet as "teacher of the chorus" (*χοροδιδάσκαλος*) that the prize was awarded, even though the "teacher of the chorus" were Æschylus himself or Sophocles. And this recognition of the relation of poetry to music is perhaps one of the many causes of the superiority of Greek to all other poetry in adapting artistic means to artistic ends. In Greek poetry, even in Homer's description of the shield of Achilles, even in the famous description by Sophocles of his native woods in the *Œdipus Coloneus*, such word-painting as occurs seems, if not inevitable and unconscious, so alive with imaginative feeling as to become part and parcel of the dramatic or lyric movement itself. And whenever description is so introduced the reader of Greek poetry need not be told that the scenery itself rises before the listener's imagination with a clearness of outline and a vigor of color such as no amount of detailed word-painting in the modern fashion can achieve. The picture even in the glorious verses at the end of the eighth book of the *Iliad* rises before our eyes—seems actually to act upon our bodily senses—simply because the poet's eagerness to use the picture for merely illustrating the solemnity and importance of his story lends to the picture that very authenticity which the work of the modern word-painter lacks.

Relation of poetry to music.

That the true place of poetry lies between music on the one hand and prose, or loosened speech, on the other, was, we say, taken for granted by the one people in whom the artistic instinct was fully developed.

No doubt they used the word music in a very wide sense, in a sense that might include several arts. But it is a suggestive fact that, in the Greek language, long before poetic art was called "making" it was called "singing." The poet was not *ποιητής* but *ἀοιδός*. And as regards the Romans it is curious to see how every now and then the old idea that poetry is singing rather than making will disclose itself. It will be remembered, for instance, how Terence, in the prologue of *Phormio*, alludes to poets as musicians. That the ancients were right in this we should be able to show did our scheme permit an historical treatment of poetry: we should be able to show that music and the lyrical function of the poet began together, but that here, as in other things, the progress of art from the implicit to the explicit has separated the two. Every art has its special function, has a certain work which it can do better than any one of its sister arts. Hence its right of existence. For instance, before the "sea of emotion" within the soul has become "curdled into thoughts," it can be expressed in inarticulate tone. Hence, among the fine arts, music is specially adapted for rendering it. It was perhaps a perception of this fact which made the Syrian Gnostics define life to be "moving music." When this sea of emotion has "curdled into thoughts," articulate language rhythmically arranged—words steeped in music and color, but at the same time embodying ideas—can do what no mere wordless music is able to achieve in giving it expression, just as unrythmical language, language mortised in a foundation of logic, that is to say prose, can best express these ideas as soon as they have cooled and settled and cleared themselves of emotion altogether. Yet every art can in some degree invade the domain of her sisters, and the nearer these sisters stand to each other the more easily and completely can this invasion be accomplished. Prose, for instance, can sometimes, as in the case of Plato, do some of the work of poetry (however imperfectly, and however trammelled by heavy conditions); and sometimes poetry, as in Pindar's odes and the waves of the Greek chorus, can do, though in the same imperfect way, the work of music. The poems of Sappho, however, are perhaps the best case in point. Here the poet's passion is expressed so completely by the mere sound of her verses that a good recitation of them to a person ignorant of Greek would convey something of that passion to the listener; and similar examples almost as felicitous might be culled from Homer, from Æschylus, and from Sophocles. Nor is this power confined to the Greek poets. The students of Virgil have often and with justice commented on such lines as *Æn.* v. 481 (where the sudden sinking of a stricken ox is rendered by means of rhythm), and such lines as *Georg.* ii. 441, where, by means of verbal sounds, the gusts of wind about a tree are rendered as completely as though the voice were that of the wind itself. In the case of Sappho the effect is produced by the intensity of her passion, in the case of Homer by the intensity of the dramatic vision, in the case of Virgil by a supreme poetic art. But it can also be produced by the mere ingenuity of the artist, as in Edgar Poe's "Ulalume." The poet's object in that remarkable *tour de force* was to express dull and hopeless gloom in the same way that the mere musician would have expressed it,—that is to say, by monotonous reiterations, by hollow and dreadful reverberations of gloomy sounds—though as an artist whose vehicle was articulate speech he was obliged to add gloomy ideas, in order to give to his work the intellectual coherence necessary for its existence as a poem. He evidently set out to do this, and he did it, and "Ulalume" properly intoned would produce something like the same effect upon a listener knowing no word of English that it produces upon us.

On the other hand, music can trench very far upon the domain of articulate speech, as we perceive in the wonderful instrumentation of Wagner. Yet, while it can be shown that the place of poetry is scarcely so close to sculpture and painting as to music on the one side and loosened speech on the other, the affinity of poetry to music must not be exaggerated. We must be cautious how we follow the canons of Wagner and the more enthusiastic of his disciples, who almost seem to think that inarticulate tone can not only suggest ideas but express them—can give voice to the *Verstand*, in short, as well as to the *Vernuft* of man. Even the Greeks drew a fundamental distinction between melic poetry (poetry written to be sung) and poetry that was written to be recited. It is a pity that, while modern critics of poetry have understood or at least have given attention to painting and sculpture, so few have possessed any knowledge of music—a fact which makes Dante's treatise *De Vulgari Eloquio* so important. Dante was a musician, and seems to have had a considerable knowledge of the relations between musical and metrical laws. But he did not, we think, assume that these laws are identical.

If it is indeed possible to establish the identity of musical and metrical laws, it can only be done by a purely scientific investigation; it can only be done by a most searching inquiry into the subtle relations that we know must exist throughout the universe between all the laws of undulation. And it is curious to remember that some of the greatest masters of verbal melody have had no knowledge of music, while some have not even shown any love of it. All Greek boys were taught music, but whether Pindar's unusual musical skill was born of natural instinct and inevitable passion, or came from the accidental circumstance that his father was, as has been alleged, a musician, and that he was as a boy elaborately taught musical science by Lasus of Hermione, we have no means of knowing. Nor can we now learn how much of Milton's musical knowledge resulted from a like exceptional "environment," or from the fact that his father was a musician. But when we find that Shelley seems to have been without the real passion for music, that Rossetti disliked it, and that Coleridge's apprehension of musical effects was of the ordinary nebulous kind, we must hesitate before accepting the theory of Wagner.

The question cannot be pursued here; but if it should on inquiry be found that, although poetry is more closely related to music than to any of the other arts, yet the power over verbal melody at its very highest is so all-sufficing to its possessor as in the case of Shelley and Coleridge that absolute music becomes a superfluity, this would only be another illustration of that intense egoism and concentration of force—the impulse of all high artistic energy—which is required in order to achieve the rarest miracles of art.

Relation of poetry to prose.

With regard to the relation of poetry to prose, Coleridge once asserted in conversation that the real antithesis of poetry was not prose but science. And if he was right the difference in kind lies, not between the poet and the prose writer, but between the literary artist (the man whose instinct is to manipulate language) and the man of facts and of action whose instinct impels him to act, or, if not to act, to inquire.

One thing is at least certain, that prose, however fervid and emotional it may become, must always be directed, or seem to be directed, by the reins of logic. Or, to vary the metaphor, like a captive balloon it can never really leave the earth.

Indeed, with the literature of knowledge as opposed to the literature of power poetry has nothing to do. Facts have no place in poetry until they are brought into relation with the human soul. But a mere catalogue of ships may become poetical if it tends to show the strength and pride and glory of the warriors who invested Troy; a detailed description of the designs upon a shield, however beautiful and poetical in itself, becomes still more so if it tends to show the skill of the divine artificer and the invincible splendor of a hero like Achilles. But mere dry exactitude of imitation is not for poetry but for loosened speech. Hence, most of the so-called poetry of Hesiod is not poetry at all. The Muses who spoke to him about "truth" on Mount Helicon made the common mistake of confounding fact with truth. And here we touch upon a very important matter. The reason why in prose speech is loosened is that, untrammeled by the laws of metre, language is able with more exactitude to imitate nature, though of course speech, even when "loosened," cannot, when actual sensible objects are to be depicted compete in any real degree with the plastic arts in accuracy of imitation, for the simple reason that its media are not colors nor solids but symbols—arbitrary symbols which can be made to indicate, but never to reproduce, colors and solids. Accuracy of imitation is the first requisite of prose. But the moment language has to be governed by the laws of metre—the moment the conflict begins between the claims of verbal music and the claims of color and form—then prosaic accuracy has to yield; sharpness of outline, mere fidelity of imitation, such as is within the compass of prose, have in some degree to be sacrificed. But, just as with regard to the relations between poetry and music, the greatest master is he who borrows the most that can be borrowed from music, and loses the least that can be lost from metre, so with regard to the relations between poetry and prose the greatest master is he who borrows the most that can be borrowed from prose and loses the least that can be lost from verse. No doubt this is what every poet tries to do by instinct; but some sacrifice on either side there must be, and, with regard to poetry and prose, modern poets at least might be divided into those who make picturesqueness yield to verbal melody, and those who make verbal melody yield to picturesqueness.

With one class of poets, fine as is perhaps the melody, it is made subservient to outline or to color; with the other class color and outline both yield to metre. The chief aim of the first class is to paint a picture: the chief aim of the second is to sing a song. Weber, in driving through a beautiful country, could only enjoy its beauty by translating it into music. The same may be said of some poets with regard to verbal melody. The supreme artist, however, is he whose pictorial and musical power are so interfused that each seems born of the other, as is the case with Sappho, Homer, Æschylus, Sophocles, and indeed most of the great Greek poets. Among our own poets, (leaving the two supreme masters undiscussed) Keats and Coleridge have certainly done this. The color seems born of the music and the music born of the color. In French poetry the same triumph has been achieved in Victor Hugo's magnificent poem "En Marchant la Nuit dans un Bois," which, as a rendering through verbal music of the witchery of nature, stands alone in the poetry of France. For there the poet conquers that crowning difficulty we have been alluding to, the difficulty of stealing from prose as much distinctness of color and clearness of outline as can be imported into verse with as little sacrifice as possible of melody,

But to return to the general relations of poetry to prose. If poetry can in some degree invade the domain of prose, so on the other hand prose can at times invade the domain of poetry, and no doubt the prose of Plato—what is called poetical prose—is a legitimate form of art. Poetry, the earliest form of literature, is also the final and ideal form of all pure literature; and, when Landor insists that poetry and poetical prose are antagonistic, we must remember that Landor's judgments are mostly based on feeling, and that his hatred of Plato would be quite sufficient basis with him for an entire system of criticism upon poetical prose. As with Carlyle, there was a time in his life when Plato (who of course is the great figure standing between the two arts of metre and loosened speech) had serious thoughts of becoming a poet. And perhaps, like Carlyle, having the good sense to see his true function, he himself desisted from writing, and strictly forbade other men to write, in verse. If we consider this, and if we consider that certain of the great English masters of poetic prose in the 17th century were as incapable of writing in metre as their followers Richter and Carlyle, we shall hardly escape the conclusion on the one hand that the faculty of writing poetry is quite another faculty than that of producing work in the arts most closely allied to it, music and prose, but that on the other hand there is nothing antagonistic between these faculties. So much for poetry's mere place among the other arts.

Importance of poetry in relation to other arts.

Importance of Poetry in Relation to other Arts.—As to the comparative importance and value of poetry among the other arts, this is a subject upon which much discussion, of a more or less idle kind has been wasted. We do not feel called to dwell at any length upon it here. Yet a word or two upon the question is necessary in order that we may understand what is the scope and what are the limits of poetry with regard to the other arts, especially with regard to music and to prose.

Where poetry is inferior and where superior to music;

There is one great point of superiority that musical art exhibits over metrical art. This consists, not in the capacity for melody, but in the capacity for harmony in the musician's sense. The finest music of Æschylus, of Pindar, of Shakespeare, of Milton, is after all only a succession of melodious notes, and, in endeavoring to catch the harmonic intent of strophe, antistrophe, and epode in the Greek chorus and in the true ode (that of Pindar), we can only succeed by pressing memory into our service. We have to recall by memory the waves that have gone before, and then to imagine their harmonic power in relation to the waves at present occupying the ear. Counterpoint, therefore, is not to be achieved by the metricist, even though he be Pindar himself; but in music this perfect ideal harmony was foreshadowed perhaps in the earliest writing. We know at least that as early as the 12th century counterpoint began to show a vigorous life, and the study of it is now a familiar branch of musical science. Now, inasmuch as "Nature's own hymn" is and must be the harmonic blending of apparently independent and apparently discordant notes, among the arts whose appeal is through the ear that which can achieve counterpoint must perhaps rank as a pure art above one which cannot achieve it. We are of course speaking here of metre only. We have not time to inquire whether the counterpoint of absolute poetry is the harmony underlying apparently discordant emotions—the emotion produced by a word being more persistent than the emotion produced by an inarticulate sound.

to prose;

But if poetry falls behind music in rythmic scope, it is capable of rendering emotion after emotion has become disintegrated into thoughts, and here, as we have seen, it enters into direct competition with the art of prose. It can use the emphasis of sound, not for its own sake merely, but to strengthen the emphasis of sense, and can thus give a fuller and more adequate expression to the soul of man than music at its highest can give. With regard to prose, no doubt such writing as Plato's description of the chariot of the soul, his description of the island of Atlantis, or of Er's visit to the place of departed souls, comes but a short way behind poetry in imaginative and even in rhythmic appeal. It is impossible, however, here to do more than touch upon the subject of the rhythm of prose in its relation to the rhythm of poetry for in this matter the genius of each individual language has to be taken into account.

Perhaps it may be said that deeper than all the rhythms of art is that rhythm which art would fain catch, the rhythm of nature; for the rhythm of nature is the rhythm of life itself. This rhythm can be caught by prose as well as by poetry, such prose, for instance, as that of the English Bible. Certainly the rhythm of verse at its highest, such, for instance, as that of Shakespeare's greatest writings, is nothing more and nothing less than the metre of that energy of the spirit which surges within the bosom of him who speaks, whether he speak in verse or in impassioned prose. Being rhythm, it is of course governed by law, but it is a law which transcends in subtlety the conscious art of the metricist, and is only caught by the poet in his most inspired moods, a law which, being part of nature's own sanctions, can of course never be formulated but only expressed, as it is expressed in the melody of the bird, in the inscrutable harmony of the entire bird-chorus of a thicket, in the whisper of the leaves of the tree, and in the song or wail of wind and sea. Now is not this rhythm of nature represented by that "sense of rhythm" which prose can catch as well as poetry, that sense of rhythm whose finest expressions are to be found in the Bible, Hebrew and English, and in the Biblical movements of the English Prayer Book, and in the dramatic prose of Shakespeare at its best? Whether it is caught by prose or by verse, one of the virtues of the rhythm of nature is that it is translatable. Hamlet's peroration about man and Raleigh's apostrophe to death are as translatable into other languages as are the Hebrew psalms, or as is Manu's magnificent passage about the singleness of man (we quote from memory):

> "Single is each man born into the world; single he dies; single he receives the reward of his good deeds, and single the punishment of his evil deeds. When he dies his body lies like a fallen tree upon the earth, but his virtue accompanies his soul. Wherefore let man harvest and garner virtue, so that he may have an inseparable companion in traversing that gloom which is so hard to be traversed."

Here the rhythm, being the inevitable movement of emotion and "sense," can be caught and translated by every literature under the sun. While, however, the great goal before the poet is to compel the listener to expect his cæsuric effects, the great goal before the writer of poetic prose is in the very opposite direction; it is to make use of the concrete figures and impassioned diction of the poet, but at the same time to avoid the recognized and expected metrical bars upon which the poet depends. The moment the prose poet passes from the rhythm of prose to the rhythm of metre the apparent sincerity of his writing is destroyed.

to plastic art.

And now how stands poetry with regard to the plastic arts? This is in truth a vast subject, and has given birth to an infinitude of eloquent criticism in the present century. It cannot be expected that we should be able to discuss it adequately here. Yet this, too, must be glanced at. On the one side poetry is inferior to the plastic arts; on another side it is superior to them.

As compared with sculpture and painting the great infirmity of poetry, as an "imitation" of nature, is of course that the medium is always and of necessity words—even when no words could, in the dramatic situation, have been spoken. It is not only Homer who is obliged sometimes to forget that passion when at white heat is never voluble, is scarcely even articulate; the dramatists also are obliged to forget that in love and in hate, at their tensest, words seem weak and foolish when compared with the silent and satisfying triumph and glory of deeds, such as the plastic arts can render. This becomes manifest enough when we compare the Niobe group or the Laocoon group, or the great dramatic paintings of the modern world, with even the finest efforts of dramatic poetry, such as the speech of Andromache to Hector, or the speech of Priam to Achilles, nay such as even the cries of Cassandra in the *Agamemnon*, or the wailings of Lear over the dead Cordelia. Even when writing the words uttered by Œdipus, as the terrible truth breaks in upon his soul, Sophocles must have felt that, in the holiest chambers of sorrow and in the highest agonies of suffering reigns that awful silence which not poetry, but painting sometimes, and sculpture always, can render. What human sounds could render the agony of Niobe, or the agony of Laocoon, as we see them in the sculptor's rendering? Not articulate speech at all; not words but wails. It is the same with hate; it is the same with love. We are not speaking merely of the unpacking of the heart in which the angry warriors of the *Iliad* indulge. Even such subtle writing as that of Æschylus and Sophocles falls below the work of the painter. Hate, though voluble perhaps, as Clytæmnestra's when hate is at that red-heat glow which the poet can render, changes in a moment whenever that redness has been fanned to hatred's own last complexion—whiteness as of iron at the melting-point,—when the heart has grown far too big to be "unpacked" at all, and even the bitter epigrams of hate's own rhetoric, though brief as the terrier's snap before he fleshes his teeth, or as the short snarl of the tigress as she springs before her cubs in danger, are all too slow and sluggish for a soul to which language at its tensest has become idle play. But this is just what cannot be rendered by an art whose medium consists solely of words.

It is in giving voice, not to emotion at its tensest, but to the variations of emotion, it is in expressing the countless shifting movements of the soul from passion to passion, that poetry shows in spite of all her infirmities her superiority to the plastic arts. *Hamlet* and the *Agamemnon*, the *Iliad* and the *Œdipus Tyrannus*, are adequate to the entire breadth and depth of man's soul.

Poetic imagination.

Poetic Imagination.—We have now reached our last general inquiry—What varieties of poetic art are the outcome of the two kinds of poetic impulse, dramatic imagination and lyric or egoistic imagination? It would of course be impossible within the space at our command to examine fully the subject of poetic imagination. For in order to do so we should have to enter upon the vast question of the effect of artistic environment upon the development of man's poetic imagination; we should have to inquire how the instinctive methods of each poet and of each group of poets have been modified and often governed by the methods characteristic of their own time and country. We should have to inquire, for instance, how far such landscape as that of Sophocles in the *Œdipus Coloneus* and such landscape as that of Wordsworth depends upon difference of individual temperament, and how far upon difference of artistic environment. That, in any thorough and exhaustive discussion of poetic imagination, the question of artistic environment must be taken into account, the case of the *Iliad* is alone sufficient to show—a case that will at once occur to the reader. Ages before Phrynichus, ages before an acted drama was dreamed of, a dramatic poet of the first order arose, and, though he was obliged to express his splendid dramatic imagination through epic forms, he expressed it almost as fully as if he had inherited the method and the stage of Sophocles. And if Homer never lived at all, then an entire group of dramatic poets arose in remote times whose method was epic instead of dramatic simply because there was then no stage.

Artistic environment.

This, contrasted with the fact that in a single half-century the tragic art of Greece arose with Æschylus, culminated with Sophocles, and decayed with Euripides, and contrasted also with the fact that in England at one time, and in Spain at one time, almost the entire poetic imagination of the country found expression in the acted drama alone, is sufficient to show that a poet's artistic methods are very largely influenced by the artistic environments of his country and time. So vast a subject as this, however, is, as we say, quite beyond the scope of any essay like this, and we can only point to the familiar instance of the troubadours and the trouvères and then pass on.

With the trouvère (the poet of the *langue d'oïl*), the story or situation is always the end of which the musical language is the means; with the troubadour (the poet of the *langue d'oc*), the form is so beloved, the musical language so enthralling, that, however beautiful may be the story or situation, it is felt to be no more than the means to a more beloved and beautiful end. But then nature makes her own troubadours and her own trouvères irrespective of fashion and of time—irrespective of *langue d'oc* and *langue d'oïl*. And, in comparing the troubadours with the trouvères, this is what strikes us at once—there are certain troubadours who by temperament, by original endowment of nature, ought to have been trouvères, and there are certain trouvères who by temperament ought to have been troubadours. Surrounding conditions alone have made them what they are. There are those whose impulse (though writing in obedience to contemporary fashions lyrics in the *langue d'oc*) is manifestly to narrate, and there are those whose impulse (though writing in obedience to contemporary fashions *fabliaux* in the *langue d'oïl*) is simply to sing. In other words, there are those who, though writing after the fashion of their brother troubadours, are more impressed with the romance and wonderfulness of the human life outside them than with the romance and wonderfulness of their own passions, and who delight in depicting the external world in any form that may be the popular form of their time; and there are those who, though writing after the fashion of their brother trouvères, are far more occupied with the life within them than with that outer life which the taste of their time and country calls upon them to paint—born rhythmists who must sing, who translate everything external as well as internal into verbal melody. Of the former class Pierre Vidal, of the latter class the author of "Le Lay de l'Oiselet," may be taken as the respective types.

That the same forces are seen at work in all literatures few students of poetry will deny,—though in some poetical groups these forces are no doubt more potent than in others, as, for instance, with the great parable poets of Persia, in some of whom there is perpetually apparent a conflict between the dominance of the Oriental taste for allegory and subtle suggestion, as expressed in the Zoroastrian definition of poetry,—"apparent pictures of unapparent realities,"—and the opposite yearning to represent human life with the freshness and natural freedom characteristic of Western poetry.

All poetry the outcome of absolute vision or of relative vision.

Allowing, however, for all the potency of external influences, we shall not be wrong in saying that of poetic imagination there are two distinct kinds—(1) the kind of poetic imagination seen at its highest in Æschylus, Sophocles, Shakespeare, and Homer, and (2) the kind of poetic imagination seen at its highest in Pindar, Dante, and Milton, or else in Sappho, Heine, and Shelley. The former, being in its highest dramatic exercise unconditioned by the personal or lyrical impulse of the poet, might perhaps be called absolute dramatic vision; the latter, being more or less conditioned by the personal or lyrical impulse of the poet, might be called relative dramatic vision. It seems impossible to classify poets, or to classify the different varieties of poetry, without drawing some such distinction as this, whatever words of definition we may choose to adopt.

For the achievement of all pure lyric poetry, such as the ode, the song, the elegy, the idyl, the sonnet, the stornello, it is evident that the imaginative force we have called relative vision will suffice. And if we consider the matter thoroughly, in many other forms of poetic art—forms which at first sight might seem to require absolute vision—we shall find nothing but relative vision at work.

Even in Dante, and even in Milton and Virgil, it might be difficult to trace the working of any other than relative vision. And as to the entire body of Asiatic poets it might perhaps be found (even in view of the Indian drama) that relative vision suffices to do all their work. Indeed the temper which produces true drama is, it might almost be said, a growth of the Western mind. For, unless it be Semitic as seen in the dramatic narratives of the Bible, or Chinese as seen in that remarkable prose story, *The Two Fair Cousins*, translated by Rémusat, absolute vision seems to have but small place in the literatures of Asia. The wonderfulness of the world and the romantic possibilities of fate, or circumstance, or chance—not the wonderfulness of the character to whom these possibilities befall—are ever present to the mind of the Asiatic poet. Even in so late a writer as the poet of the *Shāh Nāmeh*, the hero Irij, the hero Zal, and the hero Zohreb are in character the same person, the virtuous young man who combines the courage of youth with the wisdom and forbearance of age. And, as regards the earlier poets of Asia, it was not till the shadowy demigods and heroes of the Asiatic races crossed the Caucasus, and breathed a more bracing air, that they became really individual characters. But among the many qualities of man's mind that were invigorated and rejuvenated by that great exodus from the dreamy plains of Asia is to be counted, above all others, his poetic imagination. The mere sense of wonder, which had formerly been an all-sufficing source of pleasure to him, was all-sufficing no longer. The wonderful adventure must now be connected with a real and interesting individual character. It was left for the poets of Europe to show that, given the interesting character, given the Achilles, the Odysseus, the Helen, the Priam, any adventure happening to such a character becomes interesting.

What then is this absolute vision, this true dramatic imagination which can hardly be found in Asia—which even in Europe cannot be found except in rare cases? Between relative and absolute vision the difference seems to be this, that the former only enables the poet, even in its very highest exercise, to make his own individuality, or else humanity as represented by his own individuality, live in the imagined situation; the latter enables him in its highest exercise to make special individual characters other than the poet's own live in the imagined situation.

"That which exists in nature," says Hegel, "is a something purely individual and particular. Art on the contrary is essentially destined to manifest the general." And no doubt this is true as regards the plastic arts, and true also as regards literary art, save in the very highest reaches of pure drama and pure lyric, when it seems to become art no longer—when it seems to become the very voice of Nature herself. The cry of Priam when he puts to his lips the hand that slew his son is not merely the cry of a bereaved and aged parent; it is the cry of the individual king of Troy, and expresses above everything else that most naif, pathetic, and winsome character. Put the words into the mouth of the irascible and passionate Lear and they would be entirely out of keeping.

It may be said then that, while the poet of relative vision, even in its very highest exercise, can only, when depicting the external world, deal with the general, the poet of absolute vision can compete with Nature herself and deal with both general and particular. Now if this is really so we may perhaps find a basis for a classification of poetry and of poets. That all poets must be singers has already been maintained. But singers seem to be divisible into three classes: first the pure lyrists, each of whom can with his one voice sing only one tune; secondly the epic poets, save Homer, the bulk of the narrative poets, and the quasi-dramatists, each of whom can with his one voice sing several tunes; and thirdly the true dramatists, who, having, like the nightingale of Gongora, many tongues, can sing all tunes.

It is to the first-named of these classes that most poets belong. With regard to the second class, there are not of course many poets left for it: the first absorbs so many. But, when we come to consider that among those who, with each his one voice, can sing many tunes, are Pindar, Firdausi, Jami, Virgil, Dante, Milton, Spenser, Goethe, Byron, Coleridge, Shelley, Keats, Schiller, Victor Hugo, the second class is so various that no generalization save such a broad one as ours could embrace its members. And now we come to class three, and must pause. The third class is necessarily very small. In it can only be placed such names as Shakespeare, Æschylus, Sophocles, Homer, and (hardly) Chaucer.

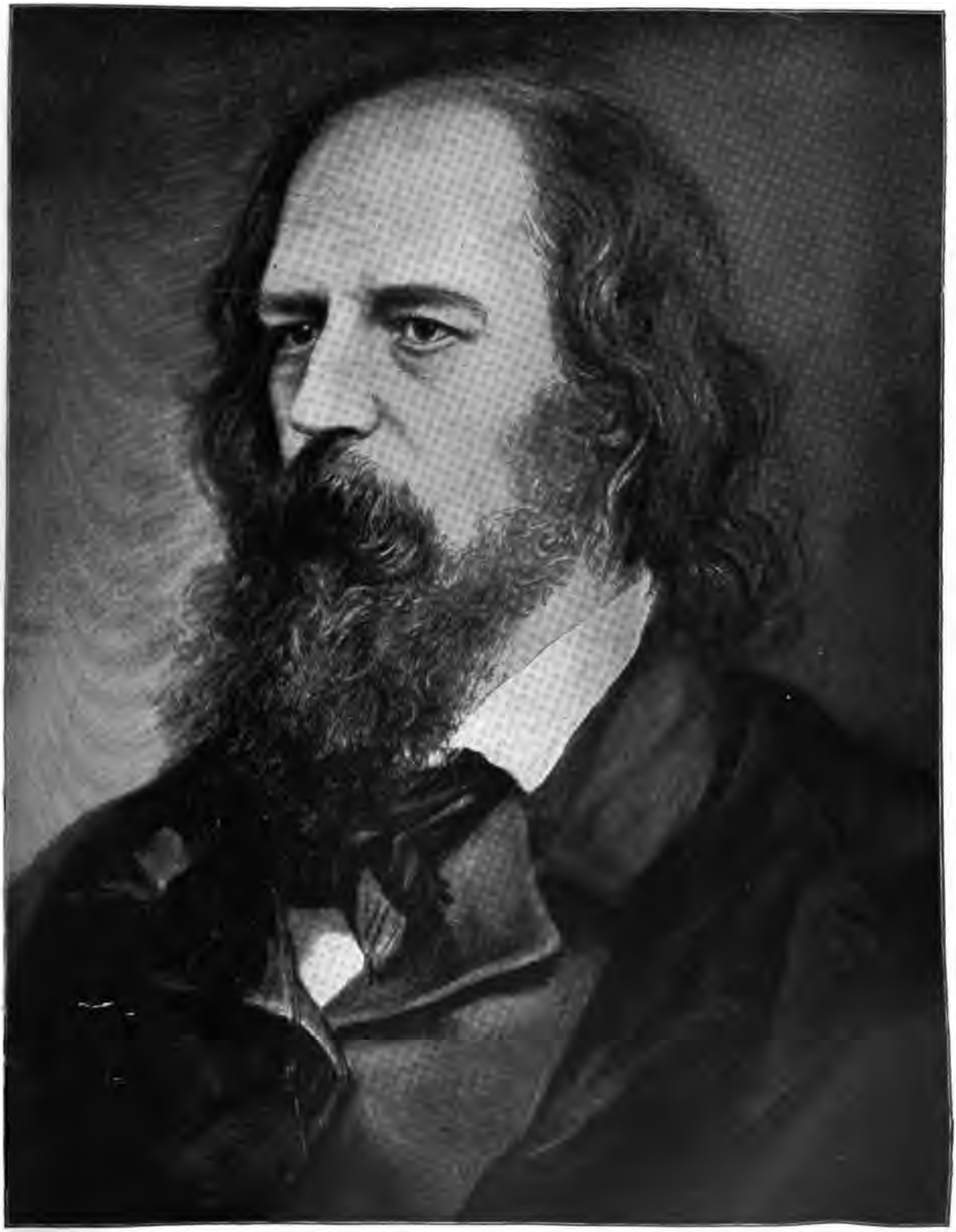
These three kinds of poets represent three totally different kinds of poetic activity.

With regard to the first, the pure lyrists, the impulse is pure egoism. Many of them have less of even relative vision at its highest than the mass of mankind. They are often too much engaged with the emotions within to have any deep sympathy with the life around them. Of every poet of this class it may be said that his mind to him "a kingdom is," and that the smaller the poet the bigger to him is that kingdom. To make use of a homely image—like the chaffinch whose eyes have been pricked by the bird-fancier, the pure lyrist is sometimes a warbler because he is blind. Still he feels that the Muse loves him exceedingly. She takes away his eyesight, but she gives him sweet song. And his song is very sweet, very sad, and very beautiful; but it is all about the world within his own soul—its sorrows, joys, fears, and aspirations.

With regard to the second class the impulse here is no doubt a kind of egoism too; yet the poets of this class are all of a different temper from the pure lyrists. They have a wide imagination; but it is still relative, still egoistic. They have splendid eyes, but eyes that never get beyond seeing general, universal humanity (typified by themselves) in the imagined situation. Not even to these is it given to break through that law of centrality by which every "me" feels itself to be the central "me"—the only "me" of the universe, round which all other spurious "mes" revolve. This "me" of theirs they can transmute into many shapes, but they cannot create other "mes,"—nay, for egoism, some of them scarcely would perhaps if they could.

The third class, the true dramatists, whose impulse is the simple yearning to create akin to that which made "the great Vishnu yearn to create a world," are "of imagination all compact,"—so much so that when at work "the divinity" which Iamblichus speaks of "seizes for the time the soul and guides it as he will."

The distinction between the pure lyrists and the other two classes of poets is obvious enough. But the distinction between the quasi-dramatists and the pure dramatists requires a word of explanation before we proceed to touch upon the various kinds of poetry that spring from the exercise of relative and absolute vision. Sometimes, to be sure, the vision of the true dramatists—the greatest dramatists—will suddenly become narrowed and obscured, as in that part of the *Œdipus Tyrannus* where Sophocles makes Œdipus ignorant of what every one in Thebes must have known, the murder of Laius. And again, finely as Sophocles has conceived the character of Electra, he makes her, in her dispute with Chrysothemis, give expression to sentiments that, in another play of his own, come far more appropriately from the lofty character of Antigone in a parallel dispute with Ismene. And, on the other hand, examples of relative vision, in its furthest reaches, can be found in abundance everywhere, especially in Virgil, Dante, Calderon, and Milton; but in



TENNYSON (P. KRAMER)

Examples of relative vision.

our limited space we can give but two or three. Some of the most remarkable examples of that high kind of relative vision which may easily be mistaken for absolute vision may be found in those great prose epics of the North which Aristotle would have called poems. Here is one from the *Völsunga Saga.* While the brothers of Gudrun are about their treacherous business of murdering Sigurd, her husband, as he lies asleep in her arms, Brynhild, Sigurd's former love, who in the frenzy of "love turned to hate" has instigated the murderers to the deed, hovers outside the chamber with Gunnar, her husband, and listens to the wail of her rival who is weltering in Sigurd's blood. At the sound of that wail Brynhild laughs—

> "Then said Gunnar to her, Thou laughest not because thy heart roots are gladded, *or else why doth thy visage wax so wan!*"[1]

This is of course very fine; but, as any two characters in that dramatic situation might have done that dramatic business, fine as it is,—as the sagaman gives us the general and not the particular,—the vision at work is not absolute but relative at its very highest exercise. But our examples will be more interesting if taken from English poets. In Coleridge's "Ancient Mariner" we find an immense amount of relative vision of so high a kind that at first it seems absolute vision. When the ancient mariner, in his narrative to the wedding guest, reaches the slaying of the albatross, he stops, he can proceed no further, and the wedding guest exclaims—

> "God save thee, Ancient Mariner,
> From the fiends that plague thee thus!
> Why look'st thou so?" "With my cross-bow
> I shot the albatross."

But there are instances of relative vision—especially in the great master of absolute vision, Shakespeare—which are higher still,—so high indeed that not to relegate them to absolute vision seems at first sight pedantic. Such an example is the famous speech of Lady Macbeth in the second act, where she says—

> "Had he not resembled
> My father as he slept, I had done 't."

Marvellously subtle as is the speech, it will be found, if analyzed, that it expresses the general human soul rather than any one special human soul. Indeed Leigh Hunt records the case of a bargeman who, charged with robbing a sleeping traveller in his barge, used in his confession almost identical words—"Had he not looked like my father as he slept, I should have killed as well as robbed him." Again, the thousand and one cases (to be found in every literature) where a character, overwhelmed by some sudden surprise or terror, asks whether the action going on is that of a dream or of real life, must all, on severe analysis, be classed under relative rather than under absolute vision,—even such a fine speech, for instance, as that where Pericles, on discovering Marina, exclaims—

> "This is the rarest dream that e'er dull sleep
> Did mock sad fools withal;"

or as that in the third act of *Titus Adronicus*, where Titus, beholding his mutilated and ruined daughter, asks—

> "When will this fearful slumber have an end?"

even here, we say, the humanity rendered is general and not particular, the vision at work is relative and not absolute. The poet, as representing the whole human race, throwing himself into the imagined situation, gives us what general humanity would have thought, felt, said, or done in that situation, not what one particular individual and he alone would have thought, felt, said, or done.

Now what we have called absolute vision operates in a very different way. So vividly is the poet's mere creative instinct at work that the *ego* sinks into passivity—becomes insensitive to all impressions other than those dictated by the vision—by the "divinity" which has "seized the soul."

We have left ourselves little room for examples; but Shakespeare is full af them.

Take the scene in the first act of *Hamlet* where Hamlet hears for the first time, from Horatio, that his father's ghost haunts the castle. Having by short sharp questions elicited the salient facts attending the apparition, Hamlet says, "I would I had been there." To this Horatio makes the very commonplace reply, "It would have much amazed you." Note the marvellously dramatic reply of Hamlet—"Very like, very like! Stayed it long?" Suppose that this dialogue had been attempted by any other poet than a true dramatist, or by a true dramatist in any other mood than his very highest, Hamlet, on hearing Horatio's commonplace remarks upon phenomena which to Hamlet were more subversive of the very order of the universe than if a dozen stars had fallen from their courses, would have burst out with—"Amazed me!" and then would have followed an eloquent declamation about the "amazing" nature of the phenomena and their effect upon him. But so entirely has the poet become Hamlet, so completely has "the divinity seized his soul," that all language seems equally weak for expressing the turbulence within the soul of the character, and Hamlet exclaims in a sort of meditative irony, "very like, very like!" It is exactly this one man Hamlet, and no other man, who in this situation would have so expressed himself. Charles Knight has some pertinent remarks upon this speech of Hamlet; yet he misses its true value, and treats it from the general rather than from the particular side. Instances of absolute vision in Shakespeare crowd upon us, but we can find room for only one other. In the pathetic speech of Othello, just before he kills himself he declares himself to be—

> "One not easily jealous, but, being *wrought*,
> Perplexed in the extreme."

Consider the marvellous *timbre* of the word "wrought," as coming from a character like Othello. When writing this passage, especially when writing this word, the poet had become entirely the simple English soldier-hero, as the Moor really is—he had become Othello, looking upon himself "as not easily jealous," whereas he was "wrought" and "perplexed in the extreme" by tricks which Hamlet would have seen through in a moment.

Where absolute vision is demanded.

While all other forms of poetic art can be vitalized by relative vision, there are two forms (and these the greatest) in which absolute vision is demanded, viz., the drama, and in a lesser degree the Greek epic, especially the *Iliad*. This will be seen more plainly perhaps if we now vary our definitions and call relative vision egoistic imagination, absolute vision dramatic imagination.

Drama has been already fully treated in the present work (see DRAMA). But it follows from what has been here said that very much of the dramatist's work can be, and in fact is, effected by egoistic imagination, while true dramatic imagination is only called into play on comparatively rare occasions. Not only fine but sublime dramatic poems have been written, however, where the vitalizing power has been entirely that of lyrical imagination. We need only instance the *Prometheus Bound* of Æschylus, the most sublime poem in the world. The dramas of Shelley too, like those of Victor Hugo and Calderon, are informed entirely by egoistic imagination. In all these splendid poems the dramatist places himself in the imagined situation, or at most he places there some typical conception of universal humanity. There is not in all Calderon any such display of dramatic imagination as we get in that wonderful speech of Priam's in the last book of the *Iliad* to which we have before alluded.

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[1] Translation of Morris and Magnusson.

There is not in the *Cenci* such a display of dramatic imagination as we get in the sudden burst of anger from the spoilt child of gods and men, Achilles (anger which alarms the hero himself as much as it alarms Priam), when the prattle of the old man has carried him too far. It may seem bold to say that the drama of Goethe is informed by egoistic imagination only,—assuredly the prison-scene in *Faust* is unsurpassed in the literatures of the world. Yet, perhaps, it could be shown of the passion and the pathos of Gretchen throughout the entire play that it betrays a female character general and typical rather than individual and particular.

The nature of this absolute vision or true dramatic imagination is easily seen if we compare the dramatic work of writers without absolute vision, such as Calderon, Goethe, Ben Jonson, Fletcher, and others, with the dramatic work of Æschylus and of Shakespeare. While of the former group it may be said that each poet skilfully works his imagination, of Æschylus and Shakespeare it must be said that each in his highest dramatic mood does not work, but is worked *by* his imagination. Note, for instance, how the character of Clytæmnestra grows and glows under the hand of Æschylus. The poet of the *Odyssey* had distinctly said that Ægisthus, her paramour, had struck the blow, but the dramatist, having imagined the greatest tragic female in all poetry, finds it impossible to let a man like Ægisthus assist such a woman in a homicide so daring and so momentous. And when in that terrible speech of hers she justifies her crime (ostensibly to the outer world but really to her own conscience), the way in which, by the sheer magnetism of irresistible personality, she draws our sympathy to herself and her crime is unrivalled out of Shakespeare and not surpassed even there. In the great drama, in the *Agamemnon*, in *Othello*, in *Hamlet*, in *Macbeth*, there is an imagination at work whose laws are inexorable, are inevitable, as the laws by the operation of which the planets move around the sun. But in this essay our business with drama is confined entirely to its relations to epic.

Epic and drama compared.

Considering how large and on the whole how good is the body of modern criticism upon drama, it is surprising how poor is the modern criticism upon epic. Aristotle, comparing tragedy with epic, gives the palm to tragedy as being the more perfect art, and nothing can be more ingenious than the way in which he has marshalled his reasons. He tells us that tragedy as well as epic is capable of producing its effect even without action; we can judge of it perfectly, says he, by reading. He goes so far as to say that, even in reading as well as in representation, tragedy has an advantage over the epic, the advantage of greater clearness and distinctness of impression. And in some measure this was perhaps true of Greek tragedy, for as Müller in his *Dissertations on the Eumenides* has well said, the ancients always remained and wished to remain conscious that the whole was a Dionysian entertainment; the quest of a common-place ἀπάτη came afterwards. And even of Romantic Drama it may be said that in the time of Shakespeare, and indeed down through the 18th century, it never lost entirely its character of a recitation as well as a drama. It was not till melodrama began to be recognized as a legitimate form of dramatic art that the dialogue had to be struck from the dramatic action "at full speed"—struck like sparks from the roadster's shoes. The truth is, however, that it was idle for Aristotle to inquire which is the more important branch of poetry, epic or tragedy.

Equally idle would it be for the modern critic to inquire how much romantic drama gained and how much it lost by abandoning the chorus. Much has been said as to the scope and the limits of epic and dramatic poetry. If in epic the poet has the power to take the imagination of his audience away from the dramatic centre and show what is going on at the other end of the great web of the world, he can do the same thing in drama by the chorus, and also by the introduction into the dramatic circle of messengers and others from the outside world.

But, as regards epic poetry, is it right that we should hear, as we sometimes do hear, the voice of the poet himself as chorus bidding us contrast the present picture with other pictures afar off, in order to enforce its teaching and illustrate its pathos? This is a favorite method with modern poets and a still more favorite one with prose narrators. Does it not give an air of self-consciousness to poetry? Does it not disturb the intensity of the poetic vision? Yet it has the sanction of Homer; and who shall dare to challenge the methods of the great father of epic? An instance occurs in *Iliad* v. 158, where, in the midst of all the stress of fight, the poet leaves the dramatic action to tell us what became of the inheritance of Phænops, after his two sons had been slain by Diomedes. Another instance occurs in iii. 243–4, where the poet, after Helen's pathetic mention of her brothers, comments on the causes of their absence, "criticizes life" in the approved modern way, generalizes upon the impotence of human intelligence—the impotence even of human love—to pierce the darkness in which the web of human fate is woven. Thus she spoke (the poet tells us); but the life-giving earth already possessed them, there in Lacedæmon, in their dear native land:

ὣς φάτο· τοὺς δ' ἤδη κάτεχεν φυσίζοος αἶα
ἐν Λακεδαίμονι αὖθι φίλῃ ἐν πατρίδι γαίῃ.

This of course is "beautiful exceedingly," but, inasmuch as the imagination at work is egoistic or lyrical, not dramatic, inasmuch as the vision is relative not absolute, it does not represent that epic strength at its very highest which we call specially "Homeric," unless indeed we remember that with Homer the Muses are omniscient: this certainly may give the passage a deep dramatic value it otherwise seems to lack.

The deepest of all the distinctions between dramatic and epic methods has relation, however, to the nature of the dialogue. Aristotle failed to point it out, and this is remarkable until we remember that his work is but a fragment of a great system of criticism. In epic poetry, and in all poetry that narrates, whether the poet be Homer, Chaucer, Thomas the Rhymer, Gottfried von Strasburg, or Turoldus, the action, of course, moves by aid partly of narrative and partly by aid of dialogue, but in drama the dialogue has a quality of suggestiveness and subtle inference which we do not expect to find in any other poetic form save perhaps that of the purely dramatic ballad. In ancient drama this quality of suggestiveness and subtle inference is seen not only in the dialogue, but in the choral odes. The third ode of the *Agamemnon* is an extreme case in point, where, by a kind of *double entendre*, the relations of Clytæmnestra and Ægisthus are darkly alluded to under cover of allusions to Paris and Helen. Of this dramatic subtlety Sophocles is perhaps the greatest master; and certain critics have been led to speak as though irony were heart-thought of Sophoclean drama. But the suggestiveness of Sophocles is pathetic (as Prof. Lewis Campbell has well pointed out) not ironical. This is one reason why drama more than epic seems to satisfy the mere intellect of the reader, though this may be counterbalanced by the hardness of mechanical structure which sometimes disturbs the reader's imagination in tragedy.

When, for instance, a dramatist pays so much attention to the evolution of the plot as Sophocles does, it is inevitable that his characters should be more or less plot-ridden; they have to say and do now and then certain things which they would not say and do but for the exigencies of the plot. Indeed one of the advantages which epic certainly has over drama is that the story can be made to move as rapidly as the poet may desire without these mechanical modifications of character.

Place of the *Iliad* in epic poetry.

The only kind of epic for Aristotle to consider was Greek epic, between which and all other epic the difference is one of kind, if the *Iliad* alone is taken to represent Greek epic. In speaking of the effect that surrounding conditions seem to have upon the form in which the poetic energy of any time or country should express itself, we instanced the *Iliad* as a typical case. The imagination vivifying it is mainly dramatic. The characters represent much more than the mere variety of mood of the delineator. Nothwithstanding all the splendid works of Calderon, Marlowe, Webster, and Goethe, it is doubtful whether as a born dramatist the poet of the *Iliad* does not come nearer to Æschylus and Shakespeare than does any other poet. His passion for making the heroes speak for themselves is almost a fault in the *Iliad* considered as pure epic, and the unconscious way in which each actor is made to depict his own character is in the highest spirit of drama. It is owing to this specialty of the *Iliad* that it stands apart from all other epics save that of the *Odyssey* where, however, the dramatic vision is less vivid. It is owing to the dramatic imagination displayed in the *Iliad* that it is impossible to say, from internal evidence, whether the poem is to be classified with the epics of growth or with the epics of art. All epics are clearly divisible into two classes, first those which are a mere accretion of poems or traditionary ballads, and second, those which, though based indeed on tradition or history, have become so fused in the mind of one great poet, so stained, therefore, with the color and temper of that mind, as to become new crystallizations—inventions, in short, as we understand that word. Each kind of epic has excellences peculiar to itself, accompanied by peculiar and indeed necessary defects. In the one we get the freedom—apparently schemeless and motiveless—of nature, but as a consequence, miss that "hard acorn of thought" (to use the picturesque definition in the *Völsunga Saga* of the heart of a man) which the mind asks for as the core of every work of art. In the other this great requisite of an adequate central thought is found, but accompanied by a constriction, a lack of freedom, a cold artificiality, the obtrusion of a pedantic scheme, which would be intolerable to the natural mind unsophisticated by literary study. The flow of the one is as that of a river, the flow of the other as that of a canal. Yet, as has been already hinted, though the great charm of Nature herself is that she never teases us with any obtrusive exhibitions of scheme, she doubtless has a scheme somewhere, she does somewhere hide a "hard acorn of thought" of which the poem of the universe is the expanded expression. And, this being so, art should have a scheme too; but in such a dilemma is she placed in this matter that the epic poet, unless he is evidently telling the story for its own sake, scornful of purposes ethic or æsthetic, must sacrifice illusion.

Among the former class of epics are to be placed the great epics of growth, such as the *Mahâbhârata*, the Niblung story, etc.; among the latter the *Odyssey*, the *Æneid*, *Paradise Lost*, the *Gerusalemme Liberata*, the *Lusiadas*.

But where in this classification are we to find a place for the *Iliad*? The heart-thought of the greatest epic in all literature is simply that Achilles was vexed and that the fortunes of the world depended upon the whim of a sulky hero. Yet, notwithstanding all the acute criticisms of Wolff, it remains difficult for us to find a place for the *Iliad* among the epics of growth. And why? Because throughout the *Iliad* the dramatic imagination shown is of the first order; and, if we are to suppose a multiplicity of authors for the poem, we must also suppose that ages before the time of Pericles there existed a group of dramatists more nearly akin to the masters of the great drama, Æschylus, Sophocles, and Shakespeare than any group that has ever existed since. Yet it is equally difficult to find a place for it amongst the epics of art. In the matter of *artistic* motive the *Odyssey* stands alone among the epics of art of the world, as we are going to see.

A conscious scheme and motive required for the true epic of art.

It is manifest that, as the pleasure derived from the epic of art is that of recognizing a conscious scheme, if the epic of art fails through confusion of scheme it fails altogether. What is demanded of the epic of art (as some kind of compensation for that natural freedom of evolution which it can never achieve, that sweet *abandon* which belongs to nature and to the epic of growth alike) is unity of impression, harmonious and symmetrical development of a conscious heart-thought, or motive. This being so, where are we to place the *Æneid* and where are we to place the *Shāh Nāmeh*? Starting with the intention, as it seems, of fusing into one harmonious whole the myths and legends upon which the Roman story is based, Virgil, by the time he reaches the middle of his epic, forgets all about this primary intent, and gives us his own thoughts and reflections on things in general. Fine as is the speech of Anchises to Æneas in Elysium (*Æn.* vi. 724–755), its incongruity with the general scheme of the poem as developed in the previous books shows how entirely Virgil lacked that artistic power shown in the *Odyssey* of making a story become the natural and inevitable outcome of an artistic idea.

In the *Shāh Nāmeh* there is the artistic redaction of Virgil, but with even less attention to a central thought than Virgil exhibits. Firdausi relies for his effects upon the very qualities which characterize not the epic of art but the epic of growth—a natural and not an artificial flow of the story; so much so indeed that if the *Shāh Nāmeh* were studied in connection with the *Iliad* on the one hand and with the *Kalevala* on the other, it might throw a light upon the way in which an epic may be at one and the same time an aggregation of the national ballad poems and the work of a single artificer. That Firdausi was capable of working from a centre not only artistic but philosophic his *Yūsuf and Zuleikha* shows; and if we consider what was the artistic temper of the Persians in Firdausi's time, what indeed has been that temper during the whole of the Mohammedan period, the subtle temper of the parable poet,—the *Shāh Nāmeh*, with its direct appeal to popular sympathies, is a standing wonder in poetic literature.

With regard, however, to Virgil's defective power of working from an artistic motive, as compared with the poet of the *Odyssey*, this is an infirmity he shares with all the poets of the Western world. Certainly he shares it with the writer of *Paradise Lost*, who setting out to "justify the ways of God to man," forgets occasionally the original worker of the evil, as where, for instance, he substitutes chance as soon as he comes (at the end of the second book) to the point upon which the entire epic movement turns, the escape of Satan from hell and his journey to earth for the ruin of man:

> "At last his sail-broad vans
> He spreads for flight, and, in the surging smoke
> Uplifted, spurns the ground; thence many a league,
> As in a cloudy chair, ascending rides
> Audacious; but, that seat soon failing, meets
> A vast vacuity; all unawares,
> Fluttering his pinions vain, plumb down he drops
> Ten thousand fathoms deep, and to this hour
> Down had been falling, had not, by ILL CHANCE,
> The strong rebuff of some tumultuous cloud
> Instinct with fire and nitre, hurried him
> As many miles aloft."

In Milton's case, however, the truth is that he made the mistake of trying to disturb the motive of a story for artistic purposes—a fatal mistake as we shall see when we come to speak of the *Nibelungenlied* in relation to the old Norse epic cycle.

Though Vondel's mystery play of *Lucifer* is, in its execution, rhetorical more than poetical, it did, beyond all question, influence Milton when he came to write *Paradise Lost*. The famous line which is generally quoted as the key-note of Satan's character—

> "Better to reign in hell than serve in heaven"—

seems to have been taken bodily from Vondel's play, and Milton's entire epic shows a study of it. While Marlowe's majestic movements alone are traceable in Satan's speech (written some years before the rest of *Paradise Lost*, when the dramatic and not the epic form had been selected), Milton's Satan became afterwards a splendid amalgam not of the Mephistopheles but of the *Faustus* of Marlowe and the *Lucifer* of Vondel. Vondel's play must have possessed a peculiar attraction for a poet of Milton's views of human progress. Defective as the play is in execution, it is far otherwise in motive. This motive, if we consider it aright, is nothing less than an explanation of man's anomalous condition on the earth—spirit incarnate in matter, created by God, a little lower than the angels—in order that he may advance by means of these very manacles which imprison him, in order that he may ascend by the staircase of the world, the ladder of fleshly conditions, above those cherubim and seraphim who, lacking the education of sense, have not the knowledge wide and deep which brings man close to God.

Here Milton found his own favorite doctrine of human development and self-education in a concrete and vividly artistic form. Much, however, as such a motive must have struck a man of Milton's instincts, his intellect was too much chained by Calvinism to permit of his treating the subject with Vondel's philosophic breadth. The cause of Lucifer's wrath had to be changed from jealousy of human progress to jealousy of the Son's proclaimed superiority. And the history of poetry shows that once begin to tamper with the central thought around which any group of incidents has crystallized and the entire story becomes thereby re-written, as we have seen in the case of the *Agamemnon* of Æschylus. Of the motive of his own epic, after he had abandoned the motive of Vondel, Milton had as little permanent grasp as Virgil had of his. As regards the *Odyssey*, however, we need scarcely say that its motive is merely artistic, not philosophic. And now we come to philosophic motive.

Philosophic motive.

The artist's power of thought is properly shown not in the direct enunciation of ideas but in mastery over motive. Here Æschylus is by far the greatest figure in Western poetry—a proof perhaps among many proofs of the Oriental strain of his genius. (As regards pure drama, however, important as is motive, freedom, organic vitality in every part, is of more importance than even motive, and in this freedom and easy abandonment the concluding part of the Oresteia is deficient as compared with such a play as *Othello* or *Lear*.) Notwithstanding the splendid exception of Æschylus, the truth seems to be that the faculty of developing a poetical narrative from a philosophic thought is Oriental, and on the whole foreign to the genius of the Western mind. Neither in Western drama nor in Western epic do we find, save in such rare cases as that of Vondel, anything like that power of developing a story from an idea which not only Jami but all the parable poets of Persia show.

In recent English poetry, the motive of Shelley's dramatic poem *Prometheus Unbound* is a notable illustration of what is here contended. Starting with the full intent of developing a drama from a motive—starting with a universalism, a belief that good shall be the final goal of ill—Shelley cannot finish his first three hundred lines without shifting (in the curse of Prometheus) into a Manichæism as pure as that of Manes himself:

> "Heap on thy soul, by virtue of this curse,
> Ill deeds, then be thou damned, beholding good;
> *Both* infinite as is the universe."

According to the central thought of the poem human nature, through the heroic protest and struggle of the human mind typified by Prometheus, can at last dethrone that supernatural terror and tyranny (Jupiter) which the human mind had itself installed. But, after its dethronement (when human nature becomes infinitely perfectible), how can the supernatural tyranny exist apart from the human mind that imagined it? How can it be as "infinite as the universe"?

The motive of *Paradise Lost* is assailed with much vigor by Victor Hugo in his poem *Religions et Religion*. But when M. Hugo, in the after parts of the poem, having destroyed Milton's "God," sets up an entirely French "Dieu" of his own and tries "to justify" him, we perceive how pardonable was Milton's failure after all. Compare such defect of mental grip and such nebulosity of thought as is displayed by Milton, Shelley, and M. Hugo with the strength of hand shown in the "Sálámán" and "Absal" of Jami, and indeed by the Sufi poets generally.

There is, however, one exception to this rule that Western poetry is nebulous as to motive.

The Great Northern Epic.

There is, besides the *Iliad*, one epic that refuses to be classified, though for entirely different reasons. That is the Niblung story, where we find unity of purpose and also entire freedom of movement. We find combined here beauties which are nowhere else combined—which are, in fact, at war with each other everywhere else. We find a scheme, a real "acorn of thought," in an epic which is not the self-conscious work of a single poetic artificer, but is as much the slow growth of various times and various minds as is the *Mahâbhârata*, in which the heart-thought is merely that the Kauravas defeated their relatives at dice and refused to disgorge their winnings.

This Northern epic-tree, as we find it in the Icelandic sagas, the Norns themselves must have watered; for it combines the virtues of the epic of growth with those of the epic of art. Though not written in metre, it may usefully be compared with the epics of Greece and of India and Persia. Free in movement as the wind, which "bloweth where it listeth," it listeth to move by law. Its action is that of free-will, but free-will at play within a ring of necessity. Within this ring there throbs all the warm and passionate life of the world outside, and all the freedom apparently. Yet from that world it is enisled by a cordon of curses—by a zone of defiant flames more impregnable than that which girdled the beautiful Brynhild at Hindfell. Natural laws, familiar emotions, are at work everywhere in the story; yet the "Ring of Andvari," whose circumference is but that of a woman's finger, encircles the whole mimic world of the sagaman as the Midgard snake encircles the earth. For this artistic perfection in an epic of growth there are, of course, many causes, some of them traceable and some of them beyond all discovery—causes no doubt akin to those which gave birth to many of the beauties of other epics of growth. Originally Sinfiotli and Sigurd were the same person, and note how vast has been the artistic effect of the separation of the two! Again, there were several different versions of the story of Brynhild. The sagamen, finding all these versions too interesting and too much beloved to be discarded, adopted them all—worked them up into one legend, so that, in the *Völsunga Saga* we have a heroine possessing all the charms of goddess, demi-goddess, earthly princess, and amazon—a heroine surpassing perhaps in fascination all other heroines that have ever figured in poetry.

It is when we come to consider such imaginative work as this that we are compelled to pause before challenging the Aristotelian doctrine that metrical structure is but an accidental quality of epic; and it will now be seen why, in the early part of this essay, this doctrine was examined so carefully.

The Nibelungenlied.

In speaking of the Niblung story we do not, of course, speak of the German version, the *Nibelungenlied*, a fine epic still, though a degradation of the elder form. Between the two the differences are fundamental in the artistic sense, and form an excellent illustration of what has just been said upon the disturbance of motive in epic, and indeed in all poetic art. It is not merely that the endings of the three principal characters Sigurd (Siegfried), Gudrun (Kriemhilt), and Brynhild are entirely different; it is not merely that the Icelandic version, by missing the blood-bath at Fafnir's lair, loses the pathetic situation of Gudrun's becoming afterwards an unwilling instrument of her husband's death; it is not merely that, on the other hand, the German version, by omitting the early love passages between Brynhild and Sigurd at Hindfell, misses entirely the tragic meaning of her story and the terrible hate that is love resulting from the breaking of the troth; but the conclusion of each version is so exactly the opposite of that of the other that, while the German story is called (and very properly) "Kriemhilt's Revenge" the story of the *Völsunga Saga* might, with equal propriety, be called Gudrun's Forgiveness.

The temper of Eastern and of Western epic.

If it be said that, in both cases, the motive shows the same Titanic temper, that is because the Titanic temper is the special characteristic of the Northwestern mind. The temper of revolt against authority seems indeed to belong to that energy which succeeds in the modern development of the great racial struggle for life. Although no epic, Eastern or Western, can exist without a struggle between good and evil—and a struggle upon apparently equal terms—it must not be supposed that the warring of conflicting forces which is the motive of Eastern epic has much real relation to the warring of conflicting forces which is the motive of Western epic.

And, as regards the machinery of epic, there is, we suspect, a deeper significance than is commonly apprehended in the fact that the Satan or Shaitan of the Eastern world becomes in Vondel and Milton a sublime Titan who attracts to himself the admiration which in Eastern poetry belongs entirely to the authority of heaven. In Asia, save perhaps among the pure Arabs of the desert, underlying all religious forms, there is apparent a temper of resignation to the irresistible authority of heaven. And as regards the Aryans it is probable that the Titanic temper—the temper of revolt against authority—did not begin to show itself till they had moved across the Caucasus. But what concerns us here is the fact that the farther they moved to the northwest the more vigorously this temper asserted itself, the prouder grew man in his attitude towards the gods, till at last in the Scandinavian cycle he became their equal and struggled alongside them, shoulder to shoulder, in the defence of heaven against the assaults of hell. Therefore, as we say, the student of epic poetry must not suppose that there is any real parallel between the attitude of Vishnu (as Rama) towards Ravana and the attitude of Prometheus towards Zeus, or the attitude of the human heroes towards Odin in Scandinavian poetry. Had Ravana been clothed with a properly constituted authority, had he been a legitimate god instead of a demon, the Eastern doctrine of recognition of authority would most likely have come in and the world would have been spared one at least of its enormous epics. Indeed, the Ravana of the *Râmâyana* answers somewhat to the Fafnir of the *Völsunga Saga*; and to plot against demons is not to rebel against authority. The vast field of Indian epic, however, is quite beyond us here.

Nor can we do more than glance at the *Kalevala*. From one point of view that group of ballads might be taken, no doubt, as a simple record of how the men of Kalevala were skilful in capturing the sisters of the Pojohla men. But from another point of view the universal struggle of the male for the female seems typified in this so-called epic of the Finns by the picture of the "Lady of the Rainbow" sitting upon her glowing arc and weaving her golden threads, while the hero is doing battle with the malevolent forces of nature.

But it is in the Niblung story that the temper of Western epic is at its best—the temper of the simple fighter whose business it is to fight. The ideal Western fighter was not known in Greece till ages after Homer, when in the pass of Thermopylæ the companions of Leonidas combed their long hair in the sun. The business of the fighter in Scandinavian epic is to yield to no power whatsoever, whether of earth or heaven or hell—to take a buffet from the Allfather himself, and to return it; to look Destiny herself in the face, crying out for quarter neither to gods nor demons nor Norns. This is the true temper of pure "heroic poetry" as it has hitherto flourished on this side the Caucasus—the temper of the fighter who is invincible because he feels that Fate herself falters when the hero of the true strain defies—the fighter who feels that the very Norns themselves must cringe at last before the simple courage of man standing naked and bare of hope against all assaults whether of heaven or hell or doom. The proud heroes of the *Völsunga Saga* utter no moans and shed no Homeric tears, knowing as they know that the day prophesied is sure when, shoulder to shoulder, gods and men shall stand up to fight the entire brood of night and evil, storming the very gates of Asgard.

That this temper is not the highest from the ethical point of view is no doubt true. Against the beautiful resignation of Buddhism it may seem barbaric, and if moral suasion could supplant physical force in epic—if Siddartha could take the place of Achilles or Sigurd—it might be better for the human race.

But it would be difficult even to glance at the countless points of interest that suggest themselves in connection with epic poetry. Returning now to the general subject of egoistic or lyrical and dramatic imagination,—as might be expected, we occasionally meet imagination of a purely dramatic kind in narrative poetry, such for instance as that of Gottfried von Strasburg, of Chaucer, and of the author of the *Chanson de Roland*.

What forms of poetic art are the natural outcome of egoistic imagination.

But we must now give undivided attention to pure egoistic or lyric imagination. This, as has been said, is sufficient to vitalize all forms of poetic art save drama and the Greek epic. Many of these forms have been or will be treated in this work under separate heads.

It would be impossible to discuss adequately here the Hebrew poets, who have produced a lyric so different in kind from all other lyrics as to stand in a class by itself. As it is equal in importance to the Great Drama of Shakespeare, Æschylus, and Sophocles, we may perhaps be allowed to call it the "Great Lyric." The Great Lyric must be religious—it must, it would seem, be an outpouring of the soul, not towards man but towards God, like that of the God-intoxicated prophets and psalmists of Scripture. Even the lyric fire of Pindar owes much to the fact that he had a child-like belief in the myths to which so many of his contemporaries had begun to give a languid assent. But there is nothing in Pindar, or indeed elsewhere in Greek poetry, like the rapturous song, combining unconscious power with unconscious grace, which we have called the Great Lyric. It might perhaps be said indeed that the Great Lyric is purely Hebrew.

The great lyric of the Hebrews stands alone.

But, although we could hardly expect to find it among those whose language, complex of syntax and alive with self-conscious inflections, bespeaks the scientific knowingness of the Western mind, to call the temper of the Great Lyric broadly "Asiatic" would be rash. It seems to belong as a birthright to those descendants of Shem who, yearning always to look straight into the face of God and live, could (when the Great Lyric was sung) see not much else.

Though two of the artistic elements of the Great Lyric, unconsciousness and power, are no doubt plentiful enough in India, the element of grace is lacking for the most part. The Vedic hymns are both nebulous and unemotional, as compared with Semitic hymns. And as to the Persians, they, it would seem, have the grace always, the power often, but the unconsciousness almost never. This is inevitable if we consider for a moment the chief characteristic of the Persian imagination—an imagination whose wings are not so much "bright with beauty" as heavy with it—heavy as the wings of a golden pheasant—steeped in beauty like the "tiger-moth's deep damasked wings." Now beauty of this kind does not go to the making of the Great Lyric.

Then there comes that poetry which, being ethnologically Semitic, might be supposed to exhibit something at least of the Hebrew temper—the Arabian. But, whatever may be said of the oldest Arabic poetry, with its deep sense of fate and pain, it would seem that nothing can be more unlike than the Hebrew temper and the Arabian temper as seen in later poets. It is not with Hebrew but with Persian poetry that Arabian poetry can be usefully compared. If the wings of the Persian imagination are heavy with beauty, those of the later Arabian imagination are bright with beauty—brilliant as an Eastern butterfly, quick and agile as a dragon-fly or a humming-bird. To the eye of the Persian poet the hues of earth are (as Firdausi says of the garden of Afrasiab) "like the tapestry of the kings of Ormuz, the air is perfumed with musk, and the waters of the brooks are the essence of roses." And to the later Arabian no less than to the Persian the earth is beautiful; but it is the clear and sparkling beauty of the earth as she "wakes up to life, greeting the Sabæan morning": we feel the light more than the color.

But it is neither the Persian's instinct for beauty nor the Arabian's quenchless wit and exhaustless animal spirits that go to the making of the Great Lyric; far from it. In a word, the Great Lyric, as we have said, cannot be assigned to the Asiatic temper generally any more than it can be assigned to the European temper.

The artistic ode of Greece.

In the poetry of Europe, if we cannot say of Pindar, devout as he is, that he produced the Great Lyric, what can we say of any other European poet? The truth is that like the Great Drama, so straight and so warm does it seem to come from the heart of man in its highest moods that we scarcely feel it to be literature at all. Passing, however, from this supreme expression of lyrical imagination, we come to the artistic ode, upon which subject the present writer can only reiterate here what he has more fully said upon a former occasion. Whatever may have been said to the contrary, enthusiasm is in the nature of things, the very basis of the ode; for the ode is a mono-drama, the actor in which is the poet himself; and, as Marmontel has well pointed out, if the actor in the mono-drama is not affected by the sentiments he expresses, the ode must be cold and lifeless. But, although the ode is a natural poetic method of the poet considered as prophet—although it is the voice of poetry as a fine frenzy—it must not be supposed that there is anything lawless in its structure. "Pindar," says the Italian critic Gravina, "launches his verses upon the bosom of the sea; he spreads out all his sails; he confronts the tempest and the rocks; the waves arise and are ready to engulf him; already he has disappeared from the spectator's view; when suddenly he springs up in the midst of the waters, and reaches happily the shore." Now it is this Pindaric discursiveness, this Pindaric unrestraint as to the matter, which has led poets to attempt to imitate him by adopting an unrestraint as to form. Although no two odes of Pindar exhibit the same metrical structure (the Æolian and Lydian rhythms being mingled with the Doric in different proportions), yet each ode is in itself obedient, severely obedient, to structural law. This we feel; but what the law is no metricist has perhaps ever yet been able to explain.

It was a strange misconception that led people for centuries to use the word "Pindaric" and irregular as synonymous terms; whereas the very essence of the odes of Pindar (of the few, alas! which survive to us) is their regularity. There is no more difficult form of poetry than this, and for this reason: when in any poetical composition the metres are varied, there must, as the present writer has before pointed out, be a reason for such freedom, and that reason is properly subjective—the varying form must embody and express the varying emotions of the singer. But when these metrical variations are governed by no subjective law at all, but by arbitrary rules supposed to be evolved from the practice of Pindar, then that very variety which should aid the poet in expressing his emotion crystallizes it and makes the ode the most frigid of all compositions. Great as Pindar undoubtedly is, it is deeply to be regretted that no other poet survives to represent the triumphal ode of Greece,—the digressions of his subject-matter are so wide, and his volubility is so great.

The modern ode.

In modern literature the ode has been ruined by theories and experiments. A poet like La Mothe, for instance, writes execrable odes, and then writes a treatise to prove that all odes should be written on the same model.

There is much confusion of mind prevalent among poets as to what is and what is not an ode. All odes are, no doubt, divisible into two great classes: those which, following an arrangement in stanzas, are commonly called regular, and those which, following no such arrangement, are commonly called irregular.

The irregular or pseudo-Pindaric ode.

We do not agree with those who assert that irregular metres are of necessity inimical to poetic art. On the contrary, we believe that in modern prosody the arrangement of the rhymes and the length of the lines in any rhymed metrical passage may be determined either by a fixed stanzaic law or by a law infinitely deeper—by the law which impels the soul, in a state of poetic exaltation, to seize hold of every kind of metrical aid, such as rhyme, cæsura, etc., for the purpose of accentuating and marking off each shade of emotion as it arises, regardless of any demands of stanza. But between the irregularity of make-shift, such as we find it in Cowley and his imitators, and the irregularity of the "fine frenzy" of such a poem, for instance, as Coleridge's *Kubla Khan*, there is a difference in kind. Strange that it is not in an ode at all but in this unique lyric *Kubla Khan*, descriptive of imaginative landscape, that an English poet has at last conquered the crowning difficulty of writing in irregular metres. Having broken away from all restraints of couplet and stanza,—having caused his rhymes and pauses to fall just where and just when the emotion demands that they should fall, scorning the exigencies of makeshift no less than the exigencies of stanza,—he has found what every writer of irregular English odes has sought in vain, a music as entrancing, as natural, and at the same time as inscrutable, as the music of the winds or of the sea.

Stanzaic law and emotional law.

The prearranged effects of sharp contrasts and antiphonal movements, such as some poets have been able to compass, do not of course come under the present definition of irregular metres at all. If a metrical passage does not gain immensely by being written independently of stanzaic law, it loses immensely; and for this reason, perhaps, that the great charm of the music of all verse, as distinguished from the music of prose, is inevitableness of cadence. In regular metres we enjoy the pleasure of feeling that the rhymes will inevitably fall under a recognized law of couplet or stanza. But if the passage flows independently of these, it must still flow inevitably—it must, in short, show that it is governed by another and a yet deeper force, the inevitableness of emotional expression. The lines must be long or short, the rhymes must be arranged after this or after that interval, not because it is convenient so to arrange them, but because the emotion of the poet inexorably demands these and no other arrangements. When, however, Coleridge came to try his hand at irregular odes, such as the odes "To the Departing Year" and "To the Duchess of Devonshire," he certainly did not succeed.

As to Wordsworth's magnificent "Ode on Intimations of Immortality," the sole impeachment of it, but it is a grave one, is that the length of the lines and the arrangement of the rhymes are not always inevitable; they are, except on rare occasions, governed neither by stanzaic nor by emotional law. For instance, what emotional necessity was there for the following rhyme-arrangement?

"My heart is at your festival,
My head hath its coronal,
The fulness of your bliss I feel—I feel it all.
Oh, evil day! if I were sullen
While earth herself is adorning,
This sweet May morning;
And the children are culling,
On every side,
In a thousand valleys far and wide,
Fresh flowers."

Beautiful as is the substance of this entire passage, so far from gaining, it loses by rhyme—loses, not in perspicuity, for Wordsworth like all his contemporaries (except Shelley) is mostly perspicuous, but in that metrical emphasis the quest of which is one of the impulses that leads a poet to write in rhyme. In spite, however, of its metrical defects, this famous ode of Wordsworth's is the finest irregular ode in the language; for, although Coleridge's "Ode to the Departing Year" excels it in Pindaric fire, it is below Wordsworth's masterpiece in almost every other quality save rhythm. Among the writers of English irregular odes, next to Wordsworth, stands Dryden. The second stanza of the "Ode for St. Cecilia's Day" is a great triumph.

The true Pindaric ode is regular.

Is it suited to modern poetry?

Leaving the irregular and turning to the regular ode, it is natural to divide these into two classes: (1) those which are really Pindaric in so far as they consist of strophes, antistrophes, and epodes, variously arranged and contrasted; and (2) those which consist of a regular succession of regular stanzas. Perhaps all Pindaric odes tend to show that this form of art is in English a mistake. It is easy enough to write one stanza and call it a strophe, another in a different movement and call it an antistrophe, a third in a different movement still and call it an epode. But in modern prosody, disconnected as it is from musical and from terpsichorean science, what are these? No poet and no critic can say.

What is requisite is that the ear of the reader should catch a great metrical scheme, of which these three varieties of movement are necessary parts,—should catch, in short, that inevitableness of structure upon which we have already touched. In order to justify a poet in writing a poem in three different kinds of movement, governed by no musical and no terpsichorean necessity, a necessity of another kind should make itself apparent; that is, the metrical wave moving in the strophe should be metrically answered by the counter-wave moving in the antistrophe, while the epode—which, as originally conceived by Stesichorus, was merely a standing still after the balanced movements of the strophe and antistrophe—should clearly, in a language like ours, be a blended echo of these two. A mere metrical contrast such as some poets labor to effect is not a metrical answer. And if the reply to this criticism be that in Pindar himself no such metrical scheme is apparent, that is the strongest possible argument in support of our position. If indeed the metrical scheme of Pindar is not apparent, that is because, having been written for chanting, it was subordinate to the lost musical scheme of the musician. It has been contended, and is likely enough, that this musical scheme was simple—as simple, perhaps, as the scheme of a cathedral chant; but to it, whatever it was, the metrical scheme of the poet was subordinated. It need scarcely be said that the phrase "metrical scheme" is used here not in the narrow sense as indicating the position and movement of strophe and antistrophe by way of simple contrast, but in the deep metrical sense as indicating the value of each of these component parts of the ode, as a counter-wave balancing and explaining the other waves in the harmony of the entire composition. We touch upon this matter in order to show that the moment odes ceased to be chanted, the words strophe, antistrophe, and epode lost the musical value they had among the Greeks, and pretended to a complex metrical value which their actual metrical structure does not appear to justify. It does not follow from this that odes should not be so arranged, but it does follow that the poet's arrangement should justify itself by disclosing an entire metrical scheme in place of the musical scheme to which the Greek choral lyric was evidently subordinated. But even if the poet were a sufficiently skilled metricist to compass a scheme embracing a wave, an answering wave, and an echo gathering up the tones of each, *i.e.*, the strophe, the antistrophe, and the epode, the ear of the reader, unaided by the musical emphasis which supported the rhythms of the old choral lyric, is, it should seem, incapable of gathering up and remembering the sounds further than the strophe and the antistrophe, after which it demands not an epode but a return to the strophe. That is to say, an epode, as alternating in the body of the modern ode, is a mistake; a single epode at the end of a group of strophes and antistrophes (as in some of the Greek odes) has, of course, a different function altogether.

The great difficulty of the English ode is that of preventing the apparent spontaneity of the impulse from being marred by the apparent artifice of the form; for, assuredly, no writer subsequent to Coleridge and to Keats would dream of writing an ode on the cold Horatian principles adopted by Wharton, and even by Collins, in his beautiful "Ode to Evening."

The simple ode of regular stanzas.

Of the second kind of regular odes, those consisting of a regular succession of regular stanzas, the so-called odes of Sappho are, of course, so transcendent that no other amatory lyrics can be compared with them. Never before these songs were sung and never since did the human soul, in the grip of a fiery passion, utter a cry like hers; and, from the executive point of view, in directness, in lucidity, in that high imperious verbal economy which only nature herself can teach the artist, she has no equal, and none worthy to take the place of second—not even in Heine, not even in Burns. Turning, however, to modern poetry, there are some magnificent examples of this simple form of ode in English poetry—Spenser's immortal "Epithalamion" leading the way in point of time, and probably also in point of excellence.

Fervor being absolutely essential, we think, to a great English ode, fluidity of metrical movement can never be dispensed with. The more billowy the metrical waves the better suited are they to render the emotions expressed by the ode, as the reader will see by referring to Coleridge's "Ode to France" (the finest ode in the English language, according to Shelley), and giving special attention to the first stanza—to the way in which the first metrical wave, after it had gently fallen at the end of the first quatrain, leaps up again on the double rhymes (which are expressly introduced for this effect), and goes bounding on, billow after billow, to the end of the stanza. Not that this fine ode is quite free from the great vice of the English ode, rhetoric. If we except Spenser and, in one instance, Collins, it can hardly be said that any English writer before Shelley and Keats produced odes independent of rhetoric and supported by pure poetry alone. But fervid as are Shelley's "Ode to the West Wind," and Keat's Odes "To a Nightingale" and "On a Grecian Urn," they are entirely free from rhetorical flavor. Notwithstanding that in the "Ode on a Grecian Urn" the first stanza does not match in rhyme arrangement with the others, while the second stanza of the "Ode to a Nightingale" varies from the rest by running on four rhyme-sounds instead of five, vexing the ear at first by disappointed expectation, these two odes are, after Coleridge's "France," the finest regular odes perhaps in the English language.

The French ode.

With regard to the French ode, Malherbe was the first writer who brought it to perfection. Malherbe showed also more variety of mood than it is the fashion just now to credit him with. This may be especially noted in his "Ode to Louis XIII." His disciple Racan is not of much account. There is certainly much vigor in the odes of Rousseau, but it is not till we reach Victor Hugo that we realize what French poetry can achieve in this line; and contemporary poetry can hardly be examined here. We may say, however, that some of Hugo's odes are truly magnificent. As a pure lyrist his place among the greatest poets of the world is very high. Here, though writing in an inferior language, he ranks with the greatest masters of Greece, of England, and of Germany. Had he attempted no other kind of poetry than lyrical, his would still have been the first name in French poetry. Whatever is defective in his work arises, as in the case of Euripides, from the importation of lyrical force where dramatic force is mainly needed.

As most of the other varieties of lyrical poetry, such as the idyl, the satire, the ballad, the sonnet, etc., have been or will be treated under different heads, or under the names of the various masters of poetic art, it would be superfluous to discuss them here.

A word or two, however, must be said about the song and the elegy. To write a good song requires that simplicity of grammatical structure which is foreign to many natures—that mastery over direct and simple speech which only true passion and feeling can give, and which "coming from the heart goes to the heart." Without going so far as to say that no man is a poet who cannot write a good song, it may certainly be said that no man can write a good song who is not a good poet.

The Italian improvisatorial peasant poetry.

In modern times we have, of course, nothing in any way representing those choral dance-songs of the Greeks, which, originating in the primitive Cretan war-dances, became, in Pindar's time, a splendid blending of song and ballet. Nor have we anything exactly representing the Greek scolia, those short drinking songs of which Terpander is said to have been the inventor. That these scolia were written, not only by poets like Alcæus, Anacreon, Praxilla, Simonides, but also by Sappho and by Pindar, shows in what high esteem they were held by the Greeks. These songs seem to have been as brief as the stornelli of the Italian peasant. They were accompanied by the lyre, which was handed from singer to singer as the time for each scolion came round.

With regard to the stornello, many critics seem to confound it with the rispetto, a very different kind of song. The Italian *rispetto* consists of a stanza of inter-rhyming lines ranging from six to ten in number, but often not exceeding eight. The Tuscan and Umbrian *stornello* is much shorter, consisting, indeed, of a hemistich naming some natural object which suggests the motive of the little poem.

The nearest approach to the Italian stornello appears to be, not the rispetto, but the Welsh triban.

Perhaps the mere difficulty of rhyming in English and the facility of rhyming in Italian must be taken into account when we inquire why there is nothing in Scotland—of course there could be nothing in England—answering to the nature-poetry of the Italian peasant. Most of the Italian rispetti and stornelli seem to be improvisations; and to improvise in English is as difficult as to improvise is easy in Italian. Nothing indeed is more interesting than the improvisatorial poetry of the Italian peasants, such as the canzone. If the peasantry discover who is the composer of a canzone, they will not sing it. The speciality of Italian peasant poetry is that the symbol which is mostly erotic is of the purest and most tender kind. A peasant girl will improvise a song as impassioned as "Come into the Garden, Maud," and as free from unwholesome taint.

English songs.

With regard to English songs, the critic cannot but ask—Wherein lies the lost ring and charm of the Elizabethan song-writers? Since the Jacobean period at least, few have succeeded in the art of writing real songs as distinguished from mere book lyrics. Between songs to be sung and songs to be read there is in our time a difference as wide as that which exists between plays for the closet and plays for the boards.

Heartiness and melody—the two requisites of a song which can never be dispensed with—can rarely be compassed, it seems, by one and the same individual. In both these qualities the Elizabethan poets stand pre-eminent, though even with them the melody is not so singable as it might be made. Since their time heartiness has, perhaps, been a Scottish rather than an English endowment of the song-writer. It is difficult to imagine an Englishman writing a song like "Tullochgorum" or a song like "Maggie Lauder," where the heartiness and impulse of the poet's mood conquer all impediments of close vowels and rugged consonantal combinations. Of Scottish song-writers Burns is, of course, the head; for the songs of John Skinner, the heartiest song-writer that has appeared in Great Britain (not excluding Herrick), are too few in number to entitle him to be placed beside a poet so prolific in heartiness and melody as Burns. With regard to Campbell's heartiness this is quite a different quality from the heartiness of Burns and Skinner, and is in quality English rather than Scottish, though, no doubt, it is of a fine and rare strain, especially in "The Battle of the Baltic." His songs illustrate an infirmity which even the Scottish song-writers share with the English—a defective sense of that true song-warble which we get in the stornelli and rispetti of the Italian peasants. A poet may have heartiness in plenty, but if he has that love of consonantal effects which Donne displays he will never write a first-rate song. Here, indeed, is the crowning difficulty of song-writing. An extreme simplicity of structure and of diction must be accompanied by an instinctive apprehension of the melodic capabilities of verbal sounds, and of what Samuel Lever, the Irish song-writer, called "singing" words, which is rare in this country, and seems to belong to the Celtic rather than to the Saxon ear. "The song-writer," says Lover, "must frame his song of open vowels with as few guttural or hissing sounds as possible, and he must be content sometimes to sacrifice grandeur and vigor to the necessity of selecting singing word and not reading words." And he exemplifies the distinction between singing words and reading words by a line from one of Shelley's songs—

"'The fresh earth in new leaves drest,'

"where nearly every word shuts up the mouth instead of opening it." But closeness of vowel sounds is by no means the only thing to be avoided in song-writing. A phrase may be absolutely unsingable, though the vowels be open enough, if it is loaded with consonants. The truth is that in song-writing it is quite as important, in a consonantal language like ours, to attend to the consonants as to the vowels; and perhaps the first thing to avoid in writing English song is the frequent recurrence of the sibilant. But this applies to all the brief and quintessential forms of poetry, such as the sonnet, the elegy, etc.

The elegy.

As to the elegy—a form of poetic art which has more relation to the objects of the external world than the song, but less relation to these than the stornello—its scope seems to be wide indeed, as practiced by such various writers as Tyrtæus, Theognis, Catullus, Tibullus, and our own Gray. It may almost be said that perfection of form is more necessary here and in the sonnet than in the song, inasmuch as the artistic pretensions are more pronounced. Hence even such apparent minutiæ as those we have hinted at above must not be neglected here.

Perfection of detail demanded in the quintessential forms of poetry.

We have quoted Dionysius of Halicarnassus in relation to the arrangement of words in poetry. His remarks on sibilants are equally deserving of attention. He goes so far as to say that σ is entirely disagreeable, and, when it often recurs, insupportable. The hiss seems to him to be more appropriate to the beast than to man. Hence certain writers, he says, often avoid it, and employ it with regret. Some, he tells us, have composed entire odes without it. But if sibilation is a defect in Greek odes, where the softening effect of the vowel sounds is so potent, it is much more so in English poetry, where the consonants dominate, though it will be only specially noticeable in the brief and quintessential forms such as the song, the sonnet, the elegy. Many poets only attend to their sibilants when these clog the rhythm. To write even the briefest song without a sibilant would be a *tour de force;* to write a good one would no doubt be next to impossible. It is singular that the only metricist who ever attempted it was John Thelwall, the famous "Citizen John," friend of Lamb and Coleridge, and editor of the famous *Champion* newspaper where many of Lamb's epigrams appeared. Thelwall gave much attention to metrical questions, and tried his hand at various metres. Though "Citizen John's" sapphics might certainly have been better, he had a very remarkable critical insight into the rationale of metrical effects, and his "Song without a sibilant" is extremely neat and ingenious. Of course, however, it would be mere pedantry to exaggerate this objection to sibilants even in these brief forms of poetry.

As a fine art English poetry is receiving much attention in our time. Defective rhymes once allowable, and makeshift work in general, are no longer tolerated. And we believe the time is not far distant when even such a subject as vowel composition (the arrangement of one vowel sound with regard to another) will have to be studied with the care which the Greeks evidently bestowed upon it. (T. W.)

POGGENDORFF, JOHANN CHRISTIAN (1796–1877), physicist, and editor for more than half a century of the well-known scientific journal called after him *Poggendorff's Annalen*, was born in Hamburg on the 29th December, 1796. His father, a wealthy manufacturer of that town, was all but ruined by the French siege. His son Christian, after receiving his education at Hamburg and Schiffbeck, had therefore, when only sixteen, to apprentice himself to an apothecary in Hamburg, and when twenty-two began to earn his living as an apothecary's assistant at Itzehoe. Ambition and a strong inclination towards a scientific career led him to throw up his business and remove to Berlin, where he entered the university in 1820. Here his abilities were speedily recognized, and in 1823 he was appointed meteorological observer to the Academy of Sciences with a small salary, which was important to him, inasmuch as the expenses of his university career had nearly exhausted his slender patrimony. Even at this early period he had conceived the idea of founding a physical and chemical scientific journal. The realization of this plan was hastened by the sudden death of Gilbert, the editor of *Gilbert's Annalen der Physik*, in 1824. Poggendorff immediately put himself in communication with the publisher, Barth of Leipsic, with the result that he was installed as editor of a scientific journal which was to be a continuation of *Gilbert's Annalen* on a somewhat extended plan, indicated by its title *Annalen der Physik und Chemie.* Poggendorff was admirably qualified for the post which he thus attained. He had an extraordinary memory, well-stored with scientific knowledge, both modern and historical, which served him in good stead in the critical part of his editorial duty. He had a cool and impartial judgment, with a strong preference for facts as against theory of the speculative kind at least, and was able to throw himself into the spirit of modern experimental science, represented in the early part of his editorial career by such great names as Berzelius, Faraday, Brewster, Fresnel, Regnault. He also possessed in more than German measure the German virtue of orderliness in the arrangement of knowledge and in the conduct of business. To this he added an engaging geniality of manner and much tact in dealing with men; so marked in fact was this part of his character that, notwithstanding his somewhat trying position, he never during his long life was involved in anything that could be fairly called a literary quarrel. These qualities of its editor soon made *Poggendorff's Annalen* the foremost scientific journal in Europe. He collected around him all the eminent scientific men of his own country, and he managed either through original contributions or by translations of memoirs of approved value already printed, to secure for many years an adequate representation of the scientific work of other lands. So true is this that, for years after the beginning of Poggendorff's editorship, the tables of contents of his annual volumes read like an index of the history of physical science.

In the course of his fifty-two years' editorship of the *Annalen* Poggendorff could not fail to acquire an unusual acquaintance with the labors of modern men of science. This knowledge, joined to what he had gathered by historical reading of equally unusual extent, he carefully digested and gave to the world in his *Biographisch-literarisches Handbuch zur Geschichte der Exacten Wissenschaften*, containing notices of the lives and labors of mathematicians, astronomers, physicists, chemists, mineralogists, geologists, etc., of all peoples and all ages. The two volumes of this work contain an astounding collection of facts invaluable to the scientific biographer and historian; they form in fact the basis of the yet unwritten history of physical science. We possess a small fragment of such a history in the form of lectures delivered by Poggendorff himself at Berlin; and probably he had contemplated at one time writing a continuous narrative; but even his long life was too short for the double task of collecting and using the material.

Poggendorff was a physicist of high although not of the very highest rank. He was wanting in mathematical ability, and never displayed in any remarkable degree the still more important power of scientific generalization, which, whether accompanied by mathematical skill or not, never fails to mark the highest genius in physical science. He was, however, an able and conscientious experimenter. He was very fertile and ingenious in devising physical apparatus, and contributed greatly in the earlier part of his life to enrich the resources of experimental science. Contemporaneously with Schweigger, he succeeded in greatly increasing the sensitiveness of the galvanometer by introducing the multiplying coil, and he made important improvements on that particular type of this instrument which is usually called the sine galvanometer. To him (according to Wiedemann) we owe the use of binding screws in most of their various forms. He invented the "Inversor" for rapidly alternating the direction of a voltaic current, and the "Wippe" for throwing a number of voltaic or electrolytic cells suddenly into "series" or into "multiple arc"; and to him is due the suggestion of the telescope and mirror method for reading galvanometers and other physical instruments, a device which has proved very valuable in all branches of physical science.

Poggendorff's contributions to physics were published for the most part in his own journal. They form an important part of the scientific work of the 19th century; but it would be difficult in a few words to characterize them inasmuch as they do not constitute a single coherent group or even a few coherent groups of connected researches. By far the greater and more important part of his work related to electricity and magnetism. As specimens we may mention his investigations into the working of Holtz's machines, and his variations on their construction; his researches on the resistance and electro-motive force of electrolytic cells, along with which ought to be noticed his admirable method of comparing electro-motive forces by "compensation"; and finally his researches on magnetism and diamagnetism.

Poggendorff's literary and scientific reputation speedily brought him honorable recognition. In 1830 he was made royal professor and in 1834 Hon. Ph.D. and extraordinary professor in the university of Berlin, and in 1839 member of the Berlin Academy of Sciences. He ultimately became a member of many foreign societies, and received more than the usual share of the orders bestowed by Continental nations for scientific merit. During his lifetime many offers of ordinary professorships were made to him, but he declined them all, devoting himself to his duties as editor of the *Annalen*, and to the pursuit of his scientific researches. He died at Berlin on January 24, 1877.

POGGIO (1380-1459). Gian Francesco Poggio Bracciolini, eminent in the annals of the revival of learning, was born in 1380 at Terranova, a village in the territory of Florence. He studied Latin under John of Ravenna, and Greek under Manuel Chrysoloras. His distinguished abilities and his dexterity as a copyist of MSS. brought him into early notice with the chief scholars of Florence. Coluccio Salutati and Niccolo de' Niccoli befriended him, and in the year 1402 or 1403 he was received into the service of the Roman curia. His functions were those of a secretary; and, though he profited by benefices conferred on him in lieu of salary, he remained a layman to the end of his life. It is noticeable that, while he held his office in the curia through that momentous period of fifty years which witnessed the councils of Constance and of Basel, and the final restoration of the papacy under Nicholas V., his sympathies were never attracted to ecclesiastical affairs. Nothing marks the secular attitude of the Italians at an epoch which decided the future course of both Renaissance and Reformation more strongly than the mundane proclivities of this apostolic secretary, heart and soul devoted to the resuscitation of classical studies amid conflicts of popes and antipopes, cardinals and councils, in all of which he bore an official part. Thus, when his duties called him to Constance in 1414, he employed his leisure in exploring the libraries of Swiss and Swabian convents. The treasures he brought to light at Reichenau, Weingarten, and above all at St. Gall, restored many lost masterpieces of Latin literature, and supplied students with the texts of authors whose works had hitherto been accessible only in mutilated copies. In one of his epistles he describes how he recovered Quintilian, part of Valerius Flaccus, and the commentaries of Asconius Pedianus at St. Gall. MSS. of Lucretius, Columella, Silius Italicus, Manilius, and Vitruvius were unearthed, copied by his hand, and communicated to the learned. Wherever Poggio went he carried on the same industry of research. At Langres he discovered Cicero's *Oration for Cæcina*, at Monte Cassino a MS. of Frontinus. He also could boast of having recovered Ammianus Marcellinus, Nonius Marcellus, Probus, Flavius Caper, and Eutyches. If a codex could not be obtained by fair means, he was ready to use fraud, as when he bribed a monk to abstract a Livy and an Ammianus from the convent library of Hersfeld. Resolute in recognizing erudition as ,the chief concern of man, he sighed over the folly of popes and princes, who spent their time in wars and ecclesiastical disputes when they might have been more profitably employed in reviving the lost learning of antiquity. This point of view is eminently characteristic of the earlier Italian Renaissance. The men of that nation and of that epoch were bent on creating a new intellectual atmosphere for Europe by means of vital contact with antiquity. Poggio, like a still more eminent humanist of his age, Æneas Sylvius Piccolomini, was a great traveller, and wherever he went he brought, like Æneas Sylvius, enlightened powers of observation trained in liberal studies to bear upon the manners of the countries he visited. We owe to his pen curious remarks on English and Swiss customs, valuable notes on the remains of antique art in Rome, and a singularly striking portrait of Jerome of Prague as he appeared before the judges who condemned him to the stake. It is necessary to dwell at length upon Poggio's devotion to the task of recovering the classics, and upon his disengagement from all but humanistic interests, because these were the most marked feature of his character and career. In literature he embraced the whole sphere of contemporary studies, and distinguished himself as an orator, a writer of rhetorical treatises, a panegyrist of the dead, a violent impugner of the living, a translator from the Greek, an epistolographer and grave historian, and a facetious compiler of fabliaux in Latin. Of his moral essays it may suffice to notice the dissertations *On Nobility*, *On Vicissitudes of Fortune*, *On the Misery of Human Life*, *On the Infelicity of Princes*, and *On Marriage in Old Age*. These compositions belonged to a species which, since Petrarch set the fashion, were very popular among Italian scholars. They have lost their value, except for the few matters of fact imbedded in a mass of commonplace meditation, and for some occasionally brilliant illustrations. Poggio's *History of Florence*, written in avowed imitation of Livy's manner, requires separate mention, since it exemplifies by its defects the weakness of that merely stylistic treatment which deprived so much of Bruni's, Carlo Aretino's, and Bembo's work of historical weight. A somewhat different criticism must be passed on the *Facetiæ*, a collection of humorous and indecent tales expressed in such Latinity as Poggio could command. This book is chiefly remarkable for its unsparing satires on the monastic orders and the secular clergy. It is also noticeable as illustrating the Latinizing tendency of an age which gave classic form to the lightest essays of the fancy. Poggio, it may be observed, was a fluent and copious writer in the Latin tongue, but not an elegant scholar. His knowledge of the ancient authors was wide, but his taste was not select and his erudition was superficial. His translation of Xenophon's *Cyropædia* into Latin cannot be praised for accuracy. Among contemporaries he passed for one of the most formidable polemical or gladiatorial rhetoricians, and a considerable section of his extant works are invectives. One of these, the *Dialogue against Hypocrites*, was aimed in a spirit of vindictive hatred at the vices of ecclesiastics; another, written at the request of Nicholas V., covered the anti-pope Felix with scurrilous abuse. But his most famous compositions in this kind are the personal invectives which he discharged against Filelfo and Valla. All the resources of a copious and unclean Latin vocabulary were employed to degrade the objects of his satire; and every crime of which humanity is capable was ascribed to them without discrimination. In Filelfo and Valla Poggio found his match, and Italy was amused for years with the spectacle of their indecent combats. To dwell upon such literary infamies would be below the dignity of the historian, were it not that these habits of the early Italian humanists imposed a fashion upon Europe which extended to the later age of Scaliger's contentions with Scioppius and Milton's with Salmasius. The greater part of Poggio's long life was spent in attendance to his duties in the papal curia at Rome and elsewhere. But about the year 1452 he finally retired to Florence, where he was admitted to the burghership, and, on the death of Carlo Aretino in 1453, was appointed chancellor and historiographer to the republic. He had already built himself a villa in Valdarno, which he adorned with a collection of antique sculpture, coins, and inscriptions. In 1435 he had married a girl of eighteen named Vaggia, of the famous Buondelmonte blood. His declining days were spent in the discharge of his honorable Florentine office and in the composition of his history. He died in 1459 and was buried in the church of Sante Croce. A statue by Donatello and a picture by Antonio del Pollajuolo remained to commemorate a citizen who chiefly for his services to humanistic literature deserved the notice of posterity.

Poggio's works were printed at Basel in 1538, "ex sedibus Henrici Petri." Dr. Shepherd's *Life of Poggio Bracciolini* is a good authority on his biography. For his position in the history of the revival, students may consult Voigt's *Wiederbelebung des classichen Alterthums* and Symond's *Renaissance in Italy*. (J. A. S.)

POGY, a popular name for the fish *Clupea menhaden*, almost universally in use in the States of Maine and Massachusetts (see MENHADEN, vol. xvi. p. 14).

POINSOT, LOUIS (1777–1859), mathematician, was born at Paris, January 3, 1777. In 1794 he became a scholar at the Polytechnic School, which he left in 1796 to act as a civil engineer. In 1804 he was appointed professor of mathematics at the Lyceum, in 1809 professor of applied mathematics and in 1816 examiner at the Polytechnic School. On the death of Lagrange in 1813 Poinsot was elected to his place in the French Academy; and in 1840 he became a member of the superior council of public instruction. In 1846 he was made an officer of the legion of honor; and on the formation of the senate in 1852 he was chosen a member of that body. He died at Paris, December 5,[1] 1859. Poinsot's earliest work was his *Élémens de Statique*, in which he introduces the idea of statical couples and investigates their properties. In the *Théorie Nouvelle de la Rotation des Corps* he treats the motion of a rigid body geometrically, and shows that the most general motion of such a body can be represented at any instant by a rotation about an axis combined with a translation parallel to this axis, and that any motion of a body of which one point is fixed may be produced by the rolling of a cone fixed in the body on a cone fixed in space. The previous treatment of the motion of a rigid body had in every case been purely analytical and so gave no aid to the formation of a mental picture of the body's motion, and the great value of this work lies in the fact that, as Poinsot himself says in the introduction, it enables us to represent to ourselves the motion of a rigid body as clearly as that of a moving point. Poinsot also contributed a number of papers on pure and applied mathematics to *Liouville's Journal* and to the *Journal* of the Polytechnic School.

POINT DE GALLE. See GALLE, vol. x. p. 37.

POINTE À PITRE, the principal port of the island of GUADELOUPE (*q.v.*).

POISONS. An exact definition of the word "poison" is by no means easy. There is no legal definition of what constitutes a poison, and the definitions usually proposed are apt to include either too much or too little. Generally, a poison may be defined to be a substance having an inherent deleterious property, rendering it capable of destroying life by whatever avenue it is taken into the system; or it is a substance which, when introduced into the system or applied externally, injures health or destroys life irrespective of mechanical means or direct thermal changes. In popular language, a poison is a substance capable of destroying life when taken in small quantity; but a substance which destroys life by mechanical means, as, *e.g.*, powdered glass, is not, strictly speaking, a poison.

The subject of toxicology forms one of the most important branches of MEDICAL JURISPRUDENCE (*q.v.*). The medical jurist should be familiar with the nature and actions of poisons, the symptoms which they produce, the circumstances which modify their working, the pathological results of their action, and the methods of combating these.

Action of Poisons.—Poisons may exert a twofold action. This may be either local or remote, or both local and remote. The local action of a poison is usually one of corrosion, inflammation, or a direct effect upon the sensory or motor nerves. The remote actions of poisons are usually of a specific character, though some writers group the remote effects of poisons under two heads, and speak of the common and the specific remote effects of a poison. The local action of a poison of the corrosive class is usually so well marked and obvious that the fact of the administration of a poison of this class is generally unmistakable. The same may be said, in a less degree, of the irritant poisons, especially the mineral irritants; but here the symptoms sometimes so closely simulate those of natural disease as to render the recognition of the administration of poison a matter of difficulty. Hence an accurate acquaintance with the remote specific effects of the various poisons is indispensable to the medical jurist. The class of poisons which has been administered or taken will thus be suggested to his mind by the observation of the symptoms, and not unfrequently the specific poison taken will be suspected. It is almost universally admitted that absorption of a poison is necessary for the production of its specific remote effects, and the old notion that a poison may kill, by its action through the nervous system, without absorption, is abandoned.

Modifying Circumstances.—The ordinary action of a poison may be greatly modified by the largeness of the dose, by the state of aggregation, admixture, or of chemical combination of the poison, by the part or membrane to which it is applied, and by the condition of the patient. Thus, for example, opium may be a medicine or a poison according to the dose in which it is given; and a dose of the drug which may be beneficial to an adult in certain states of the system may be fatal to a child, or to an adult when suffering from some forms of disease. All barium salts, again, are poisonous, except the quite insoluble sulphate. The simple cyanides, and many double cyanides, are highly poisonous; but yellow prussiate of potash, which is a double cyanide of iron and potassium, is almost without action upon the system. The part or tissue to which a poison is applied greatly affects the activity of a poison, owing to the varying rapidity with which absorption takes place through the cutaneous, mucous, and serous surfaces, and by the other tissues of the body. Curare, an arrow poison, may be swallowed in considerable quantity without appreciable results, whilst a minute quantity of the same substance introduced into a wound is speedily fatal. Idiosyncracy has an important bearing in toxicology. Pork, mutton, certain kinds of fish, more especially shell fish so-called, and mushrooms have each produced all the symptoms of violent irritant poisoning, whilst other persons who have partaken of the same food at the same time have experienced no ill effects. Some persons are stated, on good authority, to be capable of taking with impunity such poisons as opium, corrosive sublimate, or arsenic, in enormous doses,—and this irrespective of habit, which is known to have such an influence in modifying the effects of some poisons, notably the narcotics. A tolerance of poisons is sometimes engendered by disease, so that a poison may fail to produce its customary effect. Thus, opium is tolerated in large quantities in tetanus, and in delirium tremens; and mercurial compounds may in some febrile affections fail to produce the usual constitutional effects of the metal. On the other hand, diseases which impede the elimination of a poison may intensify its effects.

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[1] [Merlieux, in *Biographie Générale*, and Larousse say 15th Dec. —AM. ED.]

The *evidence* that a poison has been administered is based upon the symptoms produced, on the appearances met with in the body after death, on the analysis of articles of food and drink, of excreta and ejecta, and of the organs of the body after death, and on physiological experiments made with substances extracted from the same articles. These physiological experiments are usually made upon animals, but in some cases, as for instance when aconite has to be searched for, the physiological experiments must be made also upon the human subject. The evidence obtained from one or more of these sources, as compared with the properties or effects of various known poisons, will enable the medical jurist to form an opinion as to the administration or non-administration of a poison.

The *symptoms* exhibited by the patient during life rarely fail to afford some clue to the poison taken. Persons may, however, be found dead of whose history nothing can be learned. Here post-mortem appearances, chemical analysis, and, it may be, physiological experiments are all important for the elucidation of the nature of the case.

Poisoning may be *acute* or *chronic*. The general conditions which should arouse a suspicion of acute poisoning are the sudden onset of serious and increasingly alarming symptoms in a person previously in good health, especially if there be pain in the region of the stomach, or, where there is complete prostration of the vital powers, a cadaveric aspect, and speedy death. In all such cases the aid of the analytical chemist must be called in either to confirm well-founded or to rebut ill-founded suspicions.

The *mode of treatment* to be adopted in the case of poisoned persons varies greatly according to the nature of the poison. The first indication, when the poison has been swallowed, is to evacuate the stomach; and this may usually be done by means of the stomach-pump when the poison is not of the corrosive class; or the stomach may be gently washed out by means of a funnel and flexible siphon-tube. In many cases emetics are valuable. Antidotes and counter-poisons may then be given. The former are such substances as chalk to neutralize the mineral acids and oxalic acid; the latter have a physiological counter-action, and are such as atropine, which is a counter-poison to morphia. These may usually be administered most effectively by hypodermic injection. The stomach may to a certain degree be protected from the injurious effects of irritants by the administration of mucilaginous drinks; alkaloids may be rendered sparingly soluble by means of astringent substances containing tannin; and pain may be relieved by means of opium, unless contra-indicated by the nature of the poison. The effects of the convulsant poisons, such as strychnine, may be combated by means of the inhalation of chloroform.

The *classification* of poisons is a matter of difficulty. Various attempts have been made to classify them scientifically, but with no signal success; and perhaps the best system is that which groups the various poisons according to the more obvious symptoms which they produce. Our knowledge of the more intimate action of poisons is still too imperfect to admit of any useful classification according to the manner in which they specifically affect the vital organs. Poisons may in the manner indicated be classified as (1) *Corrosives*, (2) *Irritants*, (3) *Neurotics*, and (4) *Gaseous Poisons*. The subject of poisonous food has already been treated under the heading **Medical Jurisprudence** (vol. xv. pp. 792–793).

1. *Corrosives*.

The typical member of this class is corrosive sublimate, the soluble chloride of mercury. In it are included also the concentrated mineral acids (sulphuric, nitric, and hydrochloric); oxalic acid; the alkalies (potash, soda, and ammonia) and their carbonates; acid, alkaline, and corrosive salts of the metals (such as bisulphate of potash, alum, butter of antimony, and nitrate of silver); also carbolic acid.

The symptoms produced by the mineral acids and the alkalies are almost altogether referable to local action; but some corrosive poisons, such as carbolic acid, produce, besides a local action, remote and specific constitutional effects. The symptoms of corrosive poisoning are marked and unmistakable, except in infants. Immediately on swallowing the corrosive substance, an acid, caustic, or metallic burning sensation is experienced in the mouth, fauces, gullet, and region of the stomach, and this speedily extends over the whole belly; as a rule vomiting speedily follows. In the case of the mineral acids, and in oxalic acid poisoning, the vomit is so acid that if it falls upon a marble or concrete floor effervescence ensues. No relief follows the evacuation of the stomach. The ejected matters contain blood, and even fragments of the corroded walls of the alimentary canal. The belly becomes distended with gas, and horribly tender. High fever prevails. The mouth is found to be corroded. Death usually ensues within a few hours; or, if the patient survives, he or she may perish miserably, months after the poison was taken, through starvation consequent upon the gradual contraction of the gullet, brought about by its corrosion and subsequent healing.

The treatment of corrosive poisoning consists in very gently emptying and washing out the stomach by means of a soft siphon-tube. The stomach-pump cannot be used with safety in consequence of the weakening of the walls of the stomach by corrosion. Demulcents and opiates may be subsequently administered. After death from corrosive poisoning the walls of the stomach are found corroded, and even perforated.

1. *Corrosive Sublimate.*—Here all the signs and symptoms of corrosive poisoning are produced in their severest form. A grain or two of this poison may prove fatal. Fortunately there is an efficient antidote in white of egg, the albumen of which, if administered at once, renders the salt insoluble. The eggs should be divested of their yolks, beaten up with water, and given promptly, repeatedly, and abundantly, followed by emetics. Poisoning by corrosive sublimate may be followed by the specific toxic effects of mercury, such as salivation and tremor.

Workers in mercury, such as water-gilders, looking-glass makers, and the makers of barometers and thermometers, are apt to suffer from a peculiar form of shaking palsy, known as "the trembles," or mecurial tremor. This disease affects most frequently those who are exposed to mercurial fumes. The victim is affected with tremors when an endeavor is made to exert the muscles, so that he is unable, for instance, to convey a glass of water to the lips steadily, and when he walks he breaks into a dancing trot. The treatment consists in removal from the mercurial atmosphere, baths, fresh air, and the administration of iron and other tonics.

2. *Mineral Acids.*—These are oil of vitriol or sulphuric acid, aqua-fortis or nitric acid, and spirit of salt or hydrochloric (muriatic) acid. These when taken in a concen-

trated form produce well-marked symptoms of corrosion. When they are diluted, the symptoms are those of an irritant poison. Nitric acid stains the mouth and skin of a yellow color. The treatment consists in the administration of alkalies or their carbonates, chalk, whiting, or even uncolored plaster scraped off the walls or ceiling, with the view of neutralizing the acid.

3. *Oxalic acid* is a vegetable acid. When taken in the state of concentrated solution it acts as a corrosive, but when diluted as an irritant. But it also exerts a specific effect, killing the patient by cardiac syncope not unfrequently within a few minutes. When a person after taking a crystalline substance, tasting strongly acid, dies within 15 or 30 minutes, after the manifestation of great weakness, small pulse, and failure of the heart's power, poisoning by oxalic acid is almost certain. The treatment consists in promptly administering an emetic, followed by chalk, whiting, or any substance containing carbonate of calcium. The alkaline carbonates are valueless, for the alkaline oxalates are almost as poisonous as oxalic acid itself.

4. *The Alkalies.*—Potash, soda, and their carbonates and sulphides produce symptoms resembling those of the mineral acids, except that purging is a usual accompaniment.

5. *Carbolic acid* when taken in the form of a concentrated liquid acts as a corrosive, causing whitening and shrinking of all the animal membranes with which it comes in contact. The patient, however, becomes speedily comatose, the poison acting profoundly upon the great nervous centres. A curious phenomenon—black or dark green urine—is commonly observed after the administration of this poison. Saccharated lime-water, diluted and drunk freely, and a solution of sulphate of soda are perhaps the most useful remedies.

2. *Irritant Poisons.*

Irritant poisons are of two classes—metallic irritants, and vegetable and animal irritants, these latter being for convenience grouped together. Perhaps none of the irritants act purely as such, the irritant symptoms being usually accompanied by well-marked effects upon the nervous system. An irritant is a substance which causes inflammation of the part to which it is applied—usually the alimentary canal. Arsenic is by far the most important of the metallic irritants. Other irritants are the moderately diluted acids, many metallic salts, such as those of antimony, lead, copper, zinc, and chromium. Elaterium, gamboge, aloes, colocynth, and croton oil are good examples of vegetable irritants; and cantharides of animal irritants. Animal and vegetable food when decomposed, or infested with certain organisms known as bacteria, may produce violent irritant symptoms. The symptoms produced by irritant poisons are usually more slow in their development than where a corrosive has been administered. Usually, after an interval, greater or less according to the specific nature of the irritant swallowed, a burning pain is felt in the mouth, throat, and gullet, with a sense of constriction of the parts, and followed by burning pain in the region of the stomach. This is increased, and not alleviated, by pressure, a mark which serves to distinguish the attack from one of ordinary colic. Nausea, vomiting, and thirst ensue, speedily followed by distention of the whole abdomen, which is exceedingly tender to the touch. Ordinarily the vomiting is followed by profuse diarrhœa. Should the poison not be speedily eliminated in the vomited and fæcal matters, inflammatory fever sets in, followed by collapse; and death may ensue in a few hours.

There is danger of confounding irritant poisoning with some forms of natural disease, such as gastritis and gastric ulcer, colic, peritonitis, cholera, and rupture of the intestines.

1. *Arsenic* is a specific irritant poison. Almost all the compounds of this metal are poisonous. The term "arsenic" is, however, most commonly applied, not to the metal itself, but to its lower oxide, arsenious oxide, which is also known as *white arsenic*. By whatever channel arsenic is introduced into the system, it invariably affects specifically the stomach and intestines, causing congestion or inflammation. The common sources of arsenical poisoning are the taking of white arsenic, which causes acute poisoning, and the inhalation of dust from arsenical wall-papers and textile fabrics, whereby a chronic form of poisoning is induced.

The symptoms of acute arsenical poisoning do not come on, as in the case of corrosive poisoning, immediately after the poison is swallowed. There is usually an interval of half an hour or so before prominent symptoms supervene. Generally, after a feeling of faintness and depression, an intense burning pain is felt in the region of the stomach, with tenderness on pressure. Nausea and vomiting generally follow, increased by every act of swallowing. Unlike what occurs in ordinary vomiting, the pain and sickness are not relieved by the evacuation of the stomach. Vomiting is followed by purging, blood being frequently distinguishable in the evacuations. There is thirst, a feeble irregular pulse, and a perspiring clammy skin. The victim usually succumbs within eighteen to seventy-two hours; if he survives the latter period, good hopes may be entertained of his recovery. The treatment consists in the use of the stomach-pump, emetics, such as mustard and warm water, demulcents, and the free administration of magnesia emulsion and either freshly precipitated ferric hydrate or dialysed iron. Ferric hydrate, and the solution known as dialysed iron, have the property of rendering arsenious anhydride insoluble.

Chronic arsenical poisoning is usually accidental. The inhalation of arsenical vapors in factories, or of arsenical dust from green wall-papers and in the manufacture of artificial flowers, are common sources of this form of poisoning. Arsenic when thus slowly absorbed into the system produces congestion and inflammation of the mucous membranes, redness and irritation of the conjunctivæ, sore throat, a peculiar eruption of the skin, and diarrhœa. The treatment consists in removal from the poisoned atmosphere, and the administration of tonics.

Arsenic-eating, or the ability of some persons to take relatively large doses of arsenic habitually, is a well-established fact. The cause of this singular immunity from the ordinary results of arsenic is quite unknown.

2. *Lead.*—The salts of lead, more especially the acetate (sugar of lead), are irritant poisons of no very great activity; and, though occasionally death ensues, recovery is the rule. Chrome yellow, or lead chromate, is a powerful irritant poison. All chromates are, indeed, irritant poisons.

Chronic lead poisoning is a much more common affection than acute irritant poisoning by lead. When lead in any form is slowly absorbed into the system, a peculiar affection results, known as saturnine poisoning, and characterized by two prominent symptoms—colic and paralysis. Workers in lead and its compounds, such as plumbers and painters, are frequently affected by this form of disease. Water, especially soft water or such as is contaminated with sewage, on being passed through leaden pipes or stored in leaden cisterns may become contaminated with lead to a dangerous extent. Acid liquids, such as cider, vinegar, etc., may also contain lead as an impurity. Potmen, who drink beer which has rested for some time in pewter vessels, are also the occasional victims of saturnine poisoning. Water which contains lead in a soluble form to the extent of more than one-tenth of a grain per gallon should not be used for drinking purposes. If more than this quantity be present, the water when placed in a white porcelain dish will become more or less dark in color on the addition of a few drops of a solution of sulphuretted hydrogen.

The commonest manifestation of chronic lead poisoning is lead colic,—a peculiar twisting and agonizing sensation around the navel, attended with obstinate constipation. This, like all forms of chronic lead poisoning, is almost invariably attended with a peculiar blue line on the margin of the gums, and when this is present the nature of the affection can scarcely be doubtful. The treatment consists in the free use of purgatives, opiates, and the internal use of potassium iodide, which favors the elimination of the metal through the urine. "Wrist-drop" or lead paralysis is also a common result of the ingestion of lead. It consists in a paralysis of the extensor muscles of the forearm, accompanied by a wasting of that structure. A dropping of the wrist is the result of this degeneration. Baths, the use of galvanism, and the administration of potassium iodide and tonics usually afford relief. Should, however, the patient in any form of lead poisoning be exposed for a lengthened period to the effects of the metal, degenerations of the liver, kidneys, and brain supervene, with fatal results.

In all cases of lead poisoning removal of the exciting cause is indispensable; the worker in lead must suspend his occupation for a time; the use of contaminated articles of food or drink must cease.

3. *Copper.*—The soluble salts of copper, such as blue vitriol (the sulphate) and verdigris (subcarbonate and sub-

acetate), are emetic and irritant salts. Their emetic effects usually, but not invariably, secure their prompt rejection by the stomach. Occasionally fatal effects have resulted from their administration. Copper becomes accidentally mixed with articles of dietary in a variety of modes. It is also used for improving the color of preserved fruits and vegetables. Its deleterious properties when thus used in minute quantities have been both asserted and denied. There is, however, a large body of evidence in favor of the at all events occasional poisonous effects of minute quantities of copper.

4. *Zinc salts* and *barium salts*, except the quite insoluble barium sulphate, are irritant poisons; and barium compounds act also upon the central nervous system.

5. *Chromates*, *e.g.*, bichromate of potash, are violent irritants. Chrome yellow, or lead chromate, has already been mentioned.

6. *Phosphorus.*—Of the two chief forms of the elements—the yellow or ordinary and the red or amorphous—the former only is poisonous. Rarely there is met with a chronic form of poisoning among workers in the material, arising from the inhalation of phosphorus vapors. Its special characteristic is a peculiar necrosis or death of the bony structure of the lower jaw. Acute phosphorus poisoning is more common. Phosphorus is used for tipping matches, and is also the basis of several vermin destroyers. When swallowed, phosphorus produces a variable amount of irritation and disturbance of the alimentary canal. There may be a burning sensation felt in the mouth, throat, and stomach, followed by vomiting. The vomited matters, and also the excreta, may be observed to be luminous in the dark. These symptoms usually subside, and for three or four days the person appears to have recovered his or her usual health. The liver then enlarges, and this and other structures undergo fatty degeneration; jaundice supervenes; and the patient dies in a few days in a semi-typhoid condition. Rarely there is recovery. Oil of turpentine is thought to be the best remedy. Most of the organs undergo fatty degeneration.

7. *Vegetable Irritants.*—These produce drastic purgative effects. Frequently the nature of the illness may be ascertained by the discovery of portions of the vegetable substance—recognizable by the microscope—in the matters ejected by the patient.

8. *Cantharides.*—The administration of CANTHARIDES (*q.v.*) is followed by vomiting, purging, strangury, or even entire inability to pass the urine. In the ejecta portions of the shining elytra or wing-cases of the fly may often be recognized. There is often great excitement of the sexual proclivities. The active principle of the fly, cantharidin, may be extracted from suspected matters by means of chloroform, and the residue left after the evaporation of this blisters the lip or any tender mucous surface to which it is applied. Demulcent remedies, with opiate enemata and injections, afford the best relief by way of treatment.

3. *Neurotics.*

It is premature, for the present, to attempt a systematic division of this most important class, which embraces poisons so widely different in their actions as opium and strychnine. We at once proceed to details.

1. *Prussic or Hydrocyanic Acid.*—Hydrocyanic acid is one of the best-known poisons, and a very deadly one. In the pure state it is said to kill with lightning-like rapidity. It is met with in commerce only in a dilute state. In Great Britain two kinds of acid are commonly sold—the pharmacopœial acid, containing 2 per cent. of anhydrous prussic acid, and Scheele's acid, containing 4 or 5 per cent. Less than a teaspoonful of the 2 per cent. acid has caused death. Given in fatal doses, the symptoms of prussic-acid poisoning set in with great rapidity; and, in consequence of the readiness with which the poison is absorbed from the stomach and diffused through the circulation, the onset of symptoms is reckoned by seconds rather than by minutes. Occasionally the victim may be able to perform a few voluntary actions before alarming symptoms are developed. There is first a very brief stage of difficult breathing, and slow action of the heart, with a tendency for the organ to stop in the state of dilatation. With widely-dilated pupils of the eye, the patient is then seized with violent irregular convulsive movements. The rhythm of the respiratory movements is disturbed, and the countenance becomes of a bluish cast. The patient now sinks to the ground with complete loss of muscular power; and the third or asphyxial stage is reached, in which there are slow gasping respirations, loss of pulse, and paralysis of motion. Death is frequently preceded by muscular spasms. The *foudroyant* character of the illness, and the speedy death of the patient, coupled with the peculiar odor of the acid in the breath and atmosphere around the body, seldom leave any doubt as to the nature of the case. The treatment consists in inhalation of the fumes of strong ammonia, drinks of warm and cold water alternately, friction of the limbs, and artificial respiration. The subcutaneous injection of atropine, which acts as a cardiac stimulant, may prove serviceable.

Other soluble cyanides, more especially cyanide of potassium, a salt largely used in photography and in the arts, are equally poisonous with hydrocyanic acid. See PRUSSIC ACID.

2. *Opium.*—In consequence of the extent to which OPIUM (*q.v.*), its preparations, and its active alkaloid morphia are used for the relief of pain, poisoning by opium is of frequent occurrence. It is largely used by suicides; and children, being very susceptible to its influence, frequently die from misadventure after administration of an overdose of the drug. The ordinary preparations of opium are the drug itself, which is the inspissated juice of the Oriental poppy, and the tincture, commonly known as laudanum. Opium contains a variety of more or less active principles, the chief of which is the alkaloid morphia, which is present in good opium to the extent of about 10 per cent. in combination with meconic acid, which is physiologically inactive. Opium is largely used by Eastern nations for smoking, and there is great discrepancy of opinion as to the extent to which opium smoking is deleterious. The preponderance of opinion is in favor of the view that opium smoking is a demoralizing, degrading, and pernicious habit, and that its victims are sufferers both in body and mind from its use.

The first symptom of the administration of a poisonous dose of opium is a state of exaltation—which may not, however, be well-marked—soon passing into a second stage, in which the symptoms are those of congestion of the brain. The countenance is suffused and of a bluish cast, known as cyanosis, due to imperfect aeration of the blood; the pupils of the eyes are minutely contracted, the skin dry and warm, and the breathing slow, labored, and becoming stertorous. The patient is apparently unconscious, but may be roused by shaking, or by shouting into the ear. When this has taken place, the breathing becomes more natural, and the skin less cyanosed. If he be left alone there is a speedy relapse into a state of insensibility. If effective treatment be not adopted, a third stage of prostration supervenes, in which there is profound coma, and it may be impossible to arouse the patient. The pupils of the eyes are now contracted to the size of pin-points. Breathing is slow, shallow, and intermittent. The countenance is at once pallid and cyanosed, the skin bathed in perspiration. The pulse becomes more rapid with increased feebleness, and at length all signs of it are lost, until death supervenes.

The treatment consists in the use of the stomach-pump. Emetics are usually inoperative. After this the patient must be kept awake by walking him about, applying cold and warm douches alternately to the chest, shouting into the ears, flicking the hands and feet with damp towels, and the application of the galvanic current. Circulation should be promoted by friction of the limbs and trunk. Strong infusion of coffee, ammonia, and alcoholic stimulants may be freely administered. As a last resort when the breathing intermits, artificial respiration may be performed. The hypodermic injection of full doses of atropine has proved of marked benefit,—atropine and morphia being to a certain extent counter-poisons.

Opium is a drug to which its victims may become habituated by the use of gradually increasing doses; and the practice of opium-eating, as it is termed, is a pernicious one. An atrophied condition of the body usually results. The only remedy is abstinence from the drug.

3. *Strychnine and Strychnine-yielding Plants.*—The alkaloids strychnine and brucine, as well as all the plants in which they are found, all act in the same manner, being highly poisonous, and causing death after spasms of a severe character. Strychnine was first extracted from the seeds of *Strychnos Nux-Vomica* in 1819, by Pelletier and Caventou. It exists in larger quantity in other species of the genus *Strychnos*, and notably in *Strychnos Ignatii*. From the bark of *Strychnos Nux-Vomica*, known as false Angostura bark, another alkaloid, *brucine* is also extracted. This bark was at one time wrongly supposed to be the bark of *Brucea antidysenterica*; hence the name *brucia* or brucine. Its effects are similar to those of strychnine, but its physiological activity is not so great. Many vermin-killers contain strychnine as their active ingredient.

Strychnine, and all substances containing that alkaloid, produce their effects within a very few minutes—usually within ten or fifteen minutes. The patient complains of stiffness about the neck, and his aspect exhibits terror. There is an impression of impending calamity or death. Very speedily the head is jerked back, the limbs extended, the back arched (opisthotonos), so that the body may rest on the head and heels only. The mouth is drawn; and the condition is one known as tetanus. In a few moments these symptoms pass off, and there is complete relaxation of the spasm. The spasmodic condition speedily returns, and is brought about by the slightest touch or movement of the patient. Accessions and remissions of the tetanic state ensue rapidly till the patient succumbs, usually within half an hour of the administration of the poison. The best treatment is to put, and keep, the patient under the influence of chloroform till time is given for the excretion of the alkaloid, having previously given a full dose of chloral hydrate.

4. *Aconite Poisoning.*—The ordinary blue rocket, wolfsbane or monkshood, *Aconitum Napellus*, and an alkaloid extracted from it, aconitine, are perhaps the most deadly of known poisons. One-sixteenth of a grain of aconitine has proved fatal to a man. All the preparations of aconite produce a peculiar burning, tingling, and numbness of the parts to which they are applied. When given in large doses they produce violent vomiting, as a rule, more or less paralysis of motion and sensation, and great depression of the heart, usually ending in death from syncope. Intelligence remains unaffected till almost the last. The treatment consists in the hypodermic injection of tincture of foxglove (*Digitalis*) or its active principle digitalin, which is a counter poison in its action upon the heart. The root of aconite has been eaten in mistake for that of horse-radish.

5. *Belladonna.*—The belladonna or deadly nightshade, *Atropa Belladonna*, contains an alkaloid, atropine, which is largely used by oculists to procure dilatation of the pupils of the eye. The bright scarlet berries of the plant have been eaten by children, who are attracted by their tempting appearance. Belladonna produces dilatation of the pupils, rapid pulse, hot dry flushed skin, with an eruption not unlike that of scarlatina, soreness of the throat, with difficulty of swallowing, intense thirst, and gay mirthful delirium. The treatment consists in evacuation of the poison by means of the stomach-pump, and the hypodermic injection of morphia as a counter-poison.

4. *Gaseous Poisons.*

The effects of these are varied,—some of them acting as irritants, while others have a specific effect, apparently in consequence of their forming chemical compounds with the red pigment of the blood, and thus destroying its capability of acting as a carrier of oxygen.

1. *Chlorine* and *bromine* act as powerful irritants. They provoke spasms of the glottis when inhaled, and subsequently induce inflammation of the respiratory mucous membrane, which may prove speedily fatal. Inhalation of diluted ammonia vapor is the best remedy.

2. *Hydrochloric* or *muriatic acid gas* and *hydrofluoric* or *fluoric acid gas* are irritating and destructive to life. The former is more destructive to vegetable life than even chlorine. They are emitted in many processes of manufacture, and especially in the manufacture of carbonate of soda from common salt by Le Blanc's process, in the salt-glazing of earthenware and in the manufacture of artificial manures.

3. *Sulphurous Acid Gas.*—The gas given off by burning sulphur is most suffocating and irritating. Its inhalation, even in a highly diluted state, may cause speedy death from spasmodic closure of the glottis.

4. *Nitrous vapors*, or gaseous oxides of nitrogen (except nitrous oxide), are given off from galvanic batteries excited by nitric acid; also in the process of etching on copper. They produce, when diluted, little immediate irritation, but are exceedingly dangerous, setting up extensive and fatal inflammation of the lungs.

5. *Ammonia gas* is highly irritant, but does not often prove fatal.

6. *Carbonic acid gas* is heavier than atmospheric air, is totally irrespirable when pure, and is fatal when present in large quantities in respired air. It is given off from burning fuel, accumulates in pits and wells as choke-damp, and constitutes the deadly after-damp of coal-mines. It is also formed during alcoholic fermentation, and hence accumulates in partially filled vats in which fermented liquors are stored. When it is breathed in a concentrated state, death is almost instantaneous. Persons descending into wells foul with this gas sink down powerless, and are usually dead before they can be removed from the vitiated atmosphere. In these cases there is true asphyxia; but carbonic acid is also a narcotic gas. Persons exposed to an atmosphere partially composed of this gas, but not long enough to produce fatal results, are affected with stertorous breathings, oppression, flushed face, prominent eyes, swollen tongue, and feeble pulse. The proper treatment is removal from the foul atmosphere, alternate cold and tepid douches to the chest, friction of the limbs and trunk, and artificial respiration. When animation is restored the patient should be put to bed and kept quiet, but should be carefully watched in case of relapse.

7. *Carbonic oxide gas* is given off by burning charcoal and other forms of fuel, mixed with carbonic acid. The poisonous effects of charcoal fumes are perhaps due rather to the more poisonous carbonic oxide than to the less poisonous carbonic acid. An atmosphere containing less than 1 per cent. of carbonic oxide would doubtless be fatal if breathed for many minutes. Carbonic oxide forms with hæmoglobin, the red pigment of the blood, a bright scarlet compound. The compound is very stable, and the oxide cannot be displaced by atmospheric oxygen. Hence the blood after death from the inhalation of carbonic oxide is of a bright arterial hue, which it retains on exposure to air.

8. *Coal-gas* acts as an asphyxiant and narcotic. The appearances met with after death—more especially the fluid state of the blood—are similar to those observed after death from carbonic oxide gas, which is a constituent of coal-gas, and to which the chief effect of coal-gas may be due.

9. *Sulphuretted hydrogen gas* is highly poisonous by whatever channel it gains access to the body. In a concentrated form it produces almost instant death from asphyxia. Even in a diluted state it produces colic, nausea, vomiting and drowsiness. This may pass into insensibility with lividity and feeble respiration. The skin is cold and clammy, or bathed in perspiration. The red blood corpuscles are disintegrated. The treatment consists in removal from the contaminated atmosphere, friction to the surface of the body, warmth, and the administration of stimulants. The inhalation of chlorine gas has been recommended on chemical grounds; but it must be remembered that chlorine is itself poisonous.

10. *Anæsthetics.*—Nitrous oxide, or laughing gas, and the gases or vapors of other anæsthetic substances, such as chloroform, produce death by asphyxia, and perhaps otherwise. Obviously, as a rule, medical assistance is at hand. The treatment consists in artificial respiration, and the use of galvanic current.

11. *Vapors of Hydrocarbons.*—The volatile vapors of the natural hydrocarbons known as benzoline, petroleum, etc., are poisonous when inhaled for lengthened periods.

(T. S. *)

POISSON, SIMÉON DENIS (1781–1840), a celebrated French mathematician, was born at Pithiviers in the department of Loiret, on the 21st June, 1781. His father, Siméon Poisson, served as a common soldier in the Hanoverian wars; but, disgusted by the ill treatment he received from his patrician officers, he deserted. About the time of the birth of his son Siméon Denis he occupied a small administrative post at Pithiviers, and seems to have been at the head of the local government of the place during the revolutionary period. The infant Poisson was put out to nurse, and concerning his nursing Arago relates the following story, which he had from its hero himself. One day the anxious father went to visit his son, but found that the nurse had gone to the fields. Impatient, he broke into the cottage, and there saw, with painful astonishment, the object of all his hopes suspended by a small cord to a nail fixed in the wall. This was a precaution on the part of the peasant nurse to prevent her charge from perishing under the teeth of the carnivorous and unclean animals that circulated in the house. Poisson, in telling the story, added—"A gymnastic effort carried me incessantly from one side of the vertical to the other; and it was thus, in my tenderest infancy, that I made my prelude to those studies on the pendulum that were to occupy so much of my maturer age."

Having survived the perils of infancy, and received the elements of his education (reading and writing) from his father, the question arose what calling he was to follow. It was at first suggested that he should be made a notary; but the family council, with amusing irony, decided that this profession made too great demands upon the intellect, and surgery was preferred. He was sent to an uncle who exercised this art at Fontainebleau, and forthwith began to take lessons in bleeding and blistering, then the leading branches of a surgeon's practice. To train him in the former, he was set to prick the veins of cabbage leaves with a lancet but made little progress; how he sped in the latter he himself relates as follows: "Once my uncle sent me, with one of my comrades, M. Vanneau, now established in the colonies, to put a blister on the arm of a child; the next day, when I presented myself to remove the apparatus, I found the child dead; this event, very common they say, made the most profound impression upon me; and I declared at once that I would never be either physician or surgeon. Nothing could shake my resolution, and they sent me back to Pithiviers." Here accident and the bent of nature solved the problem that had passed the wisdom of the family council. The elder Poisson, being a Government official, received a copy of the *Journal de l'École Polytechnique*; the son read it, and soon began unaided to solve the problems propounded there from time to time; and thus his mathematical talent was discovered. He was sent to the École Centrale of Fontainebleau, and was fortunate in having a kind and sympathetic teacher, M. Billy, who, when he speedily found that his pupil was becoming his master, devoted himself to the study of higher mathematics in order to follow and appreciate him, and predicted his future fame by the punning quotation from Lafontaine[1]—

> "Petit Poisson deviendra grand
> Pourvu que Dieu lui prête vie."

At the age of seventeen the young provincial, less remarkable for the elegance of his attire than for the profundity of his scientific knowledge, came up to Paris to undergo the entrance examination for the Polytechnic School. He passed first in his year, and immediately began to attract the notice of the professors of the school, who, seeing his obvious genius, excused him from the ordinary drudgery of the curriculum, and left him free to follow the studies of his predilection. The wisdom of this course was soon proved; for, in 1800, less than two years after his entry, he published two memoirs, one on Bezout's method of elimination, the other on the number of integrals of an equation of finite differences. The latter of these memoirs was examined by Lacroix and Legendre, who recommended that it should be published in the *Recueil des Savants Étrangers*, an unparalleled honor for a youth of eighteen. This success at once procured for Poisson an entry into the Parisian scientific society of the day, the like of which for brilliancy has never elsewhere been seen. Its two kings both patronized him. Lagrange, whose lectures on the theory of functions he attended at the Polytechnic School, early recognized his talent, and became his friend; while Laplace, in whose footsteps Poisson followed, regarded him almost as his son. The rest of his career, till his death on the 25th of April, 1840, was almost entirely occupied in the composition and publication of his many works, and in discharging the duties of the numerous educational offices to which he was successively appointed. Immediately after finishing his course at the Polytechnic School he was appointed repetiteur there, an office which he had discharged as an amateur while still a pupil in the school; for it had been the custom of his comrades often to resort to his room after an unusually difficult lecture to hear him repeat and explain it. He was made professeur suppléant in 1802, and full professor in succession to Fourier in 1806. In 1808 he became astronomer to the Bureau des Longitudes; and when the Faculté des Sciences was instituted in 1809, he was appointed Professeur de la Mécanique Rationelle. He further became member of the Institute in 1812, examiner at the military school at St. Cyr in 1815, leaving examiner at the Polytechnic in 1816, councillor of the university in 1820, and geometer to the Board of Longitude in succession to Laplace in 1827.

In 1817 he married Mademoiselle Nancy de Bardi, daughter of a French family which had emigrated to England, and by her he had two sons and two daughters.

Poisson was a simple-minded affectionate man. This is seen in the close relations which he kept up with his old teacher M. Billy, who ardently loved and admired his former pupil, and whose presence at the Institute was a well-known sign that Poisson was to read a paper there. Although he never returned to Pithiviers after his entry into the Polytechnic School, he corresponded constantly with his parents, more especially with his mother; and he regularly sent copies of his memoirs to his father, who read and re-read with unwearied patience the parts of them within his comprehension. His tastes seem to have been of the simplest description; he took little exercise and he had more than a Frenchman's horror of travelling. Arago says that he only travelled once, and that by medical prescription, disguised under the form of some mission connected with the Polytechnic School, and that, after devoting his savings to the purchase of a beautiful farm in the department of Seine-et-Marne, he never so much as visited it.

It is probable that his simplicity of character had much to do with his passing apparently quite undisturbed through the stormy time in which he lived, a period in which many men of mark lost their heads, and few such escaped without loss of office and fortune. His father, whose early experiences led him to hate aristocrats, bred him in the stern creed of the first republic. Throughout the empire Poisson faithfully adhered to the family principles, and refused to worship Napoleon. Napoleon, however, never interfered with Poisson's promotion. He said once himself that he never did anything uselessly, certainly never committed a useless crime; and he was wise enough to see that nothing was to be gained by persecuting the harmless academician, whose fame he doubtless regarded like that of the other savants of France as an apanage of his own glory. When the Bourbons were restored, his hatred against Napoleon led him to become a Legitimist—a conclusion which says more for the simplicity of his character than for the strength or logic of his political creed.

He was faithful to the Bourbons during the Hundred Days, in fact was with difficulty dissuaded from volunteering to fight in their cause. After the second restoration his fidelity was recognized by his elevation to the dignity of baron in 1825; but he never either took out his diploma or used the title. The revolution of July, 1830, threatened him with the loss of all his honors; but this disgrace to the government of Louis Philippe was adroitly averted by Arago, who, while his "revocation" was being plotted by the council of ministers, procured him an invitation to dine at the Palais Royale, where he was openly and effusively received by the citizen king, who "remembered" him. After this, of course, his degradation was impossible; he was left in undisturbed possession of all his well-earned appointments; and seven years later he was made a peer of France, not for political reasons, but as a representative of French science.

As a teacher of mathematics Poisson is said to have been more than ordinarily successful, as might have been expected from his early promise as a repetiteur at the Polytechnic School. As a scientific worker his activity has rarely if ever been equalled. Notwithstanding his many official duties, he found time to publish more than three hundred works, several of them extensive treatises, and many of them memoirs dealing with the most abstruse branches of pure and applied mathematics. There are two remarks of his, or perhaps two versions of the same remark, that explain how he accomplished so much: one, "La vie n'est bonne qu' à deux choses—à faire des mathématiques et à les professer;" the other, "La vie c'est le travail."

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[1] This prediction is sometimes attributed to Laplace.

A list of Poisson's works, drawn up by himself, is given at the end of Arago's biography. A lengthened analysis of them would be out of place here, and all that is possible is a brief mention of the more important. There are few branches of mathematics to which he did not contribute something, but it was in the application of mathematics to physical subjects that his greatest services to science were performed. Perhaps the most original, and certainly the most permanent in their influence, were his memoirs on the theory of electricity and magnetism, which virtually created a new branch of mathematical physics. They have been already repeatedly referred to in the articles ELECTRICITY and MAGNETISM (*q.v.*). Next (perhaps in the opinion of some first) in importance stand the memoirs on celestial mechanics, in which he proved himself a worthy successor to Laplace. The most important of these are his memoirs "Sur les inégalités séculaires des moyens mouvements des planètes," "Sur la variation des constantes arbitraires dans les questions de mécanique," both published in the *Journal* of the Polytechnic School, 1809; "Sur la libration de la lune," in *Connaiss. d. Temps*, 1821, etc.; and "Sur la mouvement de la terre autour de son centre de gravité," in *Mém. d. l'Acad.*, 1827, etc. In the first of these memoirs Poisson discusses the famous question of the stability of the planetary orbits, which had already been settled by Lagrange to the first degree of approximation for the disturbing forces. Poisson showed that the result could be extended to a second approximation, and thus made an important advance in the planetary theory. The memoir is remarkable inasmuch as it roused Lagrange, after an interval of inactivity, to compose in his old age one of the greatest of his memoirs, viz., that "Sur la théorie des variations des éléments des planètes, et en particulier des variations des grands axes de leurs orbites." So highly did he think of Poisson's memoir that he made a copy of it with his own hand, which was found among his papers after his death. Poisson made important contributions to the theory of attraction. His well-known correction of Laplace's partial differential equation for the potential was first published in the *Bulletin de la Société Philomatique*, 1813. His two most important memoirs on the subject are "Sur l'attraction des sphéroides" (*Connaiss. d. Temps*, 1829), and "Sur l'attraction d'un ellipsoide homogène (*Mém. d. l'Acad.*, 1835). In concluding our selection from his physical memoirs we may mention his memoir on the theory of waves (*Mém. d. l'Acad.*, 1825).

In pure mathematics, his most important works were his series of memoirs on definite integrals, and his discussion of Fourier's series, which paved the way for the classical researches of Dirichlet and Riemann on the same subject; these are to be found in the *Journal* of the Polytechnic School from 1813 to 1823, and in the *Memoirs* of the Academy for 1823. In addition we may also mention his essay on the calculus of variations (*Mém. d. l'Acad.*, 1833), and his memoirs on the probability of the mean results of observations (*Connaiss. d. Temps*, 1827, etc.).

Besides his many memoirs Poisson published a number of treatises, most of which were intended to form part of a great work on mathematical physics, which he did not live to complete. Among these may be mentioned his *Traité de Mécanique*, 2 vols. 8vo, 1811 and 1833, which was long a standard work; *Théorie Nouvelle de l'Action Capillaire*, 4to, 1831; *Théorie Mathématique de la Chaleur*, 4to, 1835; *Supplément* to the same, 4to, 1837; *Recherches sur la probabilité des jugements en matières criminelles*, etc., 4to, 1837, all published at Paris.

Enough has been said to establish Poisson's fertility as a writer on mathematical subjects, and the question naturally suggests itself, What is his rank among the mathematicians of all ages? Since his own age was more productive of great mathematicians than any other the world has yet seen, it is natural to compare him with his contemporaries, chief among whom were Lagrange and Laplace. In so doing, we see at once that, although we cannot seat him alongside of these mighty sovereigns, yet it is impossible to deny him the nearest rank to them in the temple of mathematical fame. In confirmation of this judgment, we cannot do better than quote one of them—"I am old," said Lagrange to Poisson one day; "during my long intervals of sleeplessness I divert myself by making numerical approximations. Keep this one; it may interest you. Huygens was thirteen years older than Newton, I am thirteen years older than Laplace; D'Alembert was thirty-two years older than Laplace, Laplace is thirty-two years older than you." Arago, who gives this story, justly remarks that no more delicate way could be conceived of intimating to Poisson his admission into the inner circle of the fraternity of mathematical genius. (G. CH.)

POITIERS, a town of France, formerly the capital of Poitou, and now the chief town of the department of Vienne, lies 206 miles southwest of Paris on the railway to Bordeaux, at the junction of the Boivre with the Clain (a tributary of the Loire by the Vienne), and occupies the slopes and summit of a plateau which rises 130 feet above the level of the streams by which it is surrounded on three sides. The town is picturesque; and its narrow, ill-paved, irregular, and deserted streets with their ill-built houses are interesting for certain remains of ancient architecture and the memories of great historical events. Blossac park, named after the intendant of the "generality" of Poitiers (1751–1786), and situated on the south side of the town, and the botanic garden on the northeast, are the two principal promenades. Besides being the see of a bishopric, which comprises the departments of Vienne and Deux-Sèvres, Poitiers possesses a court of appeal, national faculties of law, literature, and science, a free faculty of Catholic theology, a school of artillery, and numerous learned societies, of which the most celebrated is that of the "Antiquaires de l'Ouest" dating from 1834. Though not strictly a commercial or industrial town, it is the centre from which railways branch out to Tours, Angers, Niort, Angoulême, Limoges, and prospectively to Châteauroux and Nantes. Up till 1857 it contained the ruins of a Roman amphitheatre more extensive than that of Nîmes; remains of Roman baths, constructed in the 1st and demolished in the 3d century, were laid bare in 1877; and in 1879 a pagan burial place and the tombs of a number of Christian martyrs were discovered on the heights to the southeast—the names of some of the Christians being preserved in paintings and inscriptions. Not far from these tombs is a huge dolmen (the "Pierre Levée"), 22 feet long, 16 feet broad, and 6 or 7 feet high, around which used to be held the great fair of St. Luke.

The cathedral of St. Peter, begun in 1162 by Eleanor of Guienne on the ruins of a Roman basilica, and well advanced at the time of her death in 1204, is a building after the Plantagenet or Angevin style. Its length is 308 feet, its width 128, and the keystone of the central vaulted roof is 89 feet above the pavement. There is no apse, and the exterior generally has a heavy appearance. The principal front has unfinished side towers 105 and 110 feet in height, begun in the 13th century. Most of the windows of the choir and the transepts preserve their stained glass of the 12th and 13th centuries; the end window, which is certainly the first in the order of time, contains the figures of Henry II. of England and Eleanor. The choir stalls, carved between 1235 and 1257, are the oldest in France. The church of St. Jean (originally a baptistery) near the cathedral is the most ancient Christian monument in the country. The church of St. Hilaire was erected at the close of the 4th century over the tomb of the celebrated bishop. At first an unpretending oratory, it was rebuilt on a larger scale by Clovis, and afterwards became, in the 10th, 11th, and 12th centuries, a sumptuous collegiate church, of which the nave was flanked by triple aisles and surmounted by six cupolas. Great damage was done to it in the wars of religion and the French Revolution. The confessional or oratory under the choir contains the relics of St. Hilary and a Christian sarcophagus of the 4th century. The church of St. Radegonde, a great resort of pilgrims, commemorates the consort of Hlothar I. (*c.* 550), and preserves in its crypt, not only the tomb of Radegonde, who founded at Poitiers the abbey of the Holy Cross, but those of St. Agnes and St. Disciola. The church is in the Angevin style; the choir is of the 11th, and the nave of the 13th century. Notre Dame la Grande, which dates from the close of the 11th century, and represents a collegiate church one or two hundred years older, has a richly sculptured Romanesque façade. The first stone of the church of Moutierneuf (*Monasterium Novum*) was laid in 1077 by William, duke of Aquitaine and count of Poitiers, who is buried within its walls; and the choir (afterwards in the 13th century modified by the erection of a "lantern") was solemnly consecrated by Urban II. in 1096. Mutilated about 1640 and during the Revolution, the building was partly restored between 1850 and 1860. The tower of St. Porchaire, a precious remnant of 11th-century architecture, has been restored in the present generation under the auspices of the Antiquaires de l'Ouest and the French archæological society. Other churches of interest are the Chapel of the Lycée, that of the Sisters of the St. Croix, and the old church of the Jesuits.

Among the secular buildings the first place belongs to the law courts, formerly the palace of the dukes of Aquitaine and counts of Poitiers, and rebuilt between the 12th and the 15th century. The Salle de Pas Perdus forms a fine nave 160 feet long by 56 feet wide, with a vaulted wooden roof. The southern wall is the work of Duke Jean de Berri, brother of Charles V.; above its three vast fireplaces are mullioned windows filled with stained glass. The Maubergeon tower attached to the palace represented the feudal centre of all the lordships of the countship of Poitiers. The prévôté or provost's mansion, now occupied by a communal school, has a fine façade of the 15th century. In the new hôtel de ville, erected between 1869 and 1876, are museums of archæology, natural history and painting. The museum of the Antiquaires de l'Ouest occupies the chapel and the great hall of the old university, now located in the old hôtel de ville; it is a valuable collection comprising Roman antiquities, Merovingian sculptures, medals, a fine Renaissance fireplace, etc. The building devoted to the faculties of law, science and literature (of which the first dates from 1431) also contains the library (35,000 printed volumes and 300 MSS.). The municipal records are very rich in charters of Eleanor of Aquitaine, Philip Augustus, Alphonse of Poitiers, etc. Convents and religious educational establishments are numerous in the town. The population of Poitiers in 1881 was 34,355.

Poitiers, called Limonum at the time of the Roman conquest, then took the name of its Gallic founders the Pictones or Pictavi. Christianity was introduced in the 3d century, and the first bishop of Poitiers, from 350 to 367, was St. Hilarius (*q.v.*). Fifty years later the city had fallen into the hands of the Arian Visigoths, and become one of the principal residences of their kings. Alaric, one of their number, was defeated by Clovis at Vouillé not far from Poitiers in 507. This was the first occasion on which the peoples of northern and southern Gaul met in conflict in the neighborhood of the town which was destined to see them so frequently join battle. By his victory in 732 over the Mohammedans at Moussais-la-Bataille in this region, Charles Martel proved the saviour of Christendom. Under the Carlovingians, Poitiers was dependent on the crown and afterwards on the duchy of Aquitaine. Eleanor of Guienne, after her divorce from Louis VII., carried it to her new husband Henry Plantagenet. She frequently resided in the city, which she embellished and fortified, and in 1199 entrusted with communal rights. Philip Augustus, having confiscated the Continental territories of John of England, united Poitou to the French crown; Louis VIII. made it an apanage for his son Alphonse of Poitiers, who afterwards became count of Toulouse. At a plenary court held in 1241 in the great hall of the palais de justice, Alphonse received the homage of his numerous vassals. After his death in 1271 Poitou reverted to the crown. But, King John having been defeated and made prisoner in the disastrous battle of Poitiers (fought 4 miles E. of the town on the hillside of Nouaille, 19th September, 1356), Poitou was recognized as an English possession by the treaty of Brétigny (1360). Nine years later it was recovered by Duguesclin; and it became in succession the apanage of Jean de Berri, brother of king Charles VI., and of the dauphin, afterward Charles VII. It was at Poitiers that the latter was proclaimed king (1423); and he removed thither the parlement and university of Paris, which remained in exile till the English withdrew from the capital in 1436. During this interval (1429) Joan of Arc was subjected to a formal inquest by the doctors of the university. Calvin had numerous converts at Poitiers. Of the violent proceedings which attended the wars of religion the city had its share. In 1569 it was defended by Count du Lude against Coligny, who after an unsuccessful bombardment retired from the siege at the end of seven weeks.

POITOU, one of the old provinces of France, which also formed one of the great military governments of the kingdom, was bounded N. by Brittany, Anjou and Touraine; S. by Angoumois and Aunis; E. by Touraine, Berri and Marche; and W. by the ocean. It was divided into Lower Poitou, which corresponded to the modern department of La Vendée and Upper Poitou, now split into the departments of Deux-Sèvres and Vienne. The principal towns in Upper Poitou were Poitiers the capital, Mirebeau, Châtellerault, Richelieu, Loudun, Thouars, Mauléon, Parthenay, Niort, etc.; and in Lower Poitou Fontenai-le-Comté, Maillezais, Luçon and Roche-sur-Yon. Île d'Yeu or Île-Dieu and Noirmoutier belonged to the province. Ecclesiastically Poitou was distributed among the dioceses of Poitiers, Luçon and La Rochelle; for the administration of justice, it was attached to the parlement of Paris.

Poitou (Poictou, Pictavia) takes its name from the Pictones or Pictavi, a Gallic nation mentioned by Cæsar, Strabo and Ptolemy, and described by Strabo as separated from the Namnetes on the north by the Loire. It formed part of the territory known as Aquitania (*q.v.*). For the history see Poitiers.

POKER, a game at cards—probably a development of *il frusso* (played in Italy in the 15th century). A similar but less simple game, called *primiera*, was also played in Italy in the 16th century, whence under the name of *primero* it travelled to Spain. *La prime* is mentioned by Rabelais (16th century); and later the game of prime elaborated was played in France under the name of *l'ambigu* or *le meslé*. Prime was also played in England in the 16th century; and later a bastard kind of prime, called post and pair, was much played in the west of England. Gleek had some points of resemblance to these games. The more modern game of brag is only post and pair with variations. Poker (originally played in America) may be described as developed brag, though in some respects it "throws back" to the parent games post and pair, l'ambigu and primero.

Any number of persons may play. If a pack of fifty-two cards is played with, from five to seven players makes the best game. Sometimes an écarté pack of thirty-two cards is used, when three or four makes the best game. There are numerous varieties of poker. *Draw poker*, with fifty-two cards, is the most common.

The dealer being determined (see Laws), he puts up a sum, previously agreed on (called the *ante*), generally one *chip* or counter, and deals five cards to each player. Then each in rotation from the dealer's left looks at his cards, and either throws up his hand (called *going out of the game*), when he stakes nothing, or *chips*, *i. e.*, puts up twice the amount of the ante (say two counters). The dealer finally looks at his hand and either goes out of the game or *makes good* his ante by putting up another counter.

The dealer then asks those in rotation who have chipped whether they will *fill their hands* (*i.e.*, whether they will exchange any cards for an equivalent number from the top of the pack) or play the hand dealt.

When the hands are filled, the players to the left of the dealer have the *say* in rotation. Each player says whether he will (1) *go out of the game* (forfeiting what he has already staked; or (2) *raise*, *i.e.*, put up a sum in addition to that already staked. As soon as any one raises, the next in rotation to say must either

(1) *go out of the game;* or (2) *see the raise*, *i.e.*, put up an equal amount; or (3) *go better*, *i.e.*, increase the raise. This continues round and round, each succeeding player being obliged either to see the stake made by the previous one, or to go better, or go out of the game.

Eventually the raising comes to an end, because either every player but one goes out of the game (when all the stakes are taken by the player who remains in, without showing his cards), or the players left in all see the last raise, no one going better. When all the stakes are thus equal, it becomes a *call*. The last to stake, who makes his raise equal to that of each of the others, *sees* them, *i.e.*, the player to his left has to show his hand, or rather such part of it as he claims to compete with. The next to the left, then similarly shows his hand, if it can beat the one first shown; if not, he throws up; and so on all round; the holder of the best hand takes the pool, and the next dealer deals.

Hands thrown up, either on a refusal to chip to fill, or on being beaten, and cards discarded when filling, are placed face down in the middle of the table, and no one is allowed to look at them.

It is usual to limit the raise to prevent very high chipping. The modern usage is to play *table stakes*, *i.e.*, each player puts up such an amount as he pleases at the commencement of each deal, and he cannot be raised more than he has on the table; but he has the option of making good from his pocket a previous raise which exceeds his table stake.

Value of the Hands.—1. A straight flush (sequence of five cards of the same suit). 2. Fours (four cards of the same rank, with one other card). 3. A full (three cards of the same rank, with a pair). 4. A flush (five cards of the same suit, not in sequence). 5. A straight (sequence of five cards, not all of the same suit). 6. Triplets (three cards of the same rank, with two other cards not a pair). 7. Two pairs (with one other card not of the same rank with either pair). 8. One pair (with three other cards of different ranks). 9. Highest card.

An ace may either begin or end a straight, *e.g.*, ace, king, queen, knave, ten; or, five, four, three, two, ace. By agreement an ace may be made not to rank in sequence with the two. In no case can ace occupy an intermediate position in a straight, and when an écarté pack is used, ace is not in a straight with the seven. A higher straight flush, or straight, wins of a lower one; the cards rank as at whist, except that ace may be highest or lowest. In combinations other than straights ace is highest. High fours win of low ones; of two fulls the one that contains the highest triplet wins; of two flushes the one that contains the highest card wins, if equal the next highest, and so on; a straight beats triplets (this is sometimes disputed, but calculation shows a straight is the less frequent hand); of two triplets, the highest wins; of two-pair hands, the highest pair wins, if both pairs are equal, the highest card; of two hands each containing a pair, the highest pair wins, if equal the highest remaining card wins; of hands containing none of the above the highest card wins, if equal the next highest, and so on. In case of an absolute tie between the best hands they divide the pool.

Variations in the Mode of Playing.—Sometimes the ante may be raised by any one who chips to fill his hand, when succeeding players must make good the raise, or go better, or go out of the game. This is a mere excuse for higher play.

The player to the dealer's left (the *age*) is generally allowed to pass the first round after the hands are filled, and to come in again. If he passes he says "my age." Also, sometimes the age puts up the ante instead of the dealer. These useless complications, which only have the effect of making the first player the last player, are better omitted.

The age is sometimes allowed to *go blind*, *i.e.*, to raise the ante before he sees his cards. The next player may *double the blind*, *i.e.*, raise to double what the age staked; the next may *straddle the blind*, *i.e.*, double again; the next may *double the straddle*, and so on. Only the age can start a blind, and any one who refuses to double or straddle prevents a further raise; but he must make good the previous stake or go out. The player to the left of the last straddler has the first say *i.e.*, on looking at his hand and before filling, he declares whether he will make good or go out. Going blind, like raising the ante, is a mere pretext for higher play.

Some players do not consider straights in the game, and omit them. This makes four aces, or four kings and an ace, invincible; and it is open to the objection that if those cards are held the player is backing a certainty.

Hints to Players.—1. The dealer should generally go in, as half his stake is already up. 2. When drawing to fill a hand, it should be done off-hand and without hesitation. If in doubt, it is better to go out of the game at once. A player may lose by going in, but can never lose by going out. 3. In filling to a pair it is generally right to draw three cards, unless drawing to a low pair, with a king or ace in hand. 4. In filling to two pairs, to a four, or to a straight or flush which wants one card, exchange one. It is not advisable to chip to fill to a straight or flush wanting more than one card; a draw to a straight or flush is usually a dear purchase. With a four the hand cannot be improved by drawing; but one card should be taken that the value of the hand may be concealed. 5. In filling to triplets one card only should be drawn, or triplets are at once declared; but, 6. Players should vary their mode of discarding to mystify the opponents, and should be sometimes cautious, sometimes bold. 7. A good *poker face* is essential; the countenance should not betray the nature of the hand. Talking without regard to facts (*poker talk*) is allowed, and is considered fair; but the best players put their cards face downwards on the table and leave them there, and neither move nor speak until it is their turn to say. 8. *Bluffing* (*i.e.*, raising high on poor cards), in hopes of inducing the other players to go out of the game, may be resorted to occasionally with success; but, as a rule, the player who goes in best will come out best. When about to bluff draw only one card or no cards. 9. A straight or higher hand may be backed freely, but the other players are more likely to go on staking if the raise is by small sums at a time. The only general rule that can be given is to change the raising tactics pretty frequently.

Laws of Poker.—These vary considerably. The following are based on "the American Hoyle." *Determination of Deal.*—1. One card is given to each player. Lowest has the deal. Ace is lowest. Ties of lowest card have one card each given again. The deal goes in rotation to the left of the last dealer. *Shuffling, Cutting, and Dealing.*—2. Any one may shuffle, the dealer last. 3. The player to the dealer's right cuts at least four cards. The dealer reunites the packets. If before the deal a card is exposed, there must be a fresh cut. A blank card is usually placed under the pack to prevent exposure of the bottom card. 4. The dealer must deal from the top of the pack, one card to each player in rotation, beginning to his left. 5. If the dealer deals without having the pack cut, or shuffles after it is cut, or misses a hand, or gives too many or too few cards to any player (but see Law 6), or exposes a card in dealing, he forfeits an ante to the pool and deals again. The forfeit does not raise the other players, and the dealer must still make his first ante good when it comes to his turn, or go out of the game. (Some players merely require a fresh deal without any forfeit, and some require a player to take the card dealt him if only one card is exposed.) *Filling the Hands.*—6. If a player, after lifting any of his cards, is found to have too many or too few cards, he must go out of the game. (Some players give a hand with only four cards the option of going in.) 7. If, when drawing to fill, the dealer gives the player too many or too few cards, and the player lifts any of them, he must go out of the game. If the error is discovered before lifting, it can be rectified—in the case of too many cards by withdrawing the superfluous ones, in the case of too few cards by filling from the top of the pack. 8. If, when drawing to fill, a card is exposed, it must be placed at the bottom of the pack, and the top card given instead (sometimes the top card after all the other players are served). 9. Cards thrown out must be placed face downwards in the middle of the table before any are drawn; otherwise the player is liable to the penalty for holding too many cards (Law 6). 10. Any player before taking up his filled hand may ask how many cards the dealer drew. *Chipping.*—11. If all the players pass without chipping to fill, the dealer takes back his ante, and the deal passes. If, after filling, no one before the dealer raises, the dealer takes the pool. 12. If a player chips with more or less than five cards (but see note to Law 6), he must go out of the game. But, if all the other players have gone out of the game before the discovery is made, there is no penalty. 13. A player who passes or throws up cannot come in again. 14. Players are bound to put up distinctly the amount they chip, separate from their other chips. *Aftercomers.*—15. The place of an aftercomer is determined by dealing a card between every two players. The aftercomer sits where the lowest card was dealt. *Incorrect Packs.*—16. The deal in which an imperfection of the pack is discovered is void. All preceding deals stand good. (H. J.)

POKROVSKAYA SLOBODA, or POKROVSK, also KASAKSTADT, a village of the district of Novouzen, in the government of Samara, Russia, on the left bank of the Volga, almost opposite Saratoff. In the 18th century it was a small cluster of clay huts occupied by a number of runaway serfs who had gathered round the storehouses erected by the crown for salt brought from Lake Elton; but, a body of free settlers having been enticed to the spot in 1747 by large grants of grazing ground, the village rapidly increased, its inhabitants, who numbered 12,776 in 1859, now exceeding 20,000. They support themselves by cattle breeding and agriculture; and the Pokrovskaya landing place is one of the most important on the Volga—the exports, mostly of wheat, reaching 99,850 cwts. in 1880.

POLA, the principal naval harbor and arsenal of the Austrian-Hungarian monarchy, is picturesquely situated at the south extremity of the peninsula of Istria, 55 miles to the south of Trieste. Its safe and commodious harbor is almost completely landlocked, and there is also a good roadstead between its mouth and the Brionian Islands. The harbor is divided into two basins by a chain of three small islands, and the inner basin is subdivided into the naval and the commercial harbor by the Scoglio Olivi, a larger island connected with the mainland by an aqueduct. The hills enclosing the harbor are defended by forts and batteries. The town proper lies opposite the Scoglio Olivi, round the base of a hill formerly crowned by the Roman capitol and now by a castle of the 17th century. Besides the castle the chief mediæval and modern buildings are the cathedral (15th century), the Franciscan convent (13th century), the Government and municipal offices, the huge infantry barracks, and the theatre. To the southwest, along the coast, extends the marine arsenal, a vast and well-planned establishment employing about 2000 workmen and possessing all the requisites for the equipment of a large fleet. It contains an interesting naval museum, and is supplemented by the docks and wharves of the Scoglio Olivi. The artillery laboratory and the powder magazine are on the north bank of the harbor. Behind the arsenal lies the suburb of San Policarpo, almost exclusively occupied by the naval population and containing large naval barracks and hospitals. In the middle of it is a pleasant park, with a handsome monument to the Emperor Maximilian of Mexico, who had been a rear-admiral in the Austrian navy. To the north, between San Policarpo and the town proper, rises the Monte Zarro, surmounted by an observatory and a statue of Admiral Tegetthoff. Pola has no manufactures outside of its naval stores, but its shipping trade is now considerable, the exports consisting of fish, timber, and quartz sand used in making Venetian glass, and the imports of manufactured and colonial wares. The population has increased from 600 at the close of last century and 5000 in 1857 to 25,175 in 1880, including a garrison of 5000 men. To many people, however, the chief interest of Pola centres in its fine Roman remains. The most extensive of these is the amphitheatre, which is 400 feet long and 320 feet wide, and could accommodate 20,000 spectators. It is remarkable as the only Roman amphitheatre of which the outer walls have been preserved intact; the interior, however, is now completely bare—though the arrangements for the naumachiæ, or naval contests, can still be traced. The oldest Roman relic is the fine triumphal arch of the Sergii, erected soon after the battle of Actium; and of not much later date is the elegant and well-preserved temple of Augustus and Roma. Among the other antiquities are three of the old town-gates and a fragment of a temple of Diana.

The foundation of Pola is usually carried back to the mythic period, and ascribed to the Colchian pursuers of Jason and the Argonauts. In all probability it was a Thracian colony, but its verifiable history begins with its capture by the Romans in 178 B.C. It was destroyed by Augustus on account of its espousal of the cause of Pompey, but was rebuilt on the intercession of his daughter Julia, and received (according to Pliny) the name of Pietas Julia. It seems to have attained its greatest prosperity about the time of the emperor Septimius Severus (193–211 A.D.), when it was an important war harbor and contained 35,000 to 50,000 inhabitants. At a later period Pola became the capital of the margraves of Istria, and was more than once captured and plundered by the Venetians, who finally made themselves masters of the peninsula. In 1379 the Genoese, after defeating the Venetians in a great naval battle off the coast, took and destroyed Pola, which disappears from history for the next four hundred and fifty years. It remained under Venetian supremacy down to 1797, and has been permanently united with Austria since 1815. In 1848 a new era began for Pola in its being selected as the principal naval harbor of Austria, and since then its progress has been constant.

POLAND.

POLAND (the Polish *Polska*, German *Polen*, French *Pologne*) was till towards the end of the 18th century a large and powerful kingdom, extending with Lithuania, which was incorporated with it, over the basins of the Warta, Vistula, Dwina, Dnieper, and upper Dniester, and having under its dominion, besides the Poles proper and the Baltic Slavs, the Lithuanians, the White Russians, and the Little Russians or Ruthenians.

Plate I.

If Schafarik is correct in seeing the name of the Poles in the *Bulanes* of the geographer Ptolemy, we should have this Slavonic people mentioned as early as the 2d century after Christ.[1] There can be no doubt about the derivation of the name; the country is one vast plain, and thus the Poles come to mean dwellers of the plain or field (*polë*). Jordanes has no distinct name for them, although he speaks of Slavs inhabiting the banks of the Vistula. About the 6th or 7th century we find a people called Lekhs settled near that river and this appears to be the oldest

The Lekhs.

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[1] There is another reading, *Sulanes* or *Sulones*; but the former is preferred by the best editors.

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name which we can possibly assign to the Poles. These Lekhs are considered by Szajnocha and some of the modern school of historians to have been a Norse tribe who in the 6th century ruled over the Slavonic peoples from the Baltic to the Carpathians. And, if this were the case, the origin of the Polish kingdom would be traced to the same source as the Russian empire. No satisfactory etymology has been given as yet of the word Lekh or Lech; we cannot accept Schafarik's attempt to connect it with *szlachta*, nobility, as that word is in all probability derived from the German *geschlecht*. From the form of the word *Lech*, Russian *Liakh*, we can see that the vowel represents a suppressed nasal, and this is further proved by the change which it undergoes in the neighboring languages; thus in Lithuanian we get *Lenkas* and in Magyar *Lengyel*. The chronicle of Thomas, archdeacon of Spalato, calls them *Lingones* (Bielowski, *Mon. Hist. Pol.*), the Polish chronicles of Mierzwa and of Vincent Kadlubek *Lenchitæ*, *Linchitæ*. The loss of the nasal in the modern Polish form is curious, and contrary to the analogy of the language; it is supposed to have disappeared under the influence of Russian pronunciation. In the 13th century Kadlubek invented the imaginary *heros eponymus* Lekh, supposed to have been the father of the Poles, and two brothers were found for him, Czech and Rus.[1] A great similarity has been noticed between these early heroes and others among the Czechs. Thus we may compare Cracus and Krok, Piast and Přemysl. Many of the legendary tales greatly resemble Scandinavian sagas, as indeed much of the early Russian history does which is contained in the chronicle of Nestor. Gradually the name Lekh was superseded by Poliani or Polaki. Nestor, the old Russian chronicler, or at least the work which goes under his name, knows both appellations and distinguishes between *Poliane Liakhove* on the Vistula and *Poliane Rousove* on the Dnieper. When we first become acquainted with the Poles we find them like the other Slavonic peoples living in a kind of democratic communism, to which we need not assign the patriarchal simplicity and happiness in which some of their chroniclers, *e.g.*, Dlugosz, would make us believe. All the early period of Polish history is mixed up with fables. Their first writers Gallus, Kadlubek, Dlugosz, Kromer, and others, who were ecclesiastics and used the Latin language as their literary medium and handled it with considerable dexterity, have treated these stories as genuine history,—just as Holinshed. Milton, Sir Richard Baker, and others did the Arthurian legends. The careful criticism, however, of modern times has relegated them to their proper place, and Lelewel has classified all the period of Polish history from the earliest times to the reign of Mieczysław I. as belonging to the era of myths. We are hardly likely to believe in the existence of a Duke Lech or a beautiful Princess Wanda, who flourished in the 8th century, or in Cracus, said to have been the founder of Cracow. All these are obviously only generic and national names individualized. Many of the quaint and striking stories of these princes have done duty in all the legendary history of Europe. It cannot be doubted that poems corresponding to the Russian *bilini* are imbedded in the writings of these early chroniclers. The good peasant Piast, from whom was derived the celebrated line of kings, reminds us of the Mikoula Selianinovich of the Russians and the Přemysl of the Czechs. Kromer has tricked out the legend of his call to the throne in all the graces of his elegant Latinity.

Views of Bielowski.

Bielowski, the editor of the *Monumenta Poloniæ Historica*, in his *Wstęp Krytyczny do Dziejów Polski*[2] ("Critical Introduction to Polish History") endeavored to prove that the original Poles dwelt on the banks of the Danube, from which they were driven by the Romans. He also attempts to trace them in the 2d and 3d centuries after Christ. According to the whimsical theory of this author—a man to whom Slavonic history in other respects owes so much—the original habitation of the Poles was by the Lake of Ochrida. The Lęchites (Lyncestæ) in the 3d century before Christ were driven by the Celts beyond the Danube, and there the kingdom of Dacia was founded. King Boirebista is Leszek II., Decebalus is Semowit, etc. Lelewel and Bielowski seem to have identified all the Thracian peoples with the Slavs.

The early Slavs.

All that we are told of the early Slavs shows them to have been a quiet agricultural people. We find them at first living in village communities with a tribal government. Nestor says, "The Poliani lived in separate groups, and each governed his family." Gradually a class of serfs sprung up, whose origin cannot be clearly traced. Röpell in his history supposes that they were the descendants of rival tribes who had been conquered. At all events we soon find the following divisions of society among the Poles: (1) the nobility, *szlachta*, who throughout Polish history constitute the nation properly so-called; (2) a superior class of peasants who were personally free, but bound to perform certain services (these are always called in the old Polish documents *cmetones*, or *kmetones*, Polish *kmieci*; and (3) the peasants strictly so called, who were the property of their masters and had no rights. We shall see how there was gradually formed in Poland a proud military aristocracy, which circumscribed the power of the king by the *pacta conventa*, so that he became a mere puppet in their hands. The nobles had absolute power over their serfs, as each separate palatinate had its tribunals. In course of time the *kmieci* became mere bondsmen. The miserable condition of the latter is seen in such books as Connor's *Letters on Poland*, published at the conclusion of the 17th century. Connor, who was physician to John Sobieski, had good opportunities for forming an opinion. Thus the trade of the country fell wholly into the hands of foreigners and Jews.

Mieczysław.

With the reign of Mieczysław I. (962–992) we begin to have something firmer in our grasp. He became a suitor for the hand of Dąbrówka, the daughter of the king of Bohemia. Being a Christian she refused to give her hand to a pagan, and Mieczysław consented to be baptized in 965. He had been previously conquered by the Germans, who seem to have enforced conversion from all whom they brought into subjection. After this he proceeded to extirpate the worship of idols in as autocratic a manner as Vladimir had employed, when at Kieff Peroun, the god of war, was thrown from his pedestal and ignominiously cast into the Dnieper. In 980 an edict was issued that every Pole who had not already submitted to baptism should immediately undergo it. No opposition was offered to this strange decree, which from its easy adoption would seem to have left but little impression upon the neophytes, and probably the chroniclers have some reason for their assertion that Mieczysław himself subsequently relapsed into gross sins. This complete conversion of the nation appears to have been aided by the labors of St. Adalbert, bishop of Prague. Such traces as remained of the early Orthodox creed which had been introduced from Moravia were effaced, although they remained for some time in the sister kingdom of Bohemia, and we find a monastery established by the emperor Charles IV. for Greek monks at Prague. Mieczysław acknowledged himself to be the feudatory of Otho of Germany; he also resisted the encroachments of Vladimir of Russia, for already the feud between the two nations was commencing. He died in 992 universally regretted, as we are told, and was succeeded by his son Bolesław, surnamed the Great. During his reign Otho III. of Germany paid him a visit, and the Polish prince received him with such magnificence that the emperor elevated his duchy into a kingdom, probably intending that it should always remain a fief of the empire. Dlugosz and Kromer vie with each other in describing the splendor of this meeting; they are, however, far outdone by their predecessor Gallus, who speaks of magnificent military manœuvres prepared by Bolesław to delight his guest, and of the gorgeous array of the lords and court ladies; "for gold," he adds, "was at this time held as common as silver, and silver as cheap as straw." Finally, Otho hailed Bolesław as king, and himself put the diadem upon his head. At his departure he presented the Polish king with the lance of St. Maurice, still to be seen, as Kromer tells us, in the cathedral of Cracow; and Bolesław in turn offered as a gift the arm of St. Adalbert, the patron saint of Poland. Lelewel treats the whole story of this coronation as a myth, because, as he observes, at that time kings were always crowned by bishops. Bolesław afterwards defeated the Russian prince, and spent the latter part of his reign in administering justice throughout his kingdom. By the commencement of the 11th century he had absorbed nearly all the western Slavonic states, including Bohemia. He enjoyed among his subjects the epithet of *Chrobry*, or brave. The Germans, however, in derision of his corpulence, which he endeavored to lessen by hunting, called him *Trinkbier*. To him is due the foundation of the archbishopric of Gniezno (Gnesen), the chief see in Poland.

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[1] For a further discussion of this subject, see the indexes to M. Leger's *Nestor* (p. 326), and especially the *Archiv für Slawische Philologie* (vol. iii., *Ueber die Namen für Polen und Lechen*, by Pro-Nehring, and vol. iv., *Polen, Ljachen, Wenden*, by Prof. Perwolf).

[2] The following directions for pronunciation may be useful; *c* — *ts*; *cz* — *ch*; *sz* — *sh*; *ż* — *zh* (the French *j*, as in *jour*); ł has a thick sound which can only be acquired by ear. In nearly every word the accent is on the penult.

Bolesław the Great.

Towards the end of his life he sought to aggrandize himself at the expense of Russia. He had previously in 1013, according to Thietmar, given his daughter in marriage to Sviatopolk, the nephew of Vladimir. His expedition against Kieff is alluded to by Nestor, but narrated more in detail by Thietmar and Martin Gallus. According to the latter he entered Kieff with the Polovtzi as his auxiliaries, and struck the golden gate with his sword. He was succeeded by Mieczysław his son, who abandoned himself to pleasure and left the kingdom in a disordered state. He is said to have first divided Poland into palatinates, a term which will be explained shortly. On his death an interregnum ensued, and his queen Ryxa, niece of Otho of Germany, held the regency. Owing, however, to the continual feuds between the Slavs and Germans, she was driven out of the kingdom and betook herself to Saxony, whither her son soon followed her. During their absence Poland presented a spectacle of anarchy, the commencement of the long series of miseries of this unhappy country. The serfs are said to have risen everywhere and massacred their lords, and even the priests were not spared. Moreover, two foreign wars, with Bohemia on the one hand and Russia on the other, increased their miseries. The pious Kromer chiefly laments the sacred relics carried off by the ferocious Bohemians which were never restored. To heal the universal wounds it was resolved to send for Kazimiérz (Casimir) the son of Mieczysław and Ryxa. But it required some time to find him, for he was hidden in Germany, although the story of his having become a monk in the abbey of Cluny in Burgundy has been shown by Röpell to be groundless. We shall see afterwards that a Polish king did actually seek in a cloister rest from the turbulence of his subjects. Kazimiérz married Maria the sister of Yaroslav, the prince of Kieff, who was willing to abjure the Greek faith, and embracing the Latin took the name of Dobrogniewa. By this marriage he became the brother-in-law of Henry I. of France, who had married another sister. This king induced several monks to come from Cluny, and founded two monasteries for them, one near Cracow and the other in Silesia, at this time forming part of the kingdom of Poland. From the earliest period we find the country inundated with foreign ecclesiastics; and to this cause we may probably trace the long use among the Poles of the Latin language. Kazimiérz was succeeded by a second Bolesław (1058–1081), of whom many curious stories are told. In an expedition against Iziaslav, the prince of Kieff, he took that city and remained in it some time with his troops. The stay of Bolesław and his soldiers at Kieff is said to have been attended with the same deleterious effects as befell Hannibal and the Carthaginians at Capua; and the conduct of the Polish ladies during the absence of their lords, unless the chroniclers belie them, cannot be held up as an example to wives. The whole story, however, has a very mythical air.

Bolesław II.

The most remarkable event, however, of the reign of Bolesław was the murder of St. Stanisław. In this respect he emulated Henry II. of England; he dared to come into collision with the ecclesiastical power, but he did not suggest the assassination of so prominent a person to others; he accomplished the deed with his own hand. His excesses had long drawn upon him the censure of Stanisław, who concluded by putting all the churches of Cracow under an interdict. Upon this the king vowed vengeance on his denunciator. The Polish chroniclers tell us that, on hearing that the saint was to celebrate mass in a chapel, he took with him a few determined followers and hurried to the place. He, however, forbore to break in upon the scene till the service was concluded. This being over, he ordered some of his attendants to enter and slay the prelate. They were restrained, however, by a miracle, for, endeavoring to strike Stanisław to the earth, they all suddenly fell backward. Again and again Bolesław urged them on, and the miracle was repeated a third time, until the king rushed in and with one blow clove the skull of the ecclesiastic. Kromer tells us that immediately after the murder the king and his impious satellites slashed the body, separated it into many pieces, and cast it to be devoured by dogs and birds of prey. It was, however, guarded by eagles who kept off the assailants; and, some monks collecting the remains, they all became mysteriously reunited and were afterwards honorably interred at Cracow. Such a crime was not likely to go unpunished in those days. Gregory VII. (Hildebrand) placed the whole kingdom under an interdict. Bolesław, regarded with hatred by all his subjects, fled into Hungary, but of his end we have no certain information. After the disappearance of Bolesław, who had taken his son with him, the state remained nearly a year without a sovereign. Finally, being afraid of a Russian or Hungarian invasion, the Poles called to the throne Władysław (Ladislaus), the brother of Bolesław. Anxious to remove the interdict, he at once despatched ambassadors to the pope; but, although the churches were allowed to be reopened, so great was the authority of the occupant of the chair of St. Peter, who refused again to ratify the title of king, that for two hundred years from this time no Polish ruler could legitimately assume such a dignity, but was obliged to consent to the humbler appellation of duke. Władysław, who was engaged in constant wars with the Russians and the heathen inhabitants of Prussia, died in 1102 at Płock,—as was suspected, of poison. The power of Poland was diminished in his reign, as many provinces were occupied by the Russians. He was succeeded by his son, Bolesław III., to whom the Poles have affixed the surname of Krzywousty, or the Wry-mouthed. Kromer tells us, "Fuit autem Boleslaus hic, habitudine corporis satis firma, vegeta, et laborum patiente, colore fusco, statura mediocri, os ei carbunculus morbus ab ineunte adolescentia distorserat, atque inde Criuousti cognomentum habuit." He married Sbislava, the daughter of Sviatopolk, the prince of Kieff, and was

Bolesław III.

successful in many wars, till, having eventually been defeated by the Hungarians on the banks of the Dniester, he is said to have died of grief. He seems to have been a redoubtable warrior, and to have distinguished himself in some very hard fighting. His expeditions against the Pomeranians were characterized by much cruelty, for we are told that Gniewomir, one of their chiefs, was beaten to death in the presence of the Polish army. Besides his attack upon the Pomeranians we learn from Gallus that he also marched against the Prussians, whom he utterly defeated, returning with a large spoil of cattle and other booty. His most important war, however, was with the German emperor Henry V., the husband of Matilda, the daughter of our Henry I. He had probably become jealous of the rising power of Bolesław, for the Germans at that time affected to regard Poland as a fief of the empire. The only event of much interest in this war is the gallant defence of Glogau, where the imperialists were driven off, in spite of their furious onslaught, and were ultimately routed near Breslau. The emperor fled precipitately, and the Poles gave little or no quarter. The field, says Kromer, where the battle took place was full of corpses, and exhibited a sorry and lamentable spectacle. The bodies of the Poles were carefully sought out and interred, but the Germans were unburied and lay as food for dogs and birds. In consequence of this the number of dogs who frequented the spot was so great that the road was rendered difficult to travellers. The place was called the Field of the Dog both by the Poles and Germans, a name which has obtained till the present day. Kromer, however, tells us that some of the German historians claimed the victory for their nation. Whatever the result may have been, peace was soon afterwards made between the emperor and the duke, a peace which was further consolidated by the marriage of Bolesław and his son Władysław to members of the imperial family. Before his death the Polish duke, following the same fatal course which in Russia paved the way for its subjugation by the Mongols, parcelled out his territories to his sons Władysław, Bolesław, Mieczysław, and Henry. There remained a fifth and youngest son, at that time of tender age, Kazimierz. The duke being asked why he had left him portionless is said to have declared that the four-wheeled chariot must have a driver, thus, as it were, prophesying the future pre-eminence of this child. The prediction, which looks very much like a prophecy after the event, reminds us of William the Conqueror distributing his kingdom to his sons. The quarrels of these princes are very tedious. Władysław was ultimately driven out and Bolesław became supreme. His subjects gave him the nickname of Kędzierzawy, or the curly. He was drawn into a contest with the German emperor Frederick Barbarossa, who invaded Poland in the year 1158. It would have been impossible for Bolesław to meet so formidable a foe in the field; he, however, succeeded in forcing him to make peace by continually harassing his army, and laying waste the territory before it. Frederick again attempted to convert Poland into a fief of the German empire, but failed. Bolesław signed a peace by which he consented to give Silesia to his brother Władysław, and the Poles were to furnish three hundred spearmen to assist the emperor Frederick against Milan. An expedition which he undertook against the Prussians in 1167 was unsuccessful; in consequence, as Kromer assures us, of treachery, the Poles became entangled in the marshes of the country and were cut to pieces. On his death Bolesław was succeeded by his brother Mieczysław, who was so unpopular that he was expelled from the country in 1177. The crown, therefore, according to the prophecy, devolved upon Kazimierz, the youngest son of Bolesław Krzywousty. During his reign many judicious laws were passed in Poland; among other improvements he abolished the evil custom of purveyance. His reign was tranquil, and by summoning a council of the bishops and nobles at Łęczyca he may be said to have instituted the Polish senate, at all events to have laid the foundations of it. At this time the third crusade was preached in Poland, and the order of the Cistercians was introduced into the country. We shall pass rapidly over the reigns of Leszek V. (the White), Władysław III., and another Bolesław. Conrad, duke of Masovia and brother of Leszek, introduced the order of Teutonic knights into the Polish territories on the Baltic, from whom the Prussian monarchy, one of the great enemies of the republic, was afterwards to develop itself. In the reign of Bolesław V. (1227–1279) the Mongols made an incursion into Poland, but were subsequently diverted into Hungary, having gained a victory at Lignica (Leignitz) in Silesia in 1241. They carried off great quantities of booty. It is said that on this occasion nine sacks were filled with the ears of the slain. During their stay Bolesław, like Ivan the Terrible at a later period, remained cloistered in a monastery. Lelewel dwells pathetically upon the many evils suffered by Poland during the long reign of this prince, and says he was an unjust judge, a soldier who had aversion to fighting, and a sovereign who neglected the government. At this time also commenced the introduction of Germans into the country in such numbers as to threaten to denationalize it. The trade was almost entirely in their hands, and instead of being governed by Polish laws they enjoyed the benefit of the *Jus Magdeburgicum*. The wide influence of these foreigners is shown by the many words of German origin to be found in the Polish language.

Mieczysław III.

Bolesław V.

An unfortunate and uninteresting prince, Leszek the Black, succeeded, but the dignity of the house of Piast was fully restored when Przemysław, without condescending to solicit the title of sovereign from the hands of the pope, received the crown from his nobles and clergy at Gniezno (Gnesen). Thus did Poland again become a kingdom. This unfortunate prince, however, was afterwards murdered by the margrave of Brandenburg at Rogozno (1295). The reign of Wacław (Wenceslaus) (1300–5) was not of great importance. He united the crowns of Poland and Bohemia, but soon became unpopular on account of his preference of his Bohemian subjects. Shortly after his election he left the country, and, confiding the control of Poland to the Bohemian garrisons, retreated with his wife to Prague, having been invited to take the crown of Hungary, which he soon abandoned to his son. His death in the year 1305 was accompanied by suspicious circumstances which rendered it probable that it had been brought about by poison. With him expired the race of the holy peasant Přemysl, which had ruled Bohemia according to the ancient chronicles for nearly six hundred years. The relations of the latter country to the German empire were now to become much closer. Władysław Loketiek, who succeeded Wacław, was constantly engaged in wars with the Teutonic knights. In three expeditions against them he allowed his troops to commit great excesses. A full account of them may be found in Kromer, who has given us a florid speech said to have been uttered by Władysław before one of the battles. Several heretics at this time made their appearance in Poland, advocating among other things communistic doctrines. They were severely repressed, and from this time dates the establishment of the Inquisition in the country which lasted till the days of Sigismund I. About 1312 Cracow appears to have been made the capital of the kingdom, and continued so till the reign of Sigismund III.

Casimir III.

Władysław was succeeded by his son Kazimiérz (Casimir) III., justly surnamed the Great, whose reign was a golden period for Poland. The material prosperity of the country increased very much at this time. Commerce was active; the Russians supplied the inhabitants with furs; the southern parts of Europe sent wines, carpets, silks, cotton, etc. The principal towns of Poland, Dantzic and Cracow, to assist the development of their commerce, joined the Hanseatic league. The towns on the Vistula now began to increase in number and importance, and we first hear of Warsaw, which, however, was not made the capital of the kingdom till the reign of Sigismund III. In 1364 Kazimiérz laid the foundation of the university of Cracow, but it was reserved for Queen Jadwiga to carry out his plans. One of the most important events of his reign was the passing of the statute of Wislica (1347). In this legal document the palatines and castellans are mentioned, and the authority possessed by them is carefully defined. It may be well to enumerate here some of the chief functionaries of the republic. The duty of a palatine was to lead the troops of his palatinate on any military expedition, and to preside in the little diets or assemblies of the nobility of his province. Immediately after the palatines came the castellans, who, like the former, were all senators. They were lieutenants of the palatines in time of war, leading the nobility of their jurisdiction into the field, under the command of the palatines. Both the palatines and castellans held judicial tribunals in their respective provinces. The nuntii (*postty*) were the deputies returned by the various districts of the palatinates. There were sixteen ecclesiastical senators, including the primate (the archbishop of Gniezno) and the archbishop of Lemberg. They all sat in one house. The *starostas*, employed in collecting the revenue and other functions, had no seat in the house. There are many things in the statute of Wislica favorable to the peasant; thus the power of life and death over him, which his master had previously enjoyed, was abolished. The peasant was not *glebæ ascriptus*, and if ill-treated by one lord could move to the estate of another. The inhabitants of the towns, foreign and chiefly German artisans were governed by the *Jus Magdeburgicum*; but appeals to Magdeburg itself were prohibited; for this purpose a Teutonic tribunal was established at Cracow, consisting of a judge properly acquainted with foreign law, and of seven citizens nominated by the starosta. Kromer, in his *Polonia*, says, "Legum scriptarum nullus fuit usus apud Polonos vetustioribus temporibus; nec ullæ extant antiquiores iis quas Cazimirus magnus rex condidit." A national diet was now being formed. It consisted of the upper clergy and the nobles, but the inferior clergy and the citizens seem sometimes to have been admitted. Gradually questions of peace and war were introduced and even the election of kings, the principle of departing from the hereditary line being admitted— a concession afterwards attended with great evils to Poland. The improvements of Kazimiérz were not confined to law-making; he fortified the chief towns of his kingdom, and built many of their most handsome edifices. He also introduced many artisans from Germany. By his marriage with his first wife Anna Aldona of Lithuania, he had only a daughter. He therefore convoked a diet at Cracow on the 8th May, 1339, in which he proposed as his successor his nephew Louis of Hungary, the son of his sister. This was to concede to the diet a very important privilege, as the throne became virtually elective. The nobles were not slow in availing themselves of the concession which had been made to them. Before they allowed Louis to succeed they exacted some very important terms from him which became the foundation of the celebrated *pacta conventa*. The year after the appointment of a successor his wife died. According to Kromer she was passionately fond of music, and took musicians with her wherever she travelled. The wars of Kazimiérz against the hereditary enemies of the country, the Russians, the Lithuanians, and Mongols, were successful. His private life was stained with licentiousness, but his reign marks a distinct epoch in the political and legislative development of the country. With him the glory of Poland begins, and he is well worthy of the glowing eulogy of the national historian Dlugosz. We cannot wonder also that the Poles dwell with pleasure upon the splendor of the court of Kazimiérz, but he certainly squandered the royal treasures too freely. We are told that at one time he entertained at Cracow the emperor of Germany and the kings of Denmark, Hungary and Cyprus. His death was occasioned by a fall from his horse while hunting near Cracow on the 5th November, 1370, and with him expired the line of the Piasts.

Louis.

Casimir was succeeded, as had been arranged, by Louis of Hungary, who held the crown for twelve years only, and of that period spent but a short time in the country. Louis showed too great a fondness for his own subjects; he had also the misfortune to be unacquainted with the Polish language.

Jadwiga.

After his death his second daughter Jadwiga was elected queen, but she was to accept as husband any prince whom the diet might propose to her. Her election is declared by Kromer to have been due to the eloquence of one Jan Tęnczyn (a member of a celebrated Polish family), whose speech, or an imaginary reproduction of it, is given at great length in very classical Latinity. Jadwiga is said to have been a woman of great beauty and worth. As a matter of state policy she was induced to marry Jagiełło, the prince of Lithuania, a man of savage manners; but Lithuania was thus annexed to Poland, with which it remained joined ever afterwards,—a more complete federation having taken place at Lublin in the year 1569. Jagiełło was a pagan, but he offered to renounce his creed and to introduce the Christian faith into his dominions; although not educated in that religion he was born of a Christian mother, and its doctrines were not entirely strange to him. The principality of Lithuania at that time stretched from the Baltic to the Black Sea, and eastwards to within a short distance of Moscow. Its religion was Greek Church, and its official language White Russian. The Lithuanian tongue, so interesting to the philologist, seems never to have been anything more than a peasant's language, and no official documents whatever have come down to us in it. This was not the first marriage between the sovereigns of the two countries, as the first wife of Casimir the Great, Anna Aldona, had been a daughter of Gedymin, a Lithuanian prince. Originally Jadwiga felt a repugnance to the marriage with Jagiełło on account of the coarse and repulsive manners of the barbarian, and also because she had previously plighted herself to the archduke William of Austria. The matter was referred to her mother Elizabeth of Hungary, who expressed herself favorable to the marriage. The archduke, however, did not abandon his hopes without a struggle: he made his appearance with a splendid retinue at Cracow, but eventually retired on finding that the prosecution of his suit would lead to no favorable result. The new candidate arrived at the metropolis after him, and Jadwiga accepted his proposals. In 1386 they were married, and from that year we may date the commencement of the dynasty of the Jagiełłos in Poland, which lasted for nearly two centuries, terminating in 1572,—indeed we may say nearly a century longer, omitting the short and brilliant period of Batory (1576–1586), for Sigismund III., was the son of Catherine daughter of Sigismund II., and Władysław IV. and John Casimir were his sons; after the death of the latter the throne became entirely elective. The new sovereign was baptized by the name of Władysław. Having been converted himself, he forced his subjects to be converted by the simple process which seems to have prevailed over all Slavonic countries. Władysław is said have assisted in these pious labors with persuasion as well as command, and by these means Lithuania, which had remained heathen longer than any other part of Europe was finally Christianized. We are told, however, by travellers of heathen customs remaining long afterwards. Although owing so much to his consort, the king seems to have treated her with jealousy and suspicion. On his impugning her chastity, she insisted on being confronted with her calumniators. The investigation resulted in Jadwiga's triumphant acquittal; and we are told by Dlugosz that her accuser was compelled in the singular fashion of the country to prostrate himself under a table and declare that he had lied like a dog, and at the same time to imitate the barking of that animal. We are further informed that this punishment for defamation continued in force in Poland until the close of the 18th century. The nobles wrested several important privileges from Władysław; and from this time we can trace step by step the rise of that fierce oligarchy which brought so much trouble upon the unfortunate kingdom. They secured for themselves exemption from all contributions when called to serve beyond the frontiers, and an allowance of five marks for every horseman; they also procured the exclusion of members of the royal family from all the higher offices of the state, reserving these for themselves. In the reign of Władysław many expeditions were undertaken against those inhabitants of Lithuania who preferred to remain pagans. In 1410 also occurred the great battle of Grünwald near Tannenberg in Prussia, in which the Teutonic knights were completely defeated and Ulrich von Jungingen, the grand master, killed. Władysław died in 1434, and was succeeded by his son of the same name. His queen Jadwiga had died in 1399; she appears to have been greatly beloved by the Poles, and was canonized after death—miracles, it is said, being wrought at her intercession. The consolidation of Lithuania with Poland was destined to be a much more tedious and protracted matter than its somewhat violent union. Great as may have been the grief of Władsław at the death of Jadwiga, it did not prevent him from contracting three subsequent marriages—the third wife being Sophia, a princess of Kieff.

The younger Władysław was able soon after his accession to add (by election) both Bohemia and Hungary to his dominions. He then commenced an expedition against the Turks, who under their sultan Amurath II. were pressing the siege of Belgrade, having already annihilated the ill-starred Lazar and his army at the battle of Kossovo in 1389. At first Władysław was everywhere successful, and had instilled such terror into the Turks that Amurath proposed a truce for ten years and offered to cede all his conquests except Bulgaria. The conditions, having been accepted, were ratified by mutual pledges; unfortunately Władysław was induced by Cardinal Cesarini to recommence the war and violate his oaths. The sultan on hearing of this perjury at once prepared for battle at the head of a formidable army. The encounter took place at Varna, in the present principality of Bulgaria. After performing prodigies of valor, Władysław was defeated and slain. Hardly a fifth part of the Polish army escaped from the battle, and of these many perished in the swamps of the Dobrudja. This melancholy engagement, which formed, as the Polish chroniclers tell us, the subject of so many lays—whereof it is a great pity that none have come down to us—is fully described by Kromer (p. 327–8), who adds many omens and pious reflections. He dwells with delight upon the conspiracy of twelve noble captives, who would have murdered Amurath if their plot had not been revealed by a Bulgarian, whereupon they committed suicide. "In necem ejus conjurarunt, peregissentque facinus præclarum et omnibus seculis memorabile nisi in ipso articulo a Bulgaro, quem unum consilii socium adhibuerant, proditi essent." There is also another curious account in the *Memoirs of a Janissary*, an early Polish work which will be further described in the section devoted to literature.

Battle of Varna, 1444.

The memory of the unhappy young prince, who was only in his twenty-first year, was long cherished amongst his countrymen, although, as Kromer tells us, during his short reign he almost drained the treasury and was so busied with the Turkish war that he had but little time to attend to the wants of his Polish subjects. The votaries of Mohammed were now beginning to make themselves a great name in Europe, and were already marching triumphant over the ruins of the effete Eastern empire. The imperial city itself was soon to fall, and the crescent to be placed upon the domes of Saint Sophia.

After a brief interregnum Kazimiérz, brother of the deceased king, was chosen to succeed him; he had previously been grand-duke of Lithuania. In this reign the Poles carried on successful wars with the Teutonic knights, which resulted in a peace, by which western Prussia, including Pomerania and the cities Dantzic, Thorn, and others, were to belong to Kazimiérz, while eastern Prussia was left to the knights, who were, however, to hold it as a fief of the crown, and each subsequent grand master was to be the vassal (*hołdownik*) of the Polish king and senate. Permanent encroachments were made, however, upon the dominions of the "Republic" (*Rzeczpospolita*) by Ivan III., who reannexed to the Russian crown Novgorod, which had been incorporated by the Lithuanians; he also appropriated a considerable portion of White Russia. The great Muscovite empire was now just becoming welded into a compact whole; with Ivan III. was to commence the era of consolidation, with Ivan IV. that of absolutism. In this reign the nobles first selected nuntii or deputies (*posły*) to attend at the diet, when they themselves were unable to be present in person. They also passed some mischievous laws, aggravating the bondage of the miserable serfs. Previously it was possible for a peasant who had been ill-treated to fly from his lord; now it was enacted that he must be surrendered upon demand, and whoever harbored him incurred severe penalties. The researches of recent Polish historiographers have shown the importance of the reign of this monarch, who may be said to have consolidated the Polish kingdom; from his time the influence of the diet began. The statute of Nieszawa in 1454 has been called as important in Polish law as Magna Charta in English; it is the great charter of the rights and privileges of the Polish nobility.

Kazimiérz was succeeded by his son John I., surnamed Albert (in Polish, Jan Olbracht), a feeble prince, most of whose wars were unsuccessful. He led an expedition against Stephen the hospodar of Wallachia, which resulted in a complete defeat. In this reign, at one of the diets (at Piotrkow in 1496—for, as was the case with the parliaments anciently in England, they were held at various places), the nobles decreed that henceforth no burgher or peasant should aspire to any of the higher offices in the church; all such appointments they reserved to themselves. Thus they constituted their clergy a mere aristocratic caste, and imitated the prince-bishops and other spiritual potentates of the Germans. The peasantry were now obliged to bring all their cases before tribunals presided over by their own masters, where they were likely at best to get but a scant measure of justice. Finally, this memorable diet still further limited the power of the king by enacting that none of their sovereigns should in future declare war without their permission. Short as was the reign of John Albert, it saw him involved in many disputes with his nobility. An Italian refugee, Buonacorsi, who had been his tutor, gave him many suggestions with a view to limit the power of the nobility. About the same time, in 1497, some nobles were killed in an unfortunate expedition in Bukowina, and a report was spread that this disaster had been caused by the king himself through the bad counsels of Buonacorsi. In this reign also laws were passed in the diets further

John Albert, 1492–1501.

limiting the power of the burghers and the peasantry, who were now forbidden to possess any landed property. John Albert was succeeded by his brother Alexander, an utterly insignificant king; in his reign, however, we trace the first germ of the detestable *liberum veto*, which ruined Poland. In a diet held at Radom it was settled that the decision of the deputies was not to depend upon the majority, but must imply unanimity of suffrages. At a diet in 1652, as we shall afterwards see, it occurred for the first time that a single nuntius annulled by his *liberum veto* the decisions of the whole body present and broke up the assembly. By this absurd custom an element of confusion and disintegration was introduced into all the meetings; it was possible to hire a venal nuntius, for the majority of the Polish nobles seem to have had their price; and as soon as such a man appeared, however important the subjects to be debated might be, he could put an end to all further discussion. The lord high treasurer had the complete control of public finance; he was appointed by the king, but could not be removed. According to the strict letter of the constitution, he must give in his accounts to the diet, but he might easily evade doing so. As the diets only lasted six weeks he might bring them in too late, or if the scrutiny became somewhat tiresome he would probably be able to find a convenient nuntius who would veto the whole proceedings.[1] The story told by Connor of a certain Count Morsztyn, whom we shall find afterwards mentioned among Polish authors, is certainly a very painful one. He says—"I may here give an account of a passage that happened when Count Morsztyn was great treasurer of Poland, who, having more regard to his own private interest than the public benefit, sent all the riches of the treasury into France, when, fearing that the diet would soon think fit to call him to account, he retired privately with all his effects out of the kingdom and went to settle in France, where he purchased the whole county of Château-Villian, which is worth above one hundred thousand livres a year." Such was the corrupt character of the Polish parliament. Other details are given of an equally painful description.[2] We are told that these meetings rarely happened without bloodshed. A serious fracas occurred among the turbulent nobles—who themselves, while dictating laws, embodied every principle of anarchy—when Sigismund III. was elected. Blood flowed in torrents, and the booths erected for the accommodation of the senators were burnt. At the election of King Michael balls from pistols flew about the tents of the senators, and nuntii were actually killed. Even worse scenes occurred at the election of Augustus II., as will be shown subsequently. In the reign of Alexander we find an instance where a few deputies from the towns were admitted, but their presence was only invited on rare occasions, reminding us how Ivan IV. now and then summoned the Russian citizens to his despotic *duma*. "He was of a middle stature," says Connor, "had a long visage and black hair, was very strong built but exceedingly dull-witted, and consequently but a little talker. He exceeded all his brothers in generosity, and was wont to delight much in musicians and such trifling artists. Nevertheless, this his liberality was generally esteemed but prodigality, insomuch that some were so bold as to say that he died in time, or else both Poland and Lithuania might have been lavished away. To prevent the like pernicious generosity for the future, the diet made a law, calling it *Statutum Alexandrinum*, by which they revoked all this king's profuse gifts." In the reign of this sovereign the former statutes of Wislica, Warta, Nieszawa, and many others were confirmed and published in a single volume under the superintendence of the chancellor Laski. The feeble Alexander was succeeded by his brother Sigismund (in Polish, Zygmunt) another son of Kazimierz. Sigismund was engaged in constant wars with Basil, the Czar of Russia; his court was also filled with factions fomented by his wife Bona Sforza, the daughter of the duke of Milan, a woman thoroughly hated in her adopted country, on whom the Poles made the following epigram:

> Si parcunt Parcæ, si luci lumine lucent,
> Si bellum bellum, tum bona Bona fuit.

When she left the country in the reign of her son Sigismund II., she carried large sums of money with her to Italy.

Sigismund I. (1507–48).

In this reign the order of Teutonic Knights embraced the doctrines of Luther; their dominions were already a fief of the Polish kingdom. Gradually this small principality was to absorb the Slavonic elements which surrounded it, and to rise triumphant over the ruins of Poland. The doctrines of the Reformation were now becoming widely spread over Europe, and the element of religious animosity was largely infused into this land of perpetual anarchy and tumults. Sigismund, however, was a man of remarkable ability, and under his rule the country flourished. He survived to the age of eighty-two, and his memory is still cherished with affection by the Poles. His broad heavy physiognomy may be seen accurately represented in the old editions of Kromer, who dwells much upon his merits. In 1538 occured the first *rokosz*, as it is termed in Polish, or rebellion of the nobility against the king. The affairs of Wallachia caused Sigismund to undertake a military expedition. Accordingly he appealed to the *rzeczpospolita*, or commonwealth, as the Polish republic was called. One hundred and fifty thousand nobles assembled at Lemberg, but instead of marching to the war they laid their complaints before the king and refused to serve, and the old man was obliged to put them off with promises. The Lithuanians had not yet become reconciled to their union with Poland, even after so long a time, and one of their chief men, Glinski, taking advantage of this feeling, attempted to restore its former independence to the country. Sigismund, however, succeeded in defeating Glinski, who fled to Russia. He then persuaded the grand-duke to invade Lithuania, and assisted him in getting possession of Smolensk in 1514. Sigismund made a treaty with the grand-duke, but he did not succeed in getting back Smolensk. In 1526, by the death of the last of the dukes of Masowsze (Masovia), this duchy was reunited to the crown of Poland. In 1533 Sigismund concluded a treaty with the Turks, then at the height of their power. This peace guaranteed to Poland the free navigation of the Black Sea, with the sovereignty of Moldavia, and prevented the irruption of the Mongols into Podolia, where they were in the habit of committing great excesses, as the Little-Russian national ballads pathetically tell us. The reign of Sigismund was a period of great peace for Poland, and we may truly say that its glory at this time culminated. It seems a rule that the great men of a country are produced at periods of national prosperity, so we now find Copernicus flourishing, the one man of genius produced by Poland whose glory has resounded throughout the world. In 1529 Sigismund published his code of laws for Lithuania, which was issued in the White-Russian language, and forms one of the most important monuments of Polish law.

He was succeeded by his son Sigismund II. (1548–72), otherwise called Sigismund Augustus, but this prince was not elected till a very stormy debate had ensued as to whether he should repudiate his wife or not. He had married, as a widower (his first wife having been Elizabeth, daughter of Ferdinand of Austria), a fair widow of the house of Radziwiłł one of the most illustrious of the families of Lithuania. The nobles, however, who already treated their sovereign as a chief magistrate and nothing more, and had begun to control all his movements, required at the diet of

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[1] See *Letters concerning the Present State of Poland*, 1773, p. 37.
[2] *Ibid.*, p. 27.

Piotrkow that the marriage should be annulled, merely on the grounds that the country would gain more by his alliance with the daughter of a foreign potentate. But Sigismund, by sowing discord in the ranks of his opponents—proposing among other things to destroy pluralities in church and state—contrived to carry his point. His wife was crowned 1550, but died within six months after, not without suspicions of having been poisoned by her mother-in-law. She is said to have made herself universally beloved during the short period in which the Poles had beheld her as queen. In three years' time Sigismund married a third wife, the sister of the first, and widow of Francis Gonzaga, duke of Mantua. During this reign the quarrels between Protestants and Romanists raged fiercely in Poland, and the latter were very severe in their persecutions. A priest was burnt to death for administering the sacrament in both kinds, and a lady suffered the same terrible fate for denying the real presence. Many of the nobles were infected with the new teaching, but Sigismund was disingenuous and inconsistent in his conduct. He is himself supposed to have been inclined to the doctrines of the Reformation; he certainly permitted Calvin to dedicate to him a commentary on one of the epistles of Paul, and Luther an edition of his German Bible. Finally, realizing that the majority of his subjects were Catholics, he abandoned a faith to which he had perhaps given but a half-hearted adherence, and allowed the bishops to suppress with severity all promulgation of the new doctrines.

The religious question was keenly debated in a diet held at Wola near Warsaw the year after the death of Sigismund. It was resolved not to allow the sword to settle any religious differences. According to the language then used there was to be universal toleration. We shall soon see how little this was carried out. We find from it that the Polish peers were supposed to be masters of the spiritual as well as the material condition of their serfs, for it was expressly stated that their power over them was to be unlimited, "tam in saecularibus quam in spiritualibus."

In his wars with Ivan the Terrible, in which the subject of quarrel was the Baltic provinces, Sigismund was not very fortunate; he was not able to prevent the Russians from acquiring the palatinate of Polotsk, nor could he subsequently hinder the Swedes from making themselves masters of Livonia. He died in 1572, leaving no issue by his three wives; and with him became extinct the race of the Jagiełłos, the second great family which had ruled over Poland. His reign was very favorable to the development of Polish literature. Then, too, the laws were first authoritatively promulgated in the native language, which was spoken at court, although Latin continued to be extensively employed. During the reign of Sigismund Augustus, Poland reached the height of outward prosperity. It included Lithuania and western Prussia, and by the addition of Masovia and Livonia extended its limits from the Baltic to the Black Sea, and almost from the Oder to the Don. The seeds of disintegration, however, had long been sown; since the marriage of Jadwiga with Władysław Jagiełło the crown of Poland had been more or less elective, although it continued in the same family. One important event which marked this reign must not be forgotten; in 1569 took place the celebrated diet of Lublin. By this a close union was effected between Poland and Lithuania, which up to this time had been ill united, and indeed there were continual jealousies breaking out during the existence of Poland as a nation—two great points being the difference of religion and language. Even the union of Lublin was not effected without considerable resistance. The following were its conditions:—Lithuania gives Podlasie to Poland; Livonia, under the title of duchy, belongs equally to the two states; Volhynia and the duchy of Kieff—that is to say, the Ukraine—are incorporated with Poland; the kingdom of Poland and the grand-duchy of Lithuania are to form a single indivisible republic, and are to have a single head, elected by their common votes; the senate is to be composed of nobles of both nationalities. Warsaw was fixed upon as the seat of the diet, since, being part of Masovia (Masowsze), it was, strictly speaking, neither Polish nor Lithuanian. It afterwards became the regular capital of the country in the reign of Sigismund III.; as we have seen, the first two capitals of Poland were Gniezno (Gnesen) and Cracow. Warsaw is of comparatively late origin. It is said to have been founded by Conrad, the duke of Masovia, in 1269. The old dukes of Masovia resided at Czersk near Warsaw, of which some of the ruins might be seen one hundred and fifty years ago (C. H. Erndtel, *Warsavia physice illustrata*, Dresden, 1730). The city is most advantageously situated, and with a better railway system and fewer fiscal restrictions would be one of the greatest emporiums in Europe. An interregnum now occurred on the failure of the line of the Jagiełłos, and the throne was publicly offered for competition. Four candidates appeared:—Ernest, archduke of Austria; Henry of Valois, duke of Anjou, brother of the French king; a Swedish prince; and finally Ivan the Terrible of Russia. The contest, however, really lay between the first two; the Swedish alliance was despised as likely to bring with it no solid advantage; the czar was hated both as coming from a race which had ever been hostile to Poland, and also on account of his detestable cruelties, which were well-known throughout Europe. The political importance of France and the astute diplomacy of Montluc, the embassador from that country, caused the decision to be given in favor of the French candidate. But, just as his name was brought forward as their probable king, the Poles, many of whom, we must remember, had embraced the Reformed doctrines, were startled by the news of the massacre of St. Bartholomew (August 24, 1572). From the awkward dilemma in which he was placed by his complicity in this act, Henry endeavored to escape by a falsehood,—impudently denying at first that anything of the sort had happened. Finding, however, but little credence given to his assertions, he attempted to explain away the affair and to lower the number of its victims, which he reduced to fifty, alleging that they had been really executed for a conspiracy. The Polish ambassadors duly made their appearance in Paris, showing their gay equipages, quaint and semi-Asiatic; their bows and arrows and shaven crowns with a single tuft of hair greatly amused the inquisitive French. Loose flowing robes, high boots, and a sword resembling a scimitar completed the *tout ensemble* of a Polish nobleman.[1]

Diet of Lublin.

Henry.

Readers of French history must be well acquainted with the character of this duke of Anjou, one of the most detestable of the house of Valois, who afterwards became king of France under the title of Henry III. The articles, some of which the Polish nobles required Henry to sign, called the *pacta conventa* so well illustrate the extraordinary influence of the aristocracy, and the shadow to which they had reduced the regal authority, that they are worth quoting *in extenso*. From this time every Polish king was compelled to accept them, together with the additions subsequently made.

Pacta conventa.

(1) The king was to have no voice in the election of his successor; the appointment was to depend entirely upon the nobles.[2] (2) He was to keep rigidly the terms of the treaty made with the Dissidents, as the Polish Protestants

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[1] The Poles regarded the national dress with peculiar fondness, and Coxe tells us that they were somewhat indignant with their last king, Stanislaus (Stanisław August Poniatowski, 1764-95), because he always appeared with flowing hair and adopted a French style of dress. They even meditated introducing a new clause into the *pacta conventa*, requiring that every king of Poland must wear the Polish dress.

[2] We shall find, however, this rule sometimes infringed, and instances occur in which the opinion of a sovereign affected the next nominee. Thus the malicious wife of Sobieski was able to exclude her son James from the succession to which the national voice had almost called him.

were called. (3) No war was to be declared nor military expedition undertaken without the consent of the diet. (4) No taxes were to be imposed without the consent of the diet. (5) The king was not to appoint ambassadors to foreign courts. (6) If different opinions prevailed among the members of the diet, the king was to adopt only such as were in accordance with the laws or advantageous to the nation. (7) The sovereign must have a permanent council, consisting of five bishops, four palatines, and eight castellans, who were to be changed every year and elected by the diet. (8) A general diet was to be convoked every two years, or oftener, if there were any need. The assembling of these diets seems to have depended upon the will of the king. (9) The duration of each diet was not to exceed six weeks.[1] (10) None but a native could hold any dignity or benefice. (11) The king must neither marry nor divorce a wife without the consent of the diet.

Thus the regal shadow who was to sit upon the throne of Poland was able to interfere but little in questions either of peace or war. The latter, we have seen, he could not declare; and, as each of the palatines held nearly supreme power in his own territories, the king could interfere in little relating to the former. A vexatious control was exercised even over his private relations; his wife could not be of his own choosing, and, however odious she might become to him, she must remain attached as a state appendage till his nobles consented to release him. Not that Henry was likely to trouble himself with any scruples on the score of marriage. He arranged all those matters very easily. What was left for the Polish king was chiefly to eat and drink at the expense of his subjects, and to form a glittering addition to their costly and semi-barbarous pageants. Still his revenue was ample, and when he commanded the army in the field his power was unchecked; he had also the nomination to the highest ecclesiastical and military appointments.

Even before the severe terms of the *pacta conventa* had been presented to Henry, Montluc had agreed to all, but probably felt convinced that his sovereign would carry out no more of them than he could possibly help. He even promised that France should send a fleet into the Baltic, so that its dominion might be secured to the Poles, and that in the event of a war with Russia she should supply four thousand of her best troops, and herself pay their expenses; in all cases of war she was to aid Poland with money. Henry was to spend a large portion of the rents which he drew from his estates in France for the benefit of his adopted country; he was also to pay the crown debts, and to educate one hundred young Polish nobles either at Paris or Cracow. Probably no sovereign in the world ever signed such galling stipulations. Henry, however, had no intention of observing them, and had so little relish for his new kingdom that he did not set out till he had almost been driven from France by his brother, and the Polish nobles already talked of a new election. He proceeded on his way slowly, with all the dignity of a royal progress, but did not escape the gibes of the German princes through whose dominions he passed, for his connection with the massacre of St. Bartholomew. He was feasted at Heidelberg opposite a large picture which delineated the tragedy in all its horrors, and attendants were allotted him selected from French Huguenot refugees. He was crowned at Cracow in February 1574, but soon began to repent of his choice. The effeminate king relished but little the throne he had chosen among a warlike and turbulent people, where he seemed to enjoy but the shadow of a sovereignty—a people also in every way inferior in civilization to the agreeable Parisians he had left behind. He felt himself a mere puppet in their hands, and, burying himself in the recesses of his palace, led a life of dissipation. But release was at hand in an unexpected way; he was destined to be king of Poland for five months only. By the death of his brother Charles IX. he became heir to the French crown. This delightful piece of news he attempted at first to conceal, and to escape before it could get noised abroad in Poland, principally to avoid the ambitious designs of his brother, the duke of Alençon; but unfortunately the report oozed out. He refused to follow the counsel of his advisers that he should convoke a general diet to see what measures should be taken. On the evening of the 18th July he gave a grand entertainment in honor of the sister of the late king Sigismund. The conviviality was great; and never had Henry assumed a more pleasing manner or seemed more genially to identify himself with his new subjects. At the usual hour, to all appearance, he retired to his apartment and the lights were extinguished: but already the king had flown. He was led by an attendant through secret passages to a chapel in the suburbs of the city, as some say—but according to more probable account to the royal stables, where a rendezvous had been appointed. Here horses had been prepared; and with a few chosen attendants he rode precipitately from his kingdom, reaching the frontiers of Silesia early on the following day. Great was the consternation in Cracow when it was known that he had fled, and hot the pursuit of the authorities. The probability of the king's flight, gathered perhaps from his ill-concealed uneasiness, had caused it to be suspected before it was known as an actual fact. The grand chamberlain, anxious to calm the universal excitement, returned to the palace to which by virtue of his office he had general access. At first he knocked at the king's door, but no answer was forthcoming; he then tried the chambers of the gentlemen-in-waiting; there equally he found a dead silence. Again, he returned to the king's bedroom, and, not being able to force the door, entered by the window—for even in matters of etiquette they seem in Poland to have treated their kings somewhat roughly. The candles were burning as usual in the room; the two pages were near the bed; the curtains of the bed were drawn, but there was no Henry to be found. The grand chamberlain, amazed, rushed in pursuit, attended by five hundred cavaliers. Probably such a ludicrous sight had never been seen before as a monarch flying from his kingdom and subjects without being driven out by them. Owing to his ignorance of the route the horsemen were soon on his track, and many of his companions, to save themselves, deserted him. One of them named Pibrac hid himself in a bog, and was even obliged to make several dives to escape the infuriated peasants, who pelted him with stones, unconscious of what he had done, but satisfied from his efforts at concealment, that he must be flying from justice. In vain did Henry cause the bridges to be broken down behind him; the Slavs on his track forded the rivers on horseback, and the king was at last overtaken on the very boundaries of the German empire. There Tęnczyn, the grand chamberlain, and five horsemen came up with the fugitives and shouted after the king "Serenissima Majestas, cur fugis?" Finding that he was quite safe Henry admitted Tęnczyn to an audience, who remonstrated with him on account of the manner in which he was leaving the kingdom, and recommended him to return and convoke a diet so that with the consent of his subjects he might take possession of his new kingdom. But he refused to be influenced by their entreaties, and merely promised in a vague manner that he would return as soon as he had placed France in a state of tranquility—a promise which it need hardly be said, he had no intention whatever of carrying out. Nor did the king show any special alacrity in repairing to France, for before reaching that country he lingered a considerable time at Vienna and Venice, trifling with the highest interests of his country, and devoted only to frivolous amusement. The Poles, however, were well rid of one of the most corrupt sovereigns of a corrupt house. In 1589 the knife of the Dominican friar terminated his life, and with it the line of the Valois.

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[1] We shall afterwards see that this mischievous law was fruitful of evil consequences to the country, as frequently debates upon the most important questions would be brought to an end by the interference of one of the nuntii declaring that the legitimate six weeks had elapsed.

Stephen Batory (1575-86).

The Poles, piqued at the contempt with which their crown had been treated, assembled at Stężyca and resolved to declare the throne vacant if the king did not return by the 12th May, 1575. During the interregnum the Mongols made incursions into Podolia and Volhynia, and grievously devastated those countries. The appointed period having elapsed, Stephen Batory, prince of Transylvania, was elected, having previously stipulated to marry the princess Anne, sister of Sigismund Augustus. There were some difficulties, however before he succeeded in obtaining the royal authority. The primate Ucharski nominated the emperor Maximilian king. This caused considerable opposition, and the city of Dantzic did not recognize the new sovereign till compelled. To conciliate the nobility Batory was obliged to consent to some serious diminutions of the royal prerogative. This king was a great soldier, successful against both Prussians and Russians, the latter of whom he compelled, in 1582, to evacuate Livonia, which was thus again annexed to Poland. He also did much to encourage letters, having founded the university of Vilna, which has, however, been suppressed in more recent times. His great fondness for the Latin language is said by Schafarik to have had a bad effect upon Polish; for from this time may be dated the classical words and idioms which have been thrust upon the language, and have disfigured Polish more than her Slavonic sisters. It was Stephen Batory who first organized the regiments of Cossacks who play such an important part in Polish history. Before his death, foreseeing the constant anarchy which the system of elective sovereignty would cause, he in vain urged the nobility to make the crown hereditary. Sarnicki, the Polish historian, says of him—"Fuit vir tam in pace quam in bello excelso et forti animo, judicii magni, præsertim ubi ab affectibus liber erat; in victu et amictu parcus, et omni jactantia et ostentatione alienus, eruditione insigniter tinctus, sermonis Latini valde studiosus et prorsus Terentianus." It would naturally be concluded that before the election of Batory the royal power had been sufficiently curtailed, but it was to undergo further mutilations. Sixteen senators were now chosen at each diet to attend the king and give their opinion in important matters, and no decree could be issued without their consent. Besides this, in 1578 the right of final appeal to the king, which had always been a royal prerogative, was taken away. The king could now only give the ultimate decision in a small district within a certain radius of his residence. The courts exercising judgments within these narrow limits were called *Assessoria Regni*, and even these judicial powers, slight as they were, were gradually abandoned after the time of Augustus II., and were exercised by the high chancellor of the realm. The king was supposed to have some control of the courts which were governed by the *Jus Magdeburgicum;* but, Batory being busy with foreign wars, these were generally managed by the chancellor also. The palatines had the right of electing their own judges in their dietines or petty diets, who formed supreme courts of justice called *Tribunalia Regni;* here the causes of the nobles, for the peasants had no voice in the matter, were decided finally and without option of any appeal.

On the death of Batory in 1586, after many quarrels among the leading families, the throne was again brought into the market. The candidates were, among others, the archduke Maximilian of Austria; Feodore Ivanovich, the feeble Russian czar; and Sigismund, a Swedish prince, son of Catherine, sister of Sigismund Augustus. The last of the three was finally elected, although not without considerable opposition from Maximilian, who was only driven from his candidature by main force. The Zborowskis a very powerful family always in opposition to Zamoiski, the chancellor of the kingdom, invited him. But Zamoiski defeated him at Byczyna in Silesia, and he was there made prisoner, and was only released on the promise of desisting from being a candidate. The Austrians, however, were always interfering in the affairs of Poland, and, if they could not procure the admission of any of their family to the headship of the republic, we shall observe that during four generations the house of Hapsburg furnished queens to Poland. A very serious riot occurred at the election on this occasion, as Lengnich tell us in his *Jus Publicum Regni Poloni;* the booths erected for the senators were burned to the ground. Such proceedings were only to be expected in a country were each noble might keep as many armed retainers as he pleased.

Sigismund III. (1587-1632).

The new king signed the *pacta conventa*, and an alliance offensive and defensive between Poland and Sweden; the navigation of the Baltic was secured, and the debts of the nation were to be discharged. Sigismund, however, soon became unpopular among his new subjects, and among other causes of offence he violated the *pacta conventa* by marrying an Austrian princess, Anne, daughter of the archduke Charles, without their consent. In 1595, at Brześć in Lithuania, took place the so-called union of the Greek and Latin Churches, but this union was not brought about without considerable violence. The disputes between the king and the diet were destined to be renewed when (his wife being dead) he married her sister Constantia in 1605. This union was also entered into without the consent of his subjects, and caused the cup of their wrath, already full, to overflow. On this occasion Jan Zamoiski, the chancellor already mentioned, addressed a vehement oration to the king, which is quoted at full length by Lelewel, in which he brought his marriage against him among many other charges. When Zamoiski had finished, Sigismund rose from his throne in a moment of anger and seized his sword. At this gesture a murmur of indignation ran through the diet, and Zamoiski cried in the midst of the crowd, "Rex, ne move gladium; ne te Caium Cæsarem, nos Brutos sera posteritas loquatur. Sumus electores regum, destructores tyrannorum; regna, sed ne impera." A great *rokosz* or secession, as the phrase was in Polish, was the result of this. But the rebels wanted able leaders, and the king defeated them at Guzow, near Radom, on the 6th July, 1607, and thus his throne, already tottering, seemed to become a little stronger. He pardoned the insurgents; and the country, on the verge of civil war, seemed pacified; but the rebellion was a fatal precedent. The most important events in this reign were the transactions which took place between Poland and Russia. The renegade monk Otrepieff personated the young Dmitri of Russia, who had been assassinated, probably by the orders of Boris Godounoff, and aspired to seat himself upon the throne of the czars. This wonderful plot was concocted at Cracow, and seems to have been a plan of the Jesuits to bring over the Russians to the Latin Church.[1] In 1606 the pretender was killed in a tumult, and many of the Poles who had accompanied him to Moscow were murdered. In 1617 Sigismund sent his son Władysław to Moscow, which had been taken by the Polish general Zolkiewski. Władysław was elected czar by a certain faction; but the Russians, disliking to have a heretic for their emperor, rose against the newly appointed sovereign; and the patriotism which was lacking to the boyars was found in the unselfish devotion of a provincial butcher. Russia was freed, and a new dynasty was established in the person of Michael Romanoff. Sigismund had many wars with the Turks, which led to no very important results; the great victory, however, of Chodkiewicz at Khotin (September 28, 1622) has become ever memorable in

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[1] See however, *Rome et Demetrius*, by A. P. Pierling, S. J. (Paris, 1878), for the contrary view.

Polish annals, and has formed the subject of several poems. Lengnich, in his *Jus Publicum Regni Poloni*, tells us that in 1632 the Cossacks petitioned to be allowed to take part in the diets. Their request was refused in an insulting manner; and the Poles had soon to pay dear for their insolence. Sigismund died in 1632; his statue still ornaments the city of Warsaw, which he made the capital in the place of Cracow. He was unceasing in his efforts to extirpate Protestantism from his dominions.

The luxury of the nobles at this period has been described at great length by Lelewel. He has also much to tell us about the small armies of retainers kept up by the Poles, which it is a pity there was no statute of maintenance, as in England, to check. These private troops, however much bravery they may have occasionally shown, prevented all unity of action. The reign of Sigismund III. was on many grounds a disastrous one for Poland, and it was a very long one. There were constant military revolts and religious tumults. The king and his Austrian wife were so foolish as to be partly drawn into the Thirty Years' War. They thought that, supported by the emperor and the king of Spain, they might be able to regain the crown of Sweden. They therefore permitted the emperor to enrol troops in Poland, and even sent him some regiments of Cossacks; they also got ready a fleet in the Baltic—strange as it may seem to hear of Poland as a naval power. All these plans, however, ended miserably. By the treaty of Malborg (Marienburg), in 1623, Sweden gained Livonia, Elbing, and part of Prussia.

Władysław IV. (1632–48).

He was succeeded by his son Władysław IV., who was elected by the diet. During his reign the usual wars took place with the ancient enemies of the republic,—the Swedes, Russians, and Turks. Before its close the revolt of Bogdan Chmielnicki had broken out, which cost Poland her Cossack subjects, who had been so happily gained over by the more vigorous policy of Batory. The Zaporogians, or Cossacks of the Dnieper, now transferred their allegiance to Alexis of Russia. They had long felt uncomfortable under the Polish government owing to the proselytizing tendencies of the bigoted Sigismund III. Fresh alarms were caused by the erection of the fortress of Kudak on the Dnieper, and they broke out into open rebellion. In 1638 they were deprived of the right of having a hetman; and Pawluk, their chief, was decapitated in spite of an express promise that his life should be spared. Władysław was in constant collision with his nobles. He fretted under the restrictions placed upon his power, and attempted to carry on wars without the consent of the diet. But the nobles compelled him to break all his engagements. He died at Merecz in Lithuania, between Grodno and Vilna, May 20, 1648, and was succeeded by his brother John Casimir (Jan Kazimiérz), the other candidates being the czar Alexis, father of Peter the Great, and Ragotzi, prince of Transylvania. One of the first acts of the new king was to endeavor to negotiate with Bogdan, but the negotiations were brought to an abrupt termination by the treachery of Wiśniowiecki, the Polish general, who fell upon the unsuspecting Cossacks while they were deliberating about the terms of the convention. After this massacre Bogdan raised another army, but was completely defeated by John Casimir at Beresteczko in 1651. The kingdom, however, was thrown into the greatest confusion by the disputes of the nobles, and all vigorous action was paralyzed. The blood-stained annals of these wars are full of horrors: the population in many districts was entirely extirpated; everywhere murder and plunder were rampant; and tortures too horrible to mention were inflicted upon the unhappy prisoners.

John Casimir (1648–68).

Liberum veto.

At a diet held in 1652 a single nuntius for the first time annulled by his *liberum veto* the united resolutions of the whole assembly,—Siciński, from Upita in Lithuania, stopping the diet with the simple word "niepozwalam" (I forbid). As soon as he had uttered this ominous protest he quitted the assembly. Those who were present were puzzled as to what construction they ought to put upon such a proceeding, but Siciński had not acted without confederates on whom he could rely. An angry debate ensued, but the principle was finally carried by a majority and firmly established. Ruptures of this kind became more frequent, as Lelewel tells us, and the queen Louise Marie, who had great influence over the king, frequently made use of them. Lengnich, in his *Jus Publicum Regni Poloni* (1742), enumerates thirteen occasions on which this baleful practice had broken up the diet. It was not finally abolished till 1791. The reasons why it was popular have already been spoken of. Among other causes may be mentioned the anxiety of the great officers of the realm—the commander-in-chief, treasurer, marshal, and others—to be free from the control of the diet. These important functionaries held their appointments for life, and were under no supervision during the intervals between the sessions of the diet. Again, it was only before the diet that a noble accused of capital crimes could be brought to trial, for the nobility exercised, as has already been said, supreme judicial powers in their own palatinates. If, therefore, as was frequently the case, a criminal of this rank happened to be brought forward, it was very convenient for him to be able to procure a dissolution of the only tribunal by which he could be convicted. Again, it was an admirable way to oppose the levying of taxes, which could only be raised by the consent of the diet; and taxes, owing to the constant wars in which she was engaged, were very heavy in Poland. There were emissaries of foreign powers, too, who fomented these internal discords and profited by fomenting them.

Treaty of Andruszowo.

The ill effects of the *liberum veto* soon began to be felt. In 1670 the members of the diet bound themselves by an oath not to make use of the privilege. In spite, however, of this resolution that very diet was brought to an end by the appeal of Zabokrzycki, the nuntius from Braclaw in Podolia. In 1667, by the treaty of Andruszowo, Poland lost to Russia Smolensk, Vitebsk, Polotsk, and other towns, the Dnieper now becoming the boundary; Kieff, the interesting old historical city, was to go two years later. In the midst of all these misfortunes the exhausted country was attacked by a new enemy, Sweden, in consequence of the Polish monarch asserting a right to the Swedish crown, as the heir of the house of Vasa—a claim which he had no possibility of enforcing. Hampered as he was by a war with Russia, John could effect nothing against his new enemies, who took both Warsaw and Cracow, and ended by entirely subjugating the country, while the wretched king fled to Silesia. Although these new enemies were afterwards expelled, yet the war was protracted for some years, and ended disastrously for Poland. Charles Gustavus, the Swedish king, is said to have proposed the partition of the country; he offered Great Poland to the elector of Brandenburg, Little Poland to the duke of Transylvania, and a part of Lithuania to a Polish nobleman named Radziwiłł. But Poland's hour had not yet come. The elector of Brandenburg procured the release of East Prussia from all seignorial rights in 1657. Livonia was also another loss, having been ceded to Sweden in 1660. An army of Cossacks and Mongols, which had invaded Podolia, was defeated by the celebrated John Sobieski, who now first appears in history and was made commander-in-chief of the Polish troops. Worn out with age, and disgusted with his repeated failures, the king abdicated in 1668. At a previous diet he had warned his turbulent subjects that the partition of the kingdom must be the inevitable consequence of their dissensions. John Casimir had already been an ecclesiastic; he had been absolved from his vows by the

Michael Wiśniowiecki (1669-73).

John III. (1674-96).

pope when he became a candidate for the throne. He now resolved to betake himself again to the cloister,—his wife, Louise Marie, daughter of the duke of Nevers, a woman of beauty and spirit, being dead. He took his leave of the Poles in an affectionate and dignified address, which is still preserved, and has been pronounced by Coxe to be "the finest piece of pathetic eloquence that history has ever recorded." There was something very touching in the fact that Jan Kazimiérz represented the last of the Jagiellos and Vasas, the former of whom had so long ruled over Poland. He was son, as previously mentioned, of Sigismund III., and great-grandson of Sigismund I., whose daughter Catherine had married John, king of Sweden. Connor says: "While I was at Warsaw I spoke with several old gentlemen, who told me that Casimir, the day after his resignation, observing the people hardly paid him the respect due to a gentleman, much less to a king, seemed to have repented heartily of the folly he had committed" (i. 135). He now returned to France, a country in which some years previously he had suffered a strange captivity, having been detained in the reign of Louis XIII. while passing its coasts; but the story is too long to be narrated in these pages. Here he became abbé of St. Germain and St. Martin, and drew his means of subsistence from these ecclesiastical foundations; for the Poles, although to all appearance abundantly moved by his melancholy rhetoric, refused to continue his pension. Nor does he appear to have spent the short remainder of his life entirely in the cloister, as we are told that he contracted a secret marriage with an amiable widow who had formerly been a laundress. He, however, survived only four years, dying in 1672, forgotten by the world but not forgetting it,—his disease, according to some accounts, being greatly aggravated by his receiving the intelligence that Kamenets in Podolia had been ceded to the Turks. His body was afterwards brought to Cracow and buried in the cathedral. The diet, which met on his abdication, passed a decree that for the future no Polish king should be allowed to abdicate. During this reign, in the year 1658, the Socinians were banished from Poland, in consequence of which Pope Alexander II. gave to the king and his successors on the Polish throne the title *Rex Orthodoxus*. In due time three candidates for the vacant throne made their appearance—the prince of Condé, the prince of Neuburg, supported by Louis XIV., and Charles of Lorraine, who was put forward by Austria. The first of these could rely upon the coöperation of the great Sobieski, but eventually none of the three was chosen. The election fell upon a native Pole—Prince Michael Korybut Wiśniowiecki, of a noble family indeed, but so impoverished that he may be said to have had regal honors thrust upon him against his will, and we are even told that he was offered the crown half in derision. A graphic picture of this extraordinary scene is given in Pasek's contemporary memoirs. Michael soon became a mere puppet in the hands of his turbulent subjects. His reign, however, was rendered illustrious by the great successes of Sobieski against the Turks, although the Poles suffered the loss of the important town of Kamenets, and Michael, powerless to make head against them, concluded the treaty of Buczacz, by which he even stipulated to pay them tribute. By the great victory of Khotin in 1673, Sobieski did much to repair these losses, and was about to follow up his glorious campaign when he heard of the death of Wiśniowiecki at Lemberg in Galicia; so sudden was the end of Michael that some have even supposed that he was poisoned,—"by a Frenchman," says Connor. The diet met at Warsaw; there were several candidates, and among others Charles of Lorraine and Philip of Neuburg again put forward their claims. While the nobles were still in session, Sobieski, fresh from his glorious victory, entered and proposed the prince of Condé. A stormy discussion ensued, and in the midst of it one of the nobles, Jablonowski, was heard to say, "Let a Pole rule over Poland." The cry found a magic echo among those who were present, and the gallant Sobieski, the greatest of Polish generals, and one of the first soldiers of his time, was appointed king under the title of John III., although not without considerable opposition from Michael Pac, the general-in-chief of Lithuania, who was, however, ultimately induced to withdraw his protest. This king signed the same *pacta conventa* as the preceding monarchs; there was, however, a trifling addition made to them, but that a very absurd one. To the article declaring that offices should only be conferred on native nobles it was added, "and on such only as have had their honors during three generations." The leading idea of Sobieski was to drive the Turks out of Europe, and if possible to resuscitate the Byzantine empire. He was soon roused to action by a new invasion of the Turks and Mongols, whose united armies are said to have amounted to 210,000 men,[1] commanded by the Seraskier Ibrahim, whose ferocious character was sufficiently indicated by his soubriquet, Shaitan or Devil. We are told that Sobieski had only 10,000 men to oppose to this vast host; he, however, set out from Lemberg, and was soon hemmed in by his adversaries at Zurawno, in Galicia, but by consummate bravery and adroitness succeeded in rescuing himself and his soldiers, even concluding a treaty with the Porte on favorable terms, by which Poland received back a part of the Ukraine and Podolia.

Siege of Vienna (1683).

Some years of peace followed, during which the king in vain endeavored to raise supplies for an army to reconquer the provinces which Russia had appropriated. All his plans were neutralized by the absurd practice of the *liberum veto*. In 1683 the Turks made their grand invasion which they had long been preparing. After scouring the plains of Hungary, they advanced to the very walls of Vienna. The emperor Leopold at once fled with his court, but had great difficulty to avoid falling into the hands of the Mongols. The imperial party made no stay till it reached the Bavarian fortress of Passau. Quick in its track followed also the wealthier portion of the inhabitants; their selfish desertion aroused murmurs of disapprobation, and also considerably thinned the number of the population capable of bearing arms; many of these fugitives fell into the hands of the invaders, who were capable of any cruelty. The command of the city was taken by Count Starhemberg; he had already approved himself a brave soldier, and had been nominated to the post by the emperor. All classes at once—including even priests and women—labored diligently at the fortifications, the burgomaster Von Liebenberg himself setting an excellent example. The imperial archives had already been removed; nothing now remained for the devoted city but to await the approach of the enemy. The inhabitants could see the desolated villages, and the fire and smoke of the burning cottages were conspicuous for miles around. At sunrise on July 14, the vast hordes of the invaders, a promiscuous crowd of soldiers, camp-followers, camels, and baggage-wagons made their appearance. The camp was arranged in the form of a crescent; splendid above all other things was the tent of the vizier, Kara Mustapha, made of green silk, worked with gold and silver, set with precious stones, and containing inside the holy standard of the prophet. Marvellous stories are told of the fountains, baths, gardens, and all the appliances of Oriental luxury which it contained. Many painful incidents characterized the siege before the arrival of Sobieski; a fire at one time broke out in the city, which was only suppressed with difficulty.

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[1] 80,000 Turks and 130,000 Mongols, as we are told by the Polish historians.

Diseases raged among the townspeople owing to their being compelled to spend their days in such close quarters and to live chiefly upon salt meat. Relief, however, was rapidly approaching. The elector of Saxony, John George, marched out of Dresden on the 22d July with twelve thousand men and eighteen guns, and reached Krems on the 28th August. The Polish king, who had been solicited by the emperor himself, and to whom all Europe looked now as its saviour, left Cracow accompanied by his son, and succeeded in reaching the quarters of Prince Charles of Lorraine. He was to act in concert with a man who had been competitor with him for the Polish crown; their meeting passed off amicably, and no subsequent jealousies seem to have marred their operations. The Polish and German troops effected their junction at Krems on the Danube, near Vienna; there were about seventy-seven thousand men ready for active operations in the field. On the 12th September, after mass, Sobieski descended from the city to encounter the dense masses of the Moslems in the plains below. He appeared with his hair partly shaven in the Polish fashion, and, although plainly attired himself, was accompanied by a brilliant retinue. In front went an attendant bearing the king's arms emblazoned, and with him another who carried a plume on the point of his lance. On his left rode his son James, unfortunate in afterwards incurring the hatred of his mother, who perhaps prevented him from being elected to the throne of Poland; on his right was his old rival, Charles of Lorraine. Before the battle the king knighted his son and made a patriotic address to his troops, in which he told them that on that occasion they did not defend Vienna alone, but rather all Christendom, and that they were not fighting for an earthly sovereign but for the King of kings. The shouts of the soldiers bore to the enemy the dreaded name of Sobieski, familiar to them on many a well-fought field. He is said to have been provoked to give the order for battle by seeing Kara Mustapha, the Turkish commander, tranquilly taking coffee with his two sons in his splendid tent.

The assault was made simultaneously on the wings and centre of the enemy. The king himself dashed forward to the pasha's tent, bearing down all opposition and repeating with a loud voice, "Non nobis, non nobis, Domine exercituum, sed nomini Tuo da gloriam." "Allah!" said the Mongol khan, "the king is surely among them." In spite of the bravery of the Turks they were overpowered by the *élan* of the Poles. Six pashas were slain, and the vizier fled with the remnant of his army. The booty taken was immense. The details of the battle may be gathered from the interesting letters which Sobieski wrote to his wife in the Polish language. She was a Frenchwoman, daughter of Henri de la Grange, captain of the guard to Philip, duke of Orleans, and had been originally maid of honor to Louisa, queen of Władysław IV., was then married to Count Zamoiski, and after his death became the wife of Sobieski. It is said that chiefly on her account the Polish king was induced to assist Austria. The selfish policy of Louis XIV. would have allowed this outpost of Christian Europe to be taken by the Turks, and he used all the secret springs of his diplomacy to divert Sobieski from his purpose. He had, however, given mortal offence to this ambitious woman in refusing the title of duke to her father. After the complete rout of the Moslem, Sobieski and his troops entered Vienna, and divine service was performed in the cathedral; a priest read aloud the text, "There was a man sent from God, whose name was John." In spite of his success, the brave Pole was doomed to meet with ingratitude at the hands of the emperor Leopold, and through the selfishness of his own troops and the Lithuanian contingent, who seem to have been always at cross purposes with the Poles, he was not able to follow up his victory to its legitimate end.

The king, after this brilliant achievement, showed some inclination to be reconciled to Louis XIV., but the emperor succeeded in diverting him by holding out hopes of securing the government of Moldavia and Wallachia for his son. By the treaty of Moscow, which Sobieski concluded in 1686 with Sophia, the regent of Russia, Smolensk, Severia, Tchernigoff, and Kieff were definitely annexed to the latter country. The private life of Sobieski was embittered by family dissensions; he was very much under the influence of his wife, a woman of great beauty, but avaricious, fond of power, and revengeful. Thus the illustrious soldier had not peace in his own house, nor was he likely to meet with it in the stormy debates of the diet, several of which were broken off by the exercise of the *liberum veto;* and so wearisome had his position become that he several times thought of abdicating, and the Austrian party (such was the gratitude he met with) sought to effect this. He finally sank under an accumulation of disorders, and expired on the 17th June, 1696, at his favorite castle of Willanow. Many incidents of his death-bed have been recorded by Załuski, the bishop of Płock, which show that the king died ill at ease, being filled with the gravest apprehensions concerning the future of his country. The family is now extinct. With him sank the glory of Poland, which was rapidly hastening to its fall.

After a time the diet met as usual to elect the new sovereign. The three chief candidates were James Sobieski, the son of the late king; the prince of Conti, nephew of the great Condé; and the elector of Saxony. The elector was appointed, and in order to qualify for the throne, abjured Protestantism. In 1699, by the peace of Carlowitz, the Turks renounced all claim over the Ukraine and Podolia, but the king was foolish enough to allow himself to be drawn into a war with the Swedes, in consequence of which Cracow was taken in 1702. Charles XII. of Sweden became master of the country, and deposed the newly elected Frederick Augustus, in whose place was chosen Stanisław Leszczyński, palatine of Posen, a man of benevolence and learning. All the courts of Europe recognized this new king except the czar Peter, and when the latter defeated Charles at the battle of Poltava in 1709 Leszczyński was compelled to leave the country, and Augustus II., as he was styled, was restored. Stanisław at the approach of the Russian troops retired to Lorraine which he governed till his death at an advanced age. In this reign Poland lost Courland, which had long been one of its fiefs, but was now seized by the Russians and given by the empress Anne to her favorite Biren. The Dissidents, as the Protestants were called, were slowly decreasing in number, and in an *émeute* which occurred at Thorn in 1724 many were cruelly put to death. A little later, in 1733, a law was passed by which they were declared incapable of holding any office or enjoying any dignity. Augustus II. died at Warsaw in the last-mentioned year. He was a contemptible king, notorious for his private vices. At the instigation of many of the Poles, Stanisław Leszczyński, who was now residing in Lorraine, and who had become the father-in-law of Louis XV., was induced to return to Poland, and was elected king at Warsaw by a large majority. This election, however, was displeasing to Austria and Russia, who resolved to resist his pretensions and to secure the election of Frederick Augustus, the son of the late king. A Russian army arrived in the neighborhood of Warsaw, and a party of the nobles opposed to the French influence proclaimed the Saxon. He accordingly swore to the *pacta conventa*, and was crowned king at Cracow in 1734. Meanwhile the unfortunate Stanisław fled to Dantzic, where he hoped to hold out till assistance should arrive from France. The city, however, was obliged to capitulate after a siege of five months; and

Augustus II. (1696–1733).

Frederick Augustus (1734–63).

islaw, after many adventures and narrow escapes,
hed the Prussian dominions. In 1736 a diet of
fication was held at Warsaw, which was followed
general amnesty. The condition of the country
ng this reign was deplorable, although Poland was
ged in no wars. Factions rent the government,
the peasantry, crushed and suffering, betook them-
s to robbery and pillage. The king was a man of
tastes, and abandoned himself to pleasure. One
is favorite amusements was shooting dogs from
windows of his palace at Warsaw, in consequence
which dogs became very scarce in the city. He
too idle to learn a word of Polish, and left every-
g to the management of his minister Brühl.
lerick died on October 3, 1763, at Dresden, where
as buried. In 1764 Stanisław August Poniatowski
was elected king, chiefly through the
machinations of the Russian empress
Catherine. The new monarch was a man
of refined manners and elegant mind, but
, and a mere puppet in Muscovite hands. He
ed the *liberum veto* to be abolished, but it was
restored (in 1766), in consequence, it is said, of
sian influence, as the ruin of Poland had been
lved upon. In 1768 a few patriots met at the
town of Bar in Podolia, and formed what was
d the Confederation of Bar, their object being to
the country from foreign influence. Among the
bers of this confederation were the Pulawskis
imir and Joseph), Joachim Potocki, and Adam
sinski, bishop of Kamenets. Their military ope-
ns extended over all Poland and Lithuania, but the
sian troops stationed round the capital prevented
unction of the confederates with the national army.
eover the confederates, whose number amounted
bout eight thousand fighting men, were badly
nized. In spite of a few trifling successes they
their efforts gradually growing weaker. Nor did a
attempt to carry off the king result in success.
r party speedily broke up, and Casimir Pulawski,
of the leading spirits, left the country and joined
Americans in their War of Independence, in which
oon afterwards perished. In consequence of the
ts of these patriots the pernicious *liberum veto* was
a stop to, though afterward for a short time
ored; but the partition of the country had already
secretly agreed upon by Russia, Prussia, and
tria. The idea appears to have been first suggested
rederick the Great. M. Rambaud, in his *Histoire*
Russie, gives the following as the chief causes
h led to the destruction of Poland, which, in
tion, had always suffered from the want of natural
tiers:

slaus
stus
95).

The national movement in Russia, which fostered the
of recovering the provinces in the west which had
erly been Russian territory, and spoke a language but
differing from Russian. To this was to be added the
that the majority of the inhabitants were members of
Greek Church. This feeling had already led to the
quest of some of the western provinces in the time of
is Mikhailovich as previously mentioned. Moreover,
members of the Greek Church were being constantly
ecuted by the Jesuits, who had done so much mischief
e country.

The great desire of Prussia to become possessed of the
r part of the Vistula, with the towns of Thorn and
tzic. A reason for Prussian interference was afforded
he Polish persecution of the "Dissidents," as a sample
which the cruelties committed at Thorn may be cited.

The general political condition of Poland—an ana-
nism among the nations of Europe. They had become
ng by centralized power and by harmonizing their
ernments with the spirit of the age. In Poland there
no middle class; for the trade in the towns was in the
ds of foreigners, and especially Jews.

here were to be seen a proud nobility, the mem-
s of which were engaged in constant feuds among
mselves, and far below them miserable serfs
rived of all political rights. There was no national
rit in the country, no sympathy between the nobility and peasantry. It was the Jews who chiefly busied themselves with commerce; they distributed the products, selling at the same time to the serfs and their masters, and preventing the two classes of the natives of the country to a great extent from coming into contact with each other. By their efforts the economic functions of every-day life were carried on, and yet they could not be considered a real part of the nation. In the moment of danger they were not at hand to bring together distinct classes and to establish a common bond of interest; the nation, thus consisting of men who did not understand each other, remained perplexed and divided. The peasants, who had at one time communal possession of the land, according to the old Slavonic custom, had long ago lost all their rights. Those Poles who struggled for liberty themselves were not willing to extend it to their unhappy serfs. Kosciuszko desired to see serfdom abolished; but the peasants who followed him only enjoyed their liberty during the war, and his decree of emancipation was so vaguely expressed that it was ineffectual. It is strange to think that the real liberators of the peasant were the Russians, who in the revolt of 1863 gave him a portion of the land which he cultivated.

Partition of the country.

In 1772 Prussia took the palatinates of Malborg, Pomeria, and Warmia, Culm, except Dantzic and Thorn, and a part of Great Poland; Austria took Red Russia or Galicia, with a part of Podolia, Sandomir, and Cracow; and Russia took White Russia, with all the part beyond the Dnieper. The Poles were obliged to sanction this plundering of their country in a diet held in 1778. The only real benefit conferred on the nation by this diet was the introduction of a better system of education; the Jesuits were also suppressed, and their immense estates became national property. Although the country had been mutilated in this fashion, it yet enjoyed tranquillity for a short time, and even made some material progress. Thus some useful manufactures were introduced. In 1788 a remarkable diet was opened, which lasted four years —the longest on record, for the others had only endured a few days or a few weeks at most. At this many important changes were introduced, such as the amelioration of the condition of the burghers and peasants; but it was now too late. On this occasion the *liberum veto* was decisively suppressed and the throne declared hereditary. The elector of Saxony, grandson of the wretched and incapable Augustus III., was declared the successor of Stanislaus. The Roman Catholic was to be the dominant religion, but the Dissidents were to be tolerated. The burghers were to send deputies to the diet on the same footing as the nobles. The peasants were not yet emancipated, but their condition was improved. The new constitution was finally promulgated on the 3d May, 1791. The king and the two chambers took the oaths to preserve it. The country now seemed to breathe afresh, and to be established upon a new basis. But the selfishness of the Polish nobles, who had always been the evil genius of the country, overturned all the arrangements. Among the most prominent non-contents was Felix Potocki, who was anxious to restore to the nobility the privileges they had lost by the new constitution. In concert with him were Francis Xavier Branicki and Severin Rzewuski, who sought the assistance of foreign powers, and especially Russia. These enemies of their country formed, in 1792, the Confederation of Targovica, and soon afterwards, at their instigation, Russian troops invaded Poland and Lithuania. The feeble king, Stanislaus Augustus, made no resistance; he signed the convention of Targovica, and the Russians occupied Warsaw. In 1793 another treaty of partition was signed, by which Prussia acquired the remainder of Great and a portion of Little Poland, and the Russian boundary was advanced to the centre of Lithuania and Volhynia. An insurrection now broke out under the leadership of Thaddeus Kosciuszko, which at first made head against the Prussians and Russians, who had invaded the country from all quarters; but the successes of the insurgents were stained by the murders committed by the popular party at Warsaw. Suwaroff now entered the country, and Kosciuszko was finally defeated and made prisoner at the battle of Maciejowice in 1794; there is no truth, however, in the assertion that he cried out on that occasion, "Finis Poloniæ;" this he always denied till the day of his death. After storming the suburb Praga, Suwaroff took Warsaw, and the city was sacked with great cruelty. The kingdom of Poland was now at an end, and the third division took place. Austria had Cracow, with the country between the Pilaca, the Vistula, and the Bug; Prussia had the capital, with the territory as far as the Niemen; and the rest went to Russia. Stanislaus resigned the crown at Grodno on April 25, 1795; he was summoned to St. Petersburg, where he is said to have endured many indignities from the emperor Paul, who never allowed him to remain seated in his presence. There he died in 1798.

Many of the Poles now entered foreign services, as, for instance, the legion which followed the fortunes of France; but the fate of these exiled patriots was often a sad one. Many perished on the burning sands of St. Domingo. Many were killed in the famous expedition to Moscow. The Poles looked anxiously to the success of Napoleon. But all that the conqueror did for them was to form the Duchy of Warsaw, consisting of six departments—Posen, Kalisz, Plock, Warsaw, Lomza, and Bydgoszcz—with a population of more than two millions, which he united with Saxony.

Resettlement by treaty of Vienna.

A resettlement of Poland took place by the treaty of Vienna (1814). (1) Austria was to have Galicia and the salt-mines of Wieliczka. (2) Posen was to belong to Prussia. This power was also confirmed in what it had gained at the first partition. (3) The city and district of Cracow were to form an independent republic under the guarantee of the three powers. This historical town was annexed by Austria in 1846, in defiance of all international law. (4) The remainder of ancient Poland, comprising the chief parts of the recent grand duchy of Warsaw (embracing a tract bounded by a line drawn from Thorn to near Cracow on the west, to the Bug and Niemen in the east), reverted to Russia, and was to form a constitutional kingdom subject to the czar. This constitution, considering the circumstances, was a very liberal one. Poland was to be governed by responsible ministers, a senate, and a legislative chamber. There were to be a national army under the national flag and a separate budget. Polish was to be the official language; personal liberty and the freedom of the press were also guaranteed. It was obvious from the first that it would be difficult to unite a country with such a liberal constitution to another still governed by a patriarchal despotism. Zajączek was named viceroy, and the grand-duke Constantine, brother of the emperor Alexander, took the command of the army.

The rebellions of the Poles in 1830 and 1863 more properly belong to Russian history; perhaps, however, a few facts connected with them may be appropriately introduced here.

Rebellion of 1830.

Considering the delicate position of affairs in Russian Poland, things had worked fairly well. The impulse to the Polish revolution was undoubtedly given by the French. It was begun by some students, who hoped to seize the grand-duke Constantine at his residence, Belvedere, in the vicinity of Warsaw. In the evening of November 29, 1830, they accordingly proceeded to the palace, but did not succeed in capturing the grand-duke. The city, however, rose, the troops fraternized with the people, and the chief command was entrusted to General Chlopicki, a veteran of the wars of Napoleon. Early in 1831 a large Russian army, commanded by Diebitsch, advanced to reduce them to submission. Chlopicki laid down his dictatorship, but the Poles pursued the insurrection with vigor under the command of Prince Adam Czartoryski. They were disappointed in their hopes of assistance from foreign powers. On the 8th September Warsaw surrendered to Paskewitch, who had taken the command, Diebitsch having died of cholera (June 10th), and a few weeks afterwards the grand-duke Constantine died at Vitebsk. On February 26, 1832, Poland was declared a Russian province.

Rebellion of 1863.

No other outbreak occurred till 1863, but for some time previously the country had been disturbed. On the 29th November, 1860, on the occasion of the thirtieth anniversary of the revolution of 1830, many political manifestations took place both in the churches and streets, and portraits of Kosciuszko and Kilinski, a patriot of the time of the last partition, were distributed. Some riots took place, and unfortunately several persons were killed. These proceedings were followed by concessions from the emperor Alexander, who established municipal institutions in Warsaw and the chief cities of the kingdom. The Russian czar was acting under the advice of Wielopolski, a Pole, who was appointed director of public instruction and worship. Riots, however, still continued, and in 1862 the grand-duke Constantine was named viceroy. On the night of January 15, 1863, a secret conscription was held, and the persons suspected of being most hostile to the Government were dragged from their beds and enlisted as soldiers. Immediately after this the insurrection broke out, which was directed by a secret committee (Rząd), the proceedings of which were as mysterious as those of the Fehmgerichte. Soon after bands of rebels began to make their appearance in the Polish forests. There were, however, no regular battles between the Russian troops and the Poles,—only guerilla fighting, in which the Poles, under the greatest disadvantages, showed splendid heroism. The secret emissaries of the revolutionary Government, armed with daggers, succeeded in putting to death many Russian spies—not the least memorable case being that of the Jew Hermani, stabbed while on the staircase of the Hôtel de l'Europe at Warsaw. On the other hand the chiefs of the insurgents captured were shot or hanged. Langiewicz held out for some time, but was defeated by the Russians, and succeeded in making his escape into Galicia. A reign of terror was inaugurated by General Mouravieff, and all attempts at reconciliation made by the great powers of Europe were useless. By May, 1864, the rebellion was quite suppressed, and it will be seen by the results that it cost Poland dear. The kingdom of Poland now ceased to exist; it has been parcelled out into six governments. The Russian language was ordered to be used in all public documents instead of Polish, and the university of Warsaw has been Russified, all lectures now being delivered in that language.

We have not dwelt upon the terrible massacres of the Polish nobles by the peasants in Galicia in 1846, said to have been instigated by the Austrian Government. This province has been tolerably quiet since, but the Poles have to struggle with the large Ruthenian or Red-Russian population, speaking a different language, and adherents of the Greek Church or Uniates.

In Prussian Poland, though it is but fair to add that we hear no stories of massacres, the Germanization of the province has been more complete. Posen will soon be lost as a Polish town, and many historical places have had their names obliterated for such substitutes as Bismarcksdorf and Sedan.

POLISH LITERATURE.

The Polish Language, according to the latest statistics, is still spoken by nearly ten millions of people, distributed, according to the *Revue Slave* (Warsaw, 1878, vol. i. p. 78), as follows: in Russia, 4,640,000; in Austria, 2,444,200; in Prussia, 2,405,800; in Turkey, 10,000. It belongs to the western branch of the Slavonic tongues, and exhibits the closest affinities with the Czech or Bohemian and Lusatian Wendish (see SLAVONIC LANGUAGES). Unlike the people of other Slavonic countries, the Poles are comparatively poor in popular and legendary poetry, but such compositions undoubtedly existed in early times, as may be seen by the writings of their chroniclers; thus Gallus translated into Latin a poem written on Bolesław the Brave, and a few old Polish songs are included in Wojcicki's *Library of Ancient Writers.* A great deal of the early literature written in Poland is in Latin. The earliest specimen of the Polish language is the so-called Psalter of Queen Margaret, discovered in 1826 at the convent of St. Florian. The date of the MS. appears to be the middle of the 14th century, and probably in its present form it is only a copy of a much older text; there is also a translation of the fiftieth psalm belonging to the 13th century.[1] The ancient Polish hymn or war song, "Piesn Boga Rodzica," was an address to the Virgin, sung by the Poles when about to fight. The oldest manuscript of this production is dated 1408, and is preserved at Cracow. By a legend which subsequently grew up the composition of it was assigned to St. Adalbert. John Lodzia, bishop of Posen from 1335 to 1346, composed several religious songs in Latin.

The next monument of Polish literature to which we come is the Bible of Queen Sophia or Bible of Szaroszpatak. It is imperfect, and only contains the early books, viz., the Pentateuch, Joshua, Ruth, and Kings; there are, however, fragments of three others. It is said to have been written for Sophia, the fourth wife of Jagiełło, about the year 1455. It has been edited with great care by Małecki. Five religious songs in Polish dating from the 15th century have been preserved; they are ascribed to Andrew Slopuchowski, prior of the monastery of the Holy Cross on Lysa Góra. There is also the fragment of a hymn in praise of Wickliffe. To these fragments may be added the prayer book of a certain Wacław, a sermon on marriage, and some Polish glosses. These are all the existing memorials of the Polish language before the 16th century.

The Latin chronicles.

Perhaps a few words should be said concerning the writers in Latin. Martin Gallus lived in Poland between 1110 and 1135. From his name he has been supposed by some to have been a Frenchman, and we must remember that Poland swarmed at that time with foreign ecclesiastics. Lelewel, the Polish historian, considers that it is merely a translation into Latin of some such name as *Kura*, signifying "a fowl." Others suppose him to have been an Italian, or a monk from the convent of St. Gall in Switzerland. He has plenty of legends to tell us, and writes altogether in a poetical style, so that his prose seems to fall into rhythm unconsciously. His quotations from the classics, Sallust, Lucan, and others, show the extent of his reading. Gallus was followed by Matthew Cholewa and Vincent Kadlubek, two bishops of Cracow, and Bogufal or Boguchwal (Gottlob), bishop of Posen, who all used Latin. The work of Kadlubek is more ornate in diction than that of Bogufal and for a long time enjoyed great popularity. He was born in 1160, educated at the university of Paris, and died in Poland in 1223, as a Cistercian monk. His Latin, like that of Gallus, is far from classical, but he writes with spirit and throws a good deal of light upon the events of his time. The education of the country was wholly in the hands of the ecclesiastics, many of whom were foreigners. In this way we must explain the great prevalence of the Latin language. Such a system would be sure to stifle all national outgrowth, and accordingly we have among the Poles none of those early monuments of the language which other countries boast. For instance, there are no *bilini* or legendary poems, such as are found among the Russians, although many passages in the ancient chroniclers from their poetical coloring seem to be borrowed from old songs or legends, and the first verses of some of these compositions have been preserved. Mention may here be made of other chroniclers such as Martin the Pole (Polonus) who died in 1279 or 1280, and Jan of Czarnkow, who died in 1389; the latter was the historian and panegyrist of Kazimiérz the Great. With the reign of Kazimiérz III. (1333 to 1370) must be associated the statutes of Wislica. Jadwiga, the wife of Jagiełło, was mainly instrumental in creating the university of Cracow, which was not founded, however, till 1400. In this institution for many years all the great men of Poland were trained—among others Gregory of Sanok, Dlugosz, and Copernicus. Kazimiérz the Great may be said to have laid the foundation of this university. Having obtained the consent of Pope Urban V., he established at Cracow a *studium generale* on the model of the university of Bologna. It consisted of three faculties—Roman law, medicine, and philosophy. But the aristocratic youth still preferred frequenting the universities of Prague, Padua, and Paris, and accordingly the newly-founded *studium* languished. Jadwiga, however, obtained from Boniface IX. permission to create a new chair, that of theology; and the university of Cracow was remodelled, having been reorganized on the same basis as that of Paris. Another university was founded later at Vilna by Batory, and one at Zamość by the chancellor Zamoiski. There were also good schools in various places, such as the Collegium Lubrańskiego of Posen and the school of St. Mary at Cracow. In the year 1474 a press was set up in the latter city, where Günther Zainer printed the first book. The first press from which books in the Polish language appeared was that of Hieronymus Wietor, a Silesian, who commenced publishing in 1515. A few fragments printed in Polish had appeared before this, as the Lord's Prayer in the statutes of the bishops of Breslau in 1475, the story of Pope Urban in Latin, German, and Polish in 1505, etc.; but the first complete work in the Polish language appeared from the press of this printer at Cracow in 1521, under the title *Speeches of the Wise King Solomon.* The translation was executed by Jan Koszycki, as the printer informs us in the preface, and the work is dedicated to Anna Wojnicka, the wife of a castellan. In 1522, a Polish translation of Ecclesiastes appeared from that press, and before the conclusion of that year *The Life of Christ*, with woodcuts, translated into Polish by Balthasar Opec. Many other presses were soon established. Printers of repute at Cracow, during the 16th and beginning of the 17th century, were Sybeneicher and Piotrkowczyk.

Dlugosz.

Little as yet had been produced in Polish, as the chroniclers still adhered to Latin; and here mention must be made of Jan Dlugosz, who called himself Longinus. He was bishop of Lemberg, the capital of Galicia, and has left us a very valuable history which has merits of style and shows considerable research. So anxious was Dlugosz to make his work as perfect as he could that he learned Russian so as to be able to read the *Chronicle* of Nestor. The best part of his book is that which treats of the period between 1386 and 1480. About 1500 was written an interesting little work entitled "Memoirs of a Polish Janissary" (*Pamietniki Ianczara Polaka*). Although written in the Polish language, it was probably the production of a Serb, Michael Konstantinovich of Ostrovitza. He was taken prisoner by the Turks in 1455 and served ten years among the Janissaries, after which he escaped into Hungary. About this time also flourished

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[1] The Psalter is called after Margaret, the first wife of King Louis, who died in 1349, by a mere conjecture. Caro thinks it more probable that the book belonged to Mary, his daughter.

Nicholas Copernicus, a native of Thorn, one of the few Poles who have made themselves known beyond the limits of their country.

The Poles call the period between 1548 and 1606 their golden age. Poland was the great land of Eastern Europe, and owing to the universal toleration encouraged by the government Protestantism was widely spread. Many of the chief nobility were Calvinists, and the Socini came to reside in the country. All this, however, was to pass away under the great Jesuit reaction. At Rakow in Poland was published the catechism of the Socinian doctrines in 1605. The Jesuits made their appearance in Poland in 1564, and soon succeeded in getting the schools of the country into their hands. Besides extirpating the various sects of Protestants, they also busied themselves with destroying the Greek Church in Lithuania. Latin poetry was cultivated with great success by Clement Janicki (1516-1543) but the earliest poet of repute who wrote in Polish is Rej of Nagłowice (1505–69). After a somewhat idle youth he betook himself to poetry. He was a Protestant, and among other religious works translated the Psalms. His best work was *Zwierciadło albo zywot Poczciwego Człowieka* ("The Mirror or Life of an Honorable Man"),—a somewhat tedious didactic piece. He was also the author of a kind of play—a mystery we may term it, and productions of this sort seem to have been common in Poland from a very early time—entitled *Life of Joseph in Egypt*. This piece is interesting merely from an antiquarian point of view; there is but little poetry in it. It teems with anachronisms; thus we have mention of the mass and organs, and also of a German servant.

Kochanowski.

Jan Kochanowski (1530–1584), called the prince of Polish poets, came of a poetical family, having a brother, a cousin, and a nephew who all enriched the literature of their country with some productions. Kochanowski studied for some time at the university of Padua, and also resided in Paris, where he made the acquaintance of Ronsard, then one of the most celebrated poets. He exercised his talents in various ways; thus he has left *The Game of Chess*, an imitation of Vida, and *Proporzec albo Hold Pruski* ("The Standard or Investiture of Prussia"), where he describes the fealty done by Albert of Brandenburg to Sigismund Augustus. He also wrote the first regular play, and executed a translation of the Psalms. The title of his play—a piece of one act, with twelve scenes—is *The Despatch of the Greek Ambassadors*. It is written in rhymeless five-foot iambics, and is altogether a product of the Renaissance, reminding us of some of the productions of George Buchanan. Rhyme is employed in the choruses only. It was acted on the marriage of the chancellor Jan Zamoiski with Christine Radziwill, in the presence of King Stephen and his wife, at Ujazdowo near Warsaw, in 1578. The poet's most popular work, however, is his *Treny* or "Lamentations," written on the death of his daughter Ursula. These beautiful elegies have been justly praised by Mickiewicz; they are enough to raise Kochanowski far above the level of a merely artificial poet. Besides poems in Polish he also wrote some in Latin. It will be observed that we get this double-sided authorship in many Polish writers. They composed for an exclusive and learned circle, certainly not for the Jew, the German trader of the town, or the utterly illiterate peasant. It may be said with truth of Kochanowski that, although the form of his poetry is classical and imitated from classical writers, the matter is Polish, and there is much national feeling in what he has left us. Mention must also be made of his epigrams, which he styled "Trifles" (*Fraszki*); they are full of spirit and geniality. Stanislaus Grochowski (1554–1612) was a priest; but his poetry is of little merit, although he was celebrated in his time as a writer of panegyrics. His satire *Babie Kolo* ("The Women's Circle") gave offence on account of its personalities. A great partisan of the Catholics in the time of Sigismund III. was Caspar Miaskowski, whose *Waleta Wloszczonowska* ("Farewell to his Native Country") deserves mention. Szarzyński, who died young in 1581, deserves notice as having introduced the sonnet to the Poles. This species of poetry was afterward to be carried to great perfection by Mickiewicz and Gaszynski.

Szymonowicz.

Szymonowicz (1554–1624) was a writer of good pastorals. Although they are imitated from classical writers, he has introduced many scenes of national life, which he describes with much vigor. Among the best are "The Lovers," "The Reapers," and "The Cake" (*Kolacz*). Mickiewicz is very loud in his praise, and considers him one of the best followers of Theocritus. The condition, however, of the Polish peasants was too miserable to admit of their being easily made subjects for bucolic poetry. There is an artificial air about the idyls of Szymonowicz which makes one feel too keenly that they are productions of the Renaissance; one of their best features is the humane spirit towards the miserable peasantry which they everywhere display. Another excellent writer of pastorals was Zimorowicz, a native of Lemberg, who died at the early age of twenty-five. Some of his short lyrics are very elegant, and remind us of Herrick and Carew,—*e.g.*, that beginning "Ukochana Lancelloto! Ciebie nie proszę o złoto." Another writer of pastorals, but not of equal merit, was Jan Gawinski, a native of Cracow. Some good Latin poetry was written by Casimir Sarbiewski, better known in the west of Europe as Sarbievius (d. 1640). He was considered to have approached Horace more nearly than any other modern poet, and a gold medal was given him by Pope Urban VIII. Martin Kromer (1512–1589) wrote a history of Poland in thirty books, and another volume, giving a description of the country and its institutions,—both in Latin. The history is written in an easy style and is a work of great merit. A poet of some importance was Klonowicz (1545–1602), who Latinized his name into Acernus, *Klon* being the Polish for maple, and wrote in both Latin and Polish. Sometimes he is descriptive, as in his Polish poem entitled *Flis* ("The Boatman"), in which he gives a detailed account of the scenery on the banks of the Vistula. There is some poetry in this composition, but it alternates with very prosaic details. In another piece, *Rhoxolania*, in Latin, he describes the beauties of Galicia. Occasionally he is didactic, as in *Worek Judaszow* ("The Bag of Judas") and *Victoria Deorum*, where, under the allegory of the gods of Olympus, he represents the struggles of parties in Poland, not without severely satirizing the nobility and ecclesiastics. A curious work called *Quincunx*, written by Orzechowski, is concerned with religious polemics. Andrew Modrzewski, a Protestant, in his work *De Republica Emendanda* (1551), recommended the establishment of a national church which should be independent of Rome, something upon the model of the Anglican.

Skarga.

A florid Jesuitical style of oratory became very popular in the time of Sigismund III., not without rhetorical power, but frequently becoming tawdry. The chief representative of this school was Peter Skarga, one of the main agents in extirpating Calvinism in Poland and the Greek Church in Lithuania. Among his numerous writings may be mentioned *Lives of the Saints*, *Discourses on the Seven Sacraments*, and especially his sermons preached before the diet, in which he lashed the Poles for their want of patriotism and prophesied the downfall of the country. Mecherzynski, in his "History of Eloquence in Poland" (*Historya Wymowy w Polsce*), especially praises his two funeral sermons on the burial of Anna Jagiellonka, widow of Stephen Batory, and Anna of Austria, first wife of Sigismund III. Besides the Latin histories of Wapowski and Gwagnin (Guagnini, of Italian origin), we have the first historical work in Polish by Martin Bielski, a Protestant, viz., *Kronika*

Polska, which was afterwards continued by his son. The author was born in 1495 on his father's estate, Biała, and was educated, like so many other of his illustrious contemporaries, at the university of Cracow. He lived to the age of eighty: but, however great were the merits of his *Chronicle*, it was long considered a suspicious book on account of the leanings of the author to Calvinism. After his death his work was continued by his son Joachim (1540–1599). There is also a *Chronicle* by Bartholomew Paprocki. In 1582 was also published the *Chronicle* of Stryjkowski, full of curious learning, and still of great use to the student of history. Five years later appeared the *Annales Poloniæ* of Sarnicki. The last three works are in Latin.

Spread of Protestantism.

A few words may be said here about the spread of Protestantism in Poland, which is so intimately mixed up with the development of the national language. The doctrines of Huss had entered the country in very early times, and we find Polish recensions of Bohemian hymns; even the hymn to the Virgin previously mentioned is supposed to have a Czech basis. The bishops were soon active against those who refused to conform to the doctrines of the Roman Church. Thus we find that Bishop Andrew of Bnin seized five Hussite priests and caused them to be burnt in the market of Posen in 1439. A hundred years afterwards a certain Katharina Malcher, on account of her Utraquist opinions, was condemned by Gamrat, the bishop of Cracow, to be burnt, which sentence was accordingly carried out in the ragmarket at Cracow. As early as 1530 Lutheran hymns were sung in the Polish language at Thorn. In Königsberg John Seklucyan, a personal friend of Luther, published a collection of *Christian Songs*. He was born in Great Poland, and was at first a Roman Catholic priest in Posen, but afterwards embraced the Protestant faith and was invited by Duke Albert as a preacher to Königsberg, where he died in 1578. He executed the first translation of the New Testament in 1551. Four years afterwards appeared a complete Polish Bible published by Scharffenberg at Cracow. In 1553 appeared at Brześć the Protestant translation of the whole Bible made by a committee of learned men and divines, and published at the expense of Nicholas Radziwiłł, a very rich Polish magnate who had embraced the Protestant doctrines. This book is now of great rarity because his son Christopher, having been induced to become a Roman Catholic by the Jesuit Skarga, caused all copies of his father's Bible which he could find to be burnt. One, however, is to be seen in the Bodleian Library, and another in the library of Christ Church, at Oxford. A Socinian Bible was issued by Simon Budny in 1570 at Nieśwież, as he professed to find many faults in the version issued under the patronage of Radziwiłł; in 1597 appeared the Roman Catholic version of the Jesuit Wujek; and in 1632 the so-called Dantzic Bible, which is in use among Protestants and is still the most frequently reprinted.

Macaronic period.

Up to this time Polish literature, although frequently rhetorical and too much tinctured with classical influences, had still exhibited signs of genius. But now, owing to the frivolous studies introduced by the Jesuits, the so-called macaronic period supervened, which lasted from 1606 to 1764, and was a time of great degradation for the language and literature. The former was now mixed with Latin and classical expressions; much of the literature consists of fulsome panegyric, verses written on the marriages and funerals of nobles, with conceits and fantastic ideas, devoid of all taste, drawn from their coats of arms. The poets of this period are, as may be imagined, in most cases mere rhymsters; there are, however, a few whose names are worth recapitulating, such as Wacław Potocki (c. 1622–c. 1696), now known to have been the author of the *Wojna Chocimska*, or "War of Khotin," the same campaign which afterwards formed the subject of the epic of Krasicki. At first the author was supposed to have been Andrew Lipski, but the real poet was traced by the historian Szajnocha. The epic, which remained in manuscript till 1850, is a genuine representation of Polish life; no picture so faithful appeared till the *Pan Tadeusz* of Mickiewicz. Moreover Potocki had the good taste to avoid the macaronic style so much in vogue; his language is pure and vigorous. He does not hesitate to introduce occasionally satirical remarks on the luxury of the times, which he compares, to its disadvantage, with the simplicity of the old Polish life. There is also another poem attributed to Potocki called the *New Mercury*. In one passage he censures King Michael for ceding Podolia to the Turks. Samuel Twardowski (1600–1660) was the most prolific poet of the period of the Vasas. His most important poem is *Władysław IV., King of Poland*, in which he sings in a very bombastic strain the various expeditions of the Polish monarch. A bitter satirist appeared in the person of Christopher Opalinski (1609–1656). His works were published under the title of *Juvenalis Redivivus*, and, although boasting but little poetical merit, give us very curious pictures of the times. Vespasian Kochowski (born between 1630 and 1633, died in 1699) was a soldier-poet, who went through the campaigns against the Swedes and Cossacks; he has left several books of lyrics full of vivacity. Another poet was Andrew Morsztyn (born about 1620, died about the commencement of the 18th century), an astute courtier, who was finance minister (*podskárbi*) under John Casimir, and was a devoted adherent of the French party at court, in consequence of which, in the reign of Sobieski, he was compelled to leave his native country and settle in France (see p. 290). His poems are elegant and free from the conceits and pedantry of the earlier writers. In fact, he introduced into Poland the easy French manner of such writers as Voiture. He translated the *Cid* of Corneille, and wrote a poem on the subject of Psyche, based upon the well-known Greek myth. History in the macaronic period made a backward step: it had been written in the Polish language in the golden age; it was now again to take a Latin form, as in the *Chronica Gestarum in Europa Singularium* of the ecclesiastic Paul Piasecki (1580–1649), who is an authority for the reigns of Sigismund III. and Władysław IV., and Rudawski, who describes events from the accession of John Casimir to the peace of Oliwa (1648–1660); and as valuable materials for history may be mentioned the five huge volumes of Andrew Chrysostom Załuski (1711), bishop of Warmia. This work is entitled *Epistolæ Historico-Familiares*. It would be impossible to recapitulate here the great quantity of material in the shape of memoirs which has come down, but mention must be made of those of John Chrysostom Pasek, a nobleman of Masovia, who has left us very graphic accounts of life and society in Poland; after a variety of adventures and many a well-fought battle, he returned to the neighborhood of Cracow, where he died between 1699 and 1701. Some of the most characteristic stories illustrating Polish history are drawn from this book. A later period, that of the miserable epoch of Augustus III., is described very graphically in the memoirs of Matuszewicz, first edited by Pawinski at Warsaw in 1876. Relating to the same period are also the memoirs of Bartholomew Michałowski (*Pamietniki Bartłomieja Michałowskiego*). A curious insight into the course of education which a young Polish nobleman underwent is furnished by the instructions which James Sobieski, the father of the celebrated John, gave to Orchowski the tutor of his sons. This has been twice printed in comparatively recent times (*Instrukcya Jakóba Sobieskiego kasztelana Krakowskiego dana panu Orchowskiemu ze strony synów*, Vilna, 1840). The old gentleman in his aristocratic imperiousness frequently reminds us of the amusing directions given by Sir John Wynne to his chaplain, quoted in Pennant's *Tour in Wales*.

A *History of the Lithuanians* in Latin was published by the Jesuit Koiałowicz; the first volume appeared at Dantzic in 1650. A valuable work on the condition of Poland was written by Stanisław Leszczynski, who was twice chosen king, entitled *Głos wolny wolność ubezpieczający* ("A Free Voice Guaranteeing Freedom"), where he tells the Poles some homely and perhaps disagreeable truths illustrating the maxim *Summa libertas etiam perire volentibus.*

Zaluski.

A notable man was Joseph Andrew Załuski, bishop of Kieff, a Pole who had become thoroughly Frenchified—so much so that he preached in French to the fashionable congregations of Warsaw. He collected a splendid library of about 300,000 volumes and 15,000 manuscripts, which he bequeathed to the Polish nation; but it was afterwards carried off to St. Petersburg, where it formed the foundation of the imperial public library. According to Nitschmann in his *Geschichte der Polnischen Litteratur*—a work which has been of service in the preparation of this article—the books were transported to Russia very carelessly, and many of them injured by the way. It was especially rich in works relating to Polish history. Konarski edited in six volumes a valuable work entitled *Volumina Legum*, containing a complete collection of Polish laws from the time of the statute of Wislica. He did much good also in founding throughout the country schools for the education of the sons of the upper classes, but as yet nothing had been done for popular education properly so-called. About the close of this period we have some valuable writers on Polish history, which now began to be studied critically, such as Hartknoch in his *Alt- und Neues Preussen* (1684), a work in which are preserved interesting specimens of the old Prussian language, and Lengnich (1689–1774), author of the valuable *Jus Publicum Regni Poloniæ*, which appeared in 1742.

We now come to the reign of the last Polish king, Stanisław Poniatowski, and the few quiet years before the final division of the country, during which the French taste was all-powerful. This is the second great period of the development of Polish literature, which has known nothing of mediæval romanticism. The literature of the first or Renaissance period gives us some good poets, who although occasionally imitators are not without national feeling, and a goodly array of chroniclers, most of whom made use of Latin. In the second or French period we get verse-makers rather than poets, who long to be Frenchmen, and sigh over the barbarism of their country; but the study of history in a critical spirit is beginning under the influence of Naruszewicz, Albertrandi, and others. In the third period, that of modern romanticism, we get true nationalism, but it is too often the literature of exile and despair. Here may be mentioned, although living a little time before the reign of Stanisław, a Polish poetess, Elizabeth Druzbacka (1695–1760), whose writings show a feeling for nature at a time when verse-making of the most artificial type was prevalent throughout the country. The portrait prefixed to the Leipsic edition of her works is a striking one, representing a handsome, intellectual-looking woman, dressed in the garb of some religious order. Her *Life of David* in verse appears tedious, but many of the descriptions in the *Seasons* are elegant. Unfortunately she introduces Latinisms, so that her Polish is by no means pure. A national theatre was founded at Warsaw in 1765 under the influence of the court, but it was not till long afterwards that anything really national connected with the drama appeared in Poland. Thomas Kajetan Węgierski, who was chamberlain to the king, enjoyed a considerable reputation among his countrymen for his satirical writing. He was a kind of Polish Churchill, and like his English parallel died young (1755–1787). His life also appears to have been as irregular as Churchill's. In consequence of an attack on the empress of Russia, he was compelled to leave Poland, and accordingly made a tour in Italy, France, America, and England, dying at Marseilles at the early age of thirty-three. His poetry shows the influence of the French taste, then prevalent throughout Europe. In times of great national disasters he deserves to be remembered as a true patriot; but the spirit of his poetry is altogether unwholesome. It is the wailing cry of a moribund nation. The great laureate of the court of Stanislaus was Trembecki (1722–1812), whose sympathies were too much with the Russian invaders of his country. He was little more than a fluent poetaster, and is now almost forgotten. One of his most celebrated pieces was *Zofjowka*, written on the country seat of Felix Potocki, a Polish magnate, for this was the age of descriptive as well as didactic poetry. Perhaps the English gave the hint in such productions as "Cooper's Hill." The old age of Trembecki appears to have been ignoble and neglected; he had, indeed, "fallen upon evil days and evil tongues"; and when he died at an advanced age all the gay courtiers of whom he had been the parasite were either dead or had submitted to the Muscovite yoke. He comes before us as a belated epicurean, whose airy trifles cannot be warbled in an atmosphere surcharged with tempests and gunpowder. The end of the 18th century was not the period for a court poet in Poland.

Krasicki.

The most conspicuous poet, however, of the time was Ignatius Krasicki, bishop of Warmia (1735–1801). He was the friend of Frederick the Great and a prominent member of the king's literary club at Sans Souci. Krasicki wrote an epic on the war of Khotin,—the same as had furnished the subject of the poem of Potocki, of which Krasicki in all probability had never heard, and also that of the Dalmatian Gundulić. Krasicki's poem is at best but a dull affair, in fact a pale copy of a poor original, the *Henriade* of Voltaire. His mock heroics are, to say the least, amusing, and among these may be mentioned *Myszeis*, where he describes how King Popiel, according to the legend, was eaten up by rats. His *Monachomachia* is in six cantos, and is a satire upon the monks. The bishop was also the writer of some pretty good comedies. In fact most styles of composition were attempted by him,—of course satires and fables among the number. He presents himself to us much more like a transplanted French abbé than a Pole. In the year 1801 he travelled to Berlin. and died there after a short illness. Among his other works the bishop published in 1781–82 in two volumes a kind of encyclopædia of *belles lettres* entitled *Zbiór Wiadomości*. His estimates of various great poets are not very accurate. Of course he finds Shakespeare a very "incorrect" author, although he is willing to allow him considerable praise for his vigor. Another bishop poet was Adam Naruszewicz. The existence of so many ecclesiastical writers was a natural feature in Polish literature; they formed the only really cultured class in the community, which consisted besides of a haughty ignorant nobility living among their serfs, and (at a vast distance) those serfs themselves, in a brutalised condition. Burghers there were, properly speaking, none, for most of the citizens in the large towns were foreigners governed by the *Jus Magdeburgicum*. Naruszewicz has not the happy vivacity of Krasicki; he attempts all kinds of poetry, especially satire and fable. He is at best but a mediocre poet; but he has succeeded better as a historian, and especially to be praised is his "History of the Polish Nation" (*Historya Narodu Polskiego*), which, however, he was not able to carry further than the year 1386. He also wrote an account of the Polish general Chodiewicz and translated Tacitus and Horace. Interesting memoirs have been published by Kilinski, a Warsaw shoemaker, and Kosmian, state referendary, who lived about this time and saw much of the War of Independence and other political affairs. Among the smaller poets of this period may be mentioned Karpiński (1741–1828), a writer of sentimental elegies in the style then so very much in fashion, and Kniaźnin, who nourished his muse on classical themes and wrote some odes; but his poetry is not of a high order. He was the court poet of Prince Adam Czartoryski at Puławy, and furnished odes in commemoration of all the important events which occurred in the household. He lost his reason on the downfall of Poland, and died after eleven years' insanity in 1807. Julian Ursin Niemcewicz (1757–1841) was one of the most popular of Polish poets at the commencement of the present century (see NIEMCEWICZ). His most popular work is the "Collection of Historical Songs" (*Spiewy Historyczne*), where he treats of the chief heroes of Polish history. Besides these he wrote one or two good plays, and a novel in letters, on the story of two Jewish lovers. John Paul Woronicz (1757–1829) born in Volhynia, and at the close of his life bishop of Warsaw and primate of Poland, was a very eloquent divine, and has been called the modern Skarga. A valuable worker in the field of Slavonic philology was Linde, the author of an excellent Polish dictionary in six volumes. For a long time the cultivation of Polish philology was in a low state, owing to the prevalence of Latin in the 17th century and French in the 18th. No Polish grammar worthy of the name appeared till that of Kopczynski at the close of the 18th century, but the reproach has been taken away in modern times by the excellent works of Małecki and Malinowski. Rakowiecki, who edited the *Rousskaia Pravda*, and Macieiowski (who died in 1883, aged ninety), author of a valuable work on Slavonic law, may here be mentioned. Here we have a complete survey of all the leading codes of Slavonic jurisprudence. At a later period (in 1856) appeared the work of Helcel, *Starodawne prawa polskiégo pomniki* ("Ancient Memorials of Polish Law"). Aloysius Feliński (1771–1820) produced an historical tragedy, *Barbara Radziwiłł*, and some good comedies were written by Count Alexander Fredro (1793–1876). In fact Fredro may be considered the most entertaining writer for the stage which Poland has produced. He introduced genuine comedy among his countrymen. The influence of Molière can be very clearly seen in his pieces; his youth was spent chiefly in France, where he formed one of the soldiers of the Polish legion of Napoleon and joined in the expedition to Russia. His first production was *Pan Geldhab*, written in 1819 and produced at Warsaw in 1821. From 1819 to 1835 he wrote about seventeen pieces and then abandoned publishing, having taken offence at some severe criticisms. At his death he left several comedies, which were issued in a posthumous edition. There is a good deal of local coloring in the pieces of Fredro; although the style is French, the characters are taken from Polish life. From him may be said to date the formation of anything like a national Polish theatre, so that his name marks an epoch. The Poles like many of the other nations of Europe, had religious plays at an early period. They were originally performed in churches; but, Pope Innocent III. finding fault with this arrangement, the acting was transferred to churchyards. Mention has already been made of plays written by Rej and Kochanowski; they are mere fruits of the Renaissance, and cannot in any way be considered national. The wife of John Casimir, a Frenchwoman, Marie Louise, hired a troop of French actors and first familiarized the Poles with something which resembled the modern stage. The Princess Franciszka Radziwiłł composed plays which were acted at her private residence, but they are spoken of as inartistic and long and tedious. The national theatre was really founded in the reign of Stanislaus Augustus; and good plays were produced by Bohomolec, Kamiński, Kropiński, Boguslawski, Zabłocki, and others. Perhaps, however, with the exception of the works of Fredro, the Poles have not produced anything of much merit in this line. A great statesman and writer of the later days of Polish nationality was Kołłątaj, born at Sandomir in 1750. He was a man of liberal sentiments, and, had his plans been carried out, Poland might have been saved. He wished to abolish serfdom and throw open state employments to all. The nobility, however, were too infatuated to be willing to adopt these wise measures. Like the French aristocrats with the reforms of Necker, they would not listen till ruin had overtaken them. During the last war of Poland as an independent country Kołłątaj betook himself to the camp of Kosciuszko, but when he saw that there was no longer hope he went to Galicia, but was captured by the Austrians and imprisoned at Olmütz till 1803. He died in 1812. An active coöperator with Kołłątaj was Salesius Jezerski, who founded clubs for the discussion of political questions, and Stanislaus Staszic, who did much for education and improved the condition of the university of Warsaw.

Polish drama.

Romanticism.

The reputation of all preceding poets in Poland was now destined to be thrown into the shade by the appearance of Mickiewicz (1798–1855), the great introducer of romanticism into the country (see MICKIEWICZ). Poland, as has been said before, is not rich in national songs and legendary poetry, in which respect it cannot compare with its sister Slavonic countries Russia and Servia. Collections have appeared, however, by Wacław Zaleski, who writes under the pseudonyms of Wacław z Oleska, Wojcicki, Roger, Zegota Pauli, and especially Oskar Kolberg. Poland and Lithuania, however, abounded with superstitions and legends which only waited the coming poet to put them into verse. In the year 1851 Romuald Zieńkiewicz published *Songs of the People of Pińsk*, and collections have even appeared of those of the Kashoubes, a remnant of the Poles living near Dantzic. Mickiewicz had had a predecessor, but of far less talent, Casimir Brodzinski (1791–1835). He served under Napoleon in the Polish legion, and has left a small collection of poems, the most important being the idyl *Wiesław*, in which the manners of the peasants of the district of Cracow are faithfully portrayed. The second great poet of the romantic school who appeared in Poland after Mickiewicz was Julius Słowacki (1809–1849), born at Krzemieniec. In 1831 he left his native country and chose Paris as his residence, where he died. His writings are full of the fire of youth, and show great beauty and elegance of expression. We can trace in them the influence of Byron and Victor Hugo. He is justly considered one of the greatest of the modern poets of Poland. His most celebrated pieces are *Hugo; Mnich* ("The Monk"); *Lambro* a Greek corsair, quite in the style of Byron; *Anhelli*, a very Dantesque poem expressing under the form of an allegory the sufferings of Poland; *Krol Duch* ("The Spirit King"), another mysterious and allegorical poem; *Wacław*, on the same subject as the *Marya* of Malczewski, to be afterwards noticed; *Beniowski*, a long poem in *ottava rima* on this strange adventurer, something in the style of Byron's humorous poems; *Kordyan*, of the same school as the English poet's *Manfred; Lilla Weneda*, a poem dealing with the early period of Slavonic history. The life of Słowacki has been published by Professor Anton Małecki in two volumes.

Mickiewicz and Słowacki were both more or less mystics, but even more we may assign this characteristic to Sigismund Krasiński, who was born in 1812 at Paris, and died there in 1859. It would be impossible to analyze here his extraordinary poem *Nieboska Komedja* ("The Undivine Comedy"), *Irydion* and others. In them Poland, veiled under different allegories, is always the central figure. They are powerful poems written with great vigor of language, but enveloped in clouds of mysticism. The life of Krasiński was embittered by the fact that he was the son of

General Vincent Krasinski who had become unpopular among the Poles by his adherence to the Russian Government; the son wrote anonymously in consequence, and was therefore called "The Unknown Poet." Among his latest productions are his "Psalms of the Future" (*Psalmy Przyszłosci*), which were attacked by the democratic party as a defence of aristocratic views which had already ruined Poland. His friend Słowacki answered them in some taunting verses, and this led to a quarrel between the poets. One of the most striking pieces of Krasiński has the title "Resurrecturis." The sorrows of his country and his own physical sufferings have communicated a melancholy tone to the writings of Krasiński, which read like a dirge, or as if the poet stood always by an open grave —and the grave is that of Poland. He must be considered as, next to Mickiewicz, the greatest poet of the country. Other poets of the romantic school of considerable merit were Gorecki, Wicke, Odyniec, and Gaszynski; the last-named wrote many exquisite sonnets, which ought alone to embalm his name. Witwicki (1800–1847) was a son of a professor at Krzemieniec. He was a writer of ballads and poems dealing with rural life, which enjoyed great popularity among his countrymen and had the good fortune to be set to music by Chopin. The historical works of Lelewel have already had separate mention (see LELEWEL); but here may be specified the labors of Narbutt, *Dzieje Starożytne Narodu Litewskiego* ("Early History of the Lithuanian People"), published at Vilna in nine volumes, and the valuable *Monumenta Poloniæ Historica*, edited at Lemberg by Bielowski, of which four volumes have appeared containing reprints of most of the early chroniclers. Bielowski died in 1876.

Ukraine school.

A further development of romanticism was the so-called Ukraine school of poets, such as Malczewski, Goszczynski, and Zaleski. Anton Malczewski (1793–1826), who died at the early age of thirty-three, wrote one poem, *Marya*, which passed unnoticed at the time of its publication, but after its author's death became very popular. Malczewski led a wandering life and became intimate with Byron at Venice; he is said to have suggested to the latter the story of Mazeppa. *Marya* is a narrative in verse, written with much feeling and elegance, and in a most harmonious metre. The chief poem of Goszczynski is *Zamek Kaniowski* ("The Tower of Kanioff'). The most interesting poem of Bogdan Zaleski is his "Spirit of the Steppe" (*Duch od Stepu*). Other poets of the so-called Ukraine school, which has been so well inspired by the romantic legends of that part of Russia, are Thomas or Timko Padoura (who also wrote in the Malo-Russian, or Little-Russian language), Alexander Groza, and Thomas Olizarowski. For many of the original songs and legends we must turn to the work of Messrs. Antonovich and Dragomanoff. Bogdan Joseph Zaleski was born in 1802 in the Ukraine village, Bohaterka. In 1820 he was sent to the university of Warsaw, where he had Goszczynski as a fellow-student. Since 1830 he has resided in Paris. Besides the longer poem previously mentioned, he is the author of many charming lyrics in the style of the Little-Russian poems, such as Shevchenko has written in that language. Michael Grabowski (1805–1863) belongs also to this school by his fine *Melodies of the Ukraine.* A poet of great vigor was Stephen Garczynski (1806–1833), the friend of Mickiewicz, celebrated for his *War Sonnets* and his poem entitled *The Deeds of Wacłow.*

Recent authors.

Among later authors, some of whom still survive, may be mentioned Wincenty Pol, born in 1807 at Lublin. He wrote a fine descriptive work, *Obrazy z Zycia i Podróży* ("Pictures of Life and Travel"), and also a poem, *Piesn o Ziemi Naszej* ("Song of our Land"). For about three years from 1849 he was professor of geography in the university of Cracow. In 1855 he published *Mohort*, a poem relating to the times of Stanisław Poniatowski. Ludwik Władysław Kondratowicz (who wrote chiefly under the name of Syrokomla) was born in 1823 in the government of Minsk. His parents were poor, and he received a meagre education, but made up for it by careful self-culture. One of his most remarkable poems is his *Jan Dęborog*, in which like Mickiewicz, he has well described the scenery of his native Lithuania. He everywhere appears as the advocate of the suffering peasants, and has consecrated to them many beautiful lyrics. In Kaczkowski the Poles have a novelist who has treated many periods of their history with great success. His sympathies, however, are mostly aristocratic, though modified by the desire of progress. An important writer of history is Karl Szajnocha, born in Galicia of Czech parents in 1818. He began his labors with *The Age of Casimir the Great* (1848), and *Bolesław the Brave* (1849), following these with *Jadwiga and Jagiełło*, in three volumes (1855–1856),—a work which Spasovich, in his Russian *History of Slavonic Literature*, compares in vigor of style and fulness of color with Macaulay's *History of England* and Thierry's *Norman Conquest*. Our author was still further to resemble the latter writer in a great misfortune; from overwork he lost his sight in 1857. Szajnocha, however, like Thierry and the American Prescott, did not abandon his studies. His excellent memory helped him in his affliction. In 1858 he published a work in which he traced the origin of Poland from the Varangians (*Lechicki początek Polski*), thus making them identical in origin with the Russians. He began to write the history of John Sobieski, but did not live to finish it, dying in 1868, soon after completing a history of the Cossack wars, *Dwa lata dziejów naszych* ("Two Years of Our History"). A writer of romances of considerable power was Joseph Korzeniowski, tutor in early youth to the poet Krasinski, and afterwards director of a school at Kharkoff. Besides some plays now forgotten, he was author of some popular novels, such as *Wedrówki oryginała* ("Tours of an Original"), 1848; *Garbaty* ("The Hunchback"), 1852, etc. He died at Dresden in 1863. But the most fertile of Polish authors beyond all question is Kraszewski[1] (born in 1812). His works constitute a library in themselves; they are chiefly historical novels, some of which treat of early times in Poland and some of its condition under the Saxon kings. Up to 1879, when he celebrated the fiftieth anniversary of his commencing authorship, he had written two hundred and fifty separate works in four hundred and forty volumes. One of the most popular of his novels is *Jermola the Potter*, a pathetic and noble story, which much resembles George Eliot's *Silas Marner*, but appeared in 1857, some time before the publication of that work. A charge of treason was recently brought against Kraszewski by the German Government, and he is now (1885) undergoing a sentence of imprisonment at Magdeburg. Among the various works of Kraszewski may be mentioned an interesting one on Lithuania (*Litwa*), which contains many valuable accounts of Lithuanian customs; perhaps, however, the historical and philological parts of the work are not always very critically treated. He is the author of two volumes of poetry. As lyrical poets may also be mentioned Jachowicz, Jaśkowski, author of a fine poem *The Beginning of Winter*, Wasilewski, and Holowinski, archbishop of Moghileff (1807–1855), author of religious poems. The style of poetry in vogue in the Polish parts of Europe at the present time is chiefly lyrical. Other writers deserving mention are Cornelius Ujejski (born in 1823), the poet of the last revolt of 1863; Theophilus Lenartowicz (born 1822), who has written some very graceful poetry; Sigismund Milkowski (born in 1820), author of romances drawn from Polish history; for the novel of the school of Sir Walter Scott still flourishes vigorously among the Poles. Among the very numerous writers of romances may be mentioned Henry Rzewuski (1791–1866); Joseph Dzierzkowski wrote novels on aristocratic life, and Michael Czajkowski tales of adventure; Valerius Wielogłowski (1865) gave pictures of country life. Of course at the head of all writers in this department must be considered the unfortunate Kraszewski.

In 1882 the Poles lost, in the prime of life, a very promising historian Szujski (born in 1835), and also Schmitt, who died in his sixty-sixth year. Szujski commenced his literary career in 1859 with poems and dramas; in 1860 appeared his first historical production, *Rzut oka na Historyę Polski* ("A Glance at Polish History"), which attracted universal attention; and in 1862 he commenced the publication in parts of his work *Dzieje Polski* ("The History of Poland"), the printing of which ceased in 1866. The value of this book is great both on account of the research it displays and its philosophical and unprejudiced style. One of the last works of Szujski, written in German, *Die Polen und Ruthenen in Galizien*, attracted a great deal of attention at the time of its appearance. Schmitt got mixed up with some of the political questions of the day—he was a native of Galicia and therefore a subject of the Austrian emperor —and was sentenced to death in 1846, but the penalty was commuted into imprisonment in Spielberg, whence he was released by the revolution of 1848. In 1863 he took part in the Polish rebellion, and was compelled to fly to Paris, whence he only returned in 1871. His chief works are *History of the Polish People from the Earliest Times to the year* 1763 (1854), *History of Poland in the* 18*th and* 19*th Centuries* (1866), and *History of Poland from the time of the Partition* (1868), which he carried down to the year 1832. In opposition to the opinion of many historians, his contemporaries, that Poland fell through the nobility and the diets, Schmitt held (as did Lelewel) that the country was brought to ruin by the kings, who always preferred dynastic interests to those of the country, and by the pernicious influence of the Jesuits. Adalbert Kętrzyński, who succeeded Bielowski in 1877 in his post of director of the Ossolinski Institute at Lemberg, is the author of some valuable monographs on the history of Poland. He was born in 1838. Kasimir Stadnicki has treated of the period of the Jagiellons; and Szaraniewicz, professor at the university of Lemberg, has written on the early history of Galicia. Thaddeus Wojciechowski has published a clever work on Slavonic antiquities. Xavier Liske, born in 1838, and now professor of universal history at Lemberg, has published many historical essays of considerable value, and must be a linguist of great attainments, as separate works by him have appeared in the German, Polish, Swedish, Danish, and Spanish languages. The "Sketch of the History of Poland" (*Dzieje Polskie w Zarysie*) by Michael Bobrzyński, born in 1849 in Cracow (where he is professor of Polish and German law), is a very spirited work, and has given rise to a great deal of controversy on account of the opposition of many of its views to those of the school of Lelewel. Vincent Zakrzewski, now professor of history at Cracow, has written some works which have attracted considerable attention, such as *On the Origin and Growth of the Reformation in Poland*, and *After the Flight of King Henry*, in which he describes the condition of the country during the period between that king's departure from Poland and the election of Stephen Batory. Smołka has published a history entitled *Mieszko the Elder and his Age*. Władysław Wisłocki has prepared a catalogue of manuscripts in the Jagiełłon library at Cracow. Dr. Joseph Casimir Plebanski is now editor of the *Biblioteka Warszawska*, a very valuable literary journal which stands at the head of all works of the kind in Poland. He has also written a dissertation (in Latin) on the *liberum veto*, which puts that institution in a new light. Felix Jezierski, the previous editor of the above-mentioned journal, published in it translations of parts of Homer, and is also the author of an excellent version of *Faust*.

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[1] [Joseph Ignatius, died March 20, 1887, an exile in Geneva, was buried in Cracow with the highest popular honors tolerated by the government censor.—AM. ED.]

The history of Polish literature has not been neglected. We first have the early history of Felix Bentkowski (1781–1852), followed by that of Michael Wiszniewski (1794–1865), which, however, only extends to the 17th century, and is at best but a quarry of materials for subsequent writers, the style being very heavy. A "History of Eloquence" (*Historya Wymowy w Polsce*) was published by Karl Mecherzyński. An elaborate history of Polish literature is now in course of preparation by Anton Małecki, who is the author of the best Polish grammar (*Gramatyka Historyczno-Porównawcza Jezyka Polskiego*,, 2 vols., Lemberg, 1879). The Polish bibliography by Karl Estreicher, now director of the Jagiełłon library at Cracow, is a work of the highest importance. One of the most active writers on Polish philology and literature is Władysław Nehring, whose numerous contributions to the *Archiv für Slavische Philologie* of Professor Jagic entitle him to the gratitude of all who have devoted themselves to Slavonic studies. Władimir Spasowicz, a lawyer of St. Petersburg, has assisted Pîpin in his valuable work on Slavonic literature. The lectures of Professor Cybulski (*ob*. 1867) on Polish literature in the first half of the 19th century are written with much spirit and appreciation. The larger poetical works which appear during that time are carefully analyzed.

In recent times many interesting gelogical and anthropological investigations have been carried on in Poland. In 1868 Count Constantine Tyszkiewicz published a valuable monograph on the *Tombs of Lithuania and Western Ruthenia*. A diligent searcher for antiquities is Prof. Joseph Łepkowski of Cracow, who has greatly enriched the archæological museum of his native city.

In philosophy the Poles (as the Slavs generally) have produced but few remarkable names. Goluchowski, the brothers Andrew and John Sniadecki, the latter of whom has gained a reputation almost European, Bronislaw, Trentowski, Karol Liebelt, and Joseph Kremer deserve mention. August Cieszkowski has written on philosophical and economic subjects. Moritz Straszewski, the present professor of philosophy at the university of Cracow, has also published some remarkable works.

Mention has already been made of the poetess Elizabeth Druzbacka. Female writers are not very common among Slavonic nations. Perhaps the most celebrated Polish authoress was Klementina Hoffmann, whose maiden name was Tanska, born at Warsaw in 1798. She married Karl Boromäus Hoffmann, and accompanied her husband, in 1831, to Passy near Paris, where she died in 1845. Her novels still enjoy great popularity in Poland. Of the poetesses of later times Gabriele Narzyssa Zmichowska (1825–1878), Maria Ilnicka, translator of Scott's *Lord of the Isles*, and Jadwiga Luszczewska may be mentioned.

A poet of considerable merit is Adam Asnyk, born in 1838. In his poetry we seem to trace the steps between romanticism and the modern realistic school, such as we see in the Russian poet Nekrasoff. In some of the flights of his Muse he reminds us of Słowacki, in the melody of his verse of Zaleski. Besides showing talent as a poet, he has also written some good plays, as "The Jew" (*Zid*), *Cola di Rienzi*, and *Kiejstut*. Other living poets worthy of mention are Zagorski, Czerwienski, and Maria Konopnicka, who has published two volumes of poems that have been very favorably noticed. Mention must also be made of Bałucki, born at Cracow in 1837, and Narzymski (1839–1872), who was educated in France, but spent part of his short life in Cracow, author of some very popular tales.

The four centres of Polish literature, which, in spite of the attempts which have been made to denationalize the country, is fairly active, are Cracow, Posen, Lemberg, and Warsaw. A few years ago a cheap edition of the leading Polish classics, well adapted for dissemination among the people, was published under the title of *Biblioteka Polska*, at Cracow, which shows a great deal of vitality and is an interesting city. Not only arė the professors of its university some of the most eminent living Poles, but it has been chosen as a place of residence by many Polish literary men. The academy of sciences, founded in 1872, celebrated the bicentenary of the raising of the siege of Vienna by Sobieski by publishing the valuable *Acta Joannis III. Regis Poloniæ*. Somo good Polish works have been issued at Posen, but it is becoming extremely Germanized, and no part of the original kingdom of Poland has undergone so much change as this. At Lemberg, the capital of Austrian Galicia, there is an active Polish press. Here appeared the *Monumenta Poloniæ Historica* of Bielowski, previously mentioned; but Polish in this province has to struggle with the Red-Russian or Ruthenian, a language or dialect which for all practical purposes is the same as the Southern or Little Russian. At Warsaw, since the last insurrection, the university has become entirely Russianized, and its *Transactions* are published in Russian; but Polish works of merit still issue from the press,—among others the leading Polish literary journal, *Biblioteka Warszawska*. (W. R. M.)

POLAND, Russian. After the three dismemberments of the old kingdom, the name of Poland was chiefly retained by the part of the divided territory annexed to Russia. Since the insurrection of 1863, however, the name "kingdom of Poland" has disappeared. Thenceforward this portion of the Russian empire is referred to in official documents only as the "territory of the Vistula," and later on as the "Vistula government." Nevertheless the geographical position of Russian Poland, its ethnographical features, its religion, and its traditions differentiate it so widely from the remainder of the Russian empire that the name of Poland still survives in current use. The area of this territory is 49,157 square miles, and the population exceeds 7,300,000. See RUSSIA, and map accompanying that article.

Surface.

Projecting to the west of Russia in a wide semicircle between Prussia and Austria, it is bounded on the N. by the provinces of western and eastern Prussia, on the W. by Posen and Prussian Silesia, on the S. by Galicia, and on the E. by the Russian governments of Volhynia, Vilna, Grodno, and Kovno. It consists for the most part of an undulating plain, 300 to 450 feet above the sea, which joins the lowlands of Brandenburg in the west, and the great plain of central Russia in the east. A low swelling separates it from the Baltic Sea; while in the south it gradually rises to a range of plateaus which imperceptibly blend with the spurs of the Carpathians. These plateaus, with an average height of from 800 to 1000 feet, occupy all the southern part of Poland. They are mostly covered with beautiful forests of oak, beech, and lime, and are deeply cut by the valleys of rivers and numerous streams, some being narrow and craggy, and others broad, with gentle slopes and marshy bottoms. Narrow ravines intersect them in all directions, and their surface often takes, especially in the east, the *puszcza* character,—in other words, that of wild, unpassable, woody, and marshy tracts. In these tracts, which occupy the southeastern corner of Poland, and are called Podlasie, the neighborhood of the Polyesie of the Pripet is felt. The Vistula, which borders these plateaus on the southwest, at a height of 700 to 750 feet, has to penetrate them before finding its way to the great plain of Poland, and thence to the Baltic. Its valley divides the hilly tracts of Poland into two parts,—the Lublin heights in the east, and the Sędomierz (Sandomir), or central, heights in the west. These last are diversified by several ridges which run east-southeast, parallel to the Beskides, the highest of them being those of the "Bald" or "Holy Cross Mountains" (Łysogórski, or Swiętokrzyski), two summits of which respectively reach 1813 and 1961 feet above the sea. Another short ridge, the Chęcinski hills, follows the same direction along the Nida river, reaching 1135 feet at Zamkowa Góra. South of the Nida, the Olkusz Hills, already blended with spurs of the Beskides, fill up the southwest corner of Poland, reaching 1473 feet at Podzamcze, and containing the chief mineral wealth of the country; while a fourth range, from 1000 to 1300 feet high, runs northwest past Częstochowo, separating the Oder from the Warta. In the north, the plain of Poland is bordered by a flat and broad swelling, 600 to 700 feet above the sea, dotted with lakes, and recalling the lake regions of northwestern Russia. Its gentle southern slopes occupy the northern parts of Poland, while the province of Suwałki, projecting as a spur towards the northeast, extends over the flat surface of this swelling. Wide tracts covered with sands, marshes, peat-bogs, ponds, and small lakes, among which the streams lazily flow from one marsh to another, the whole being covered with poor pine-forests and a scanty vegetation, with occasional patches of fertile soil—such are the general characters of the northern border-region of the great plains of central Poland.

These plains extend in a broad belt, 150 miles wide, from the Oder to the upper Niemen and the marshes of Pinsk, gently sloping towards the west, and slowly rising towards "the woods" of Volhynia and Grodno. Few hills raise their flat tops above the surface, the irregularities of which for the most part escape the eye, and can be detected only by levellings. As far as the eye can see, it perceives a plain; and each hill, though but a few hundred feet above its surface, is called a "góra" (mountain). The rivers flow in broad, level valleys, only a few hundred or even only a few dozen feet lower than the watersheds; they separate into many branches, enclosing islands, forming creeks, and covering wide tracts of land during inundations. Their basins, especially in the west, are mixed up with one another in the most intricate way, the whole bearing unmistakable traces of having been in recent geological and partly in historical times the bottom of extensive lakes, whose alluvial deposits now yield rich crops. The fertility of the soil and the facility of communication by land and by water have made this plain the very cradle of the Polish nationality, and every furlong of it to the Pole is rich in historical memories. The very name of Poland is derived from it,—Wielkopolska and Wielkopolane being the Slavonian for the great plain and its inhabitants.

Rivers.

Russian Poland belongs mostly, though not entirely, to the basin of the Vistula—its western parts extending into the upper basin of the Warta, a tributary of the Oder, and its northeast spur (Suwałki) penetrating into the basin of the Niemen, of which it occupies the left bank. For many centuries, however, the Poles have been driven back from the mouths of their rivers by the German race, maintaining only the middle parts of their basins.

The chief river of Poland, and the very cradle of the Polish nationality, is the Vistula (Pol., *Wisła*), the *Vandalus*, *Visula* and *Istula* of antiquity. It has a length of 620 miles, and a drainage area of 72,000 square miles. It rises in Galicia, in the Beskides, 3675 feet above the sea, where the Black and White Vistulas unite. Flowing first northeast, in an elevated valley between the Beskides and the Sandomir heights, it separates Russian Poland from Galicia, and already at Cracow has a breadth of 90 yards. It enters Russian Poland at Zawichwost, 473 feet above the sea. After having received the San, it turns north, traversing for some 35 miles a broad valley deeply cut through the plateaus of southern Poland. This valley reaches at several places a width of 10 miles between the limestone crags which border it on both sides, the space between being occupied by two alluvial terraces, where the river winds freely, divides into several branches, and frequently changes its bed. Here it has a speed of 8 feet per second, with a gradient of 1.3 to 1.5 feet per mile, and a depth ranging from 4 to 20 feet. About Jusefow (51° N. lat.) it enters the great central plain, where it flows north and west-northwest between low banks, with a breadth of 1000 yards. Its inundations, dangerous even at Cracow, become still more so in the plain, where the accumulations of ice in its lower course obstruct the outflow, or the heavy rains in the Carpathians raise its level. Dams 20 to 24 feet high, are maintained at great expense by the inhabitants for 60 miles, but they do not always prevent the river from inundating the plains of Opolic and Kozienic, the waters sometimes spreading as far as 150 miles to the east. Below Warsaw (267 feet) it frequently changes its bed, so that, for example, Płock (180 feet), which formerly was on its left bank, is now on the right. About Thorn it enters Prussia, and a few miles below this town it finds its way through the Baltic ridge flowing in a northeast direction and entering the Baltic Sea in the Frische-Haff at Dantzic. On the whole, it is what the physical geographer would call a "young" river, which is still excavating its bed, and probably on this account few towns of importance are situated on the Vistula in Russian Poland, the principle being Sędomierz, Warsaw and Płock, and the fortresses of Ivangorod and Novogeorgievsk (Modlin), while very many small towns have sprung up within short distances from its course. It is navigable almost from Cracow for small boats and rafts, which descend it at high water. Real navigation begins, however, only below its confluence with the Wieprz, the middle and lower Vistula being the chief artery for the traffic of Poland. Thousands of rafts and boats of all descriptions descend every year, with cargoes of corn, wool, timber and wooden wares, giving occupation to a large number of men. Steamers ply as far as to Sędomierz.

The Vistula receives many tributaries, the most important being the San, the Wieprz and the Bug on the right, and the Nida and the Pilica on the left. The San (220 miles) rises in Galicia, in the same part of the Carpathians as the Dneister, and flows northwest, close to the southern frontier of Poland; it is navigable downwards from Dynow, and is ascended by boats as far as Yarosław in Galicia. The Wieprz (180 miles) is the chief artery of the Lublin government; it flows northwest past Lublin and Lubartow, joining the Vistula at Ivangorod. It is navigable for small boats and rafts for 105 miles from Krasnostaw. The Bug, which describes a wide curve concentric with those of the middle Vistula and Narew, rises to the east of Lwow (Lemberg) and flows north and west, past Hrubieszow, Chełm and Brest-Litowski, separating the Polish provinces of Lublin and Siedlce from Volhynia and Grodno. It joins the Vistula a few miles below its confluence with the Narew, some 20 miles below Warsaw, after a course of more than 675 miles. Only light boats (*galary*) are floated down this broad but shallow stream, whose flat and open valley is often inundated. Its great tributary, the Narew (150 miles), brings the forest-lands of Byełowezha into communication with Poland, timber being floated down from Surazh and light boats from Tykocin. The mountain-stream Nida waters the hilly tracts of Kielce, and, rapidly descending southeast, joins the Vistula close by the Opatowiec customhouse. The Pilica rises in the southwestern corner of Poland, and flows for 135 miles north and east in a broad, flat, sandy or marshy valley, of evil repute for its unhealthiness; it joins the Vistula at Mniszew, 30 miles above Warsaw.

The Warta (450 miles) rises in the Częstochowo hills, 909 feet above the sea, and flows north and west past Sieradz (448 feet) and Koło. Below Częstochowo it waters a flat lowland, whose surface rises only from 2 to 5 feet above the level of the river, and the inhabitants have a constant struggle to keep it to its bed; the country is, however, so low that every spring an immense lake is formed by the river at the mouth of the Ner; as regards its right hand tributaries, it is almost impossible to define them from those of the Bzura, tributary of the Vistula, amidst the marshy grounds where both take their origin. The Warta turns west at Koło and leaves Poland at Pyzdry in the government of Kalisz; it serves to convey timber to Prussia.

The Niemen, which has a total length of 500 miles and a basin of 40,000 square miles, flows along the northeast frontier of Poland, from Grodno to Yurburg, separating it from Lithuania. Already 70 yards wide at Grodno, it advances northwards in great windings, between limestone hills covered with sand, or amidst forests, past numerous ruins of castles, or *koorgans*, which witness the battles that have been fought for its possession. The yellowish sandy plains on its left allow only the cultivation of oats, buckwheat and some rye. The river flows so slowly below Kovno as to seem almost stationary; it often changes its bed, and, notwithstanding repeated attempts to regulate it, offers great difficulties to navigation. Still, large amounts of corn, wool, and timber are floated down, especially after its junction with the Black Hancza, giving occupation to about 90,000 men. A little above Kovno the Niemen turns west, and after having received the Wilja from the right, it attains a width of nearly 500 yards. At Yurburg it enters eastern Prussia, and reaches the Baltic Sea at the Kurische-Haff. Of its tributaries in Poland, only the Hancza Czarna and the Szeszupa, which winds through the province of Suwałki, are worthy of mention.

Lakes.

Lakes are numerous in the province of Suwałki, amounting there to over five hundred; but the largest of them, Wigry, traversed by the Hancza, covers only 11,000 acres. They are mostly concealed amid thick coniferous or birch forests, and their waters stretch with undefined banks amidst marshes, sands, or layers of boulders thickly covered with moss. Another group of some one hundred and twenty small lakes is situated in the basin of the Warta (north part of Kalisz), the largest being Gopło, 18 miles long and 100 feet deep, surrounded by many smaller lakes, and receiving the Noteć river. It was much larger even within historical times, and was well known from being situated on the highway from the Adriatic, *via* Koło on the Oder, to the basin of the Vistula.

Canals.

Though navigable for a few months only, the rivers of Poland have always been of considerable importance for the traffic of the country, and this importance is further increased by several canals connecting them with Russian and German rivers. The Niemen is connected with the Dnieper by the Oginski Canal, situated in the Russian government of Minsk. The Dnieper-and-Bug (Horodecki, Brzeski, also Królewski) Canal in Grodno connects the Mukhavets, tributary of the Bug, with the Pina of the basin of the Pripet, that is, the Dnieper with the Vistula. The Vistula is connected also with the Oder by the Bydgoski or Bromberg Canal in Prussia, which connects the Brda, of the basin of the Vistula, with the Noteć, or Netze, tributary of the Warta. All these canals are, however, beyond Russian Poland. In Poland proper, the Augustowski Canal connects the Vistula with the Niemen, by means of the Hancza, Netta, Biebrz and Narew. Another canal, to the west of Łęczyca, connects the Bzura, a tributary of the Vistula, with the Ner and Warta; and the bed of the former has recently been altered so as to obtain regular irrigation of the rich meadows extending along its banks.

Geology.

With the exception of its southern parts, Poland is built up almost exclusively of Secondary and Tertiary formations, covered with a thick sheet of Quaternary deposits. The non-schistous rocks are represented only by a small patch of porphyries near Chęcin, and another of basalts at the castle of Tęczyński. Small deposits of quartzites in the Dyminski Hills, characterised by the *Orthis kielcensis*, Röm., which formerly were considered as Devonian, belong to the Silurian as also a few dolomites appearing from beneath the Devonian Old Red Sandstone and limestones. The last two cover wide tracts in the province of Kielce, and in the district of Będzin, on the Silesian frontier. The Devonian limestones of Kielce, which contain the *Orthis striatula*, *Spirifer inflatus*, *Atrypa reticularis*, *A. desquamata*, *Leptæna interstrialis*, *Bronteus flabellifer*, *Spirifer verneuili*, and *Rhynchonella cuboides*, thus exhibit a fauna closely akin to that of the Devonian of Germany and Belgium, or the lowest part of the Upper Devonian—the so-called "*Cuboides*-Schichten." The hard sandstone of Dombrowa, Brzezina, etc., with *Chonetes sarcinulata*, *Spirifer paradoxus*, *S. cultrijugatus*, and *Pterinea pailletei*, is certainly Lower Devonian. This formation contains the chief mineral resources of Poland.

The Carboniferous formation appears in the Olkusz and Będzin districts. It consists of sandstones and clays, with layers of coal 30 feet thick. The Permian is represented by porphyric tuffs in the Olkusz district, "Zechstein" characterized by *Productus horridus*, Sow., at Kielce, and a breccia consisting of Devonian boulders. The Trias is widely spread. It consists of variegated sandstones, characterized by *Myophoria costata*, occurring extensively in the governments of Kielce and Radom, yielding a fine building stone. The red sandstones north and west of Kielce, considered as Permian on Pusch's map, probably belong to the same formation, like the red sandstones in the most northern parts of the Kielce mountains. The "Muschelkalk" appears in the districts of Olkusz and Będzin, as also in the Kielce mountains, and has great importance, containing as it does zinc, tin and iron ores. The "Keuper" in the governments of Kielce, Piotrków, and Radom consists of sandstones, dolomites, and limestones, and contains brown coal and iron ores.

The Jurassic formation is widely spread; in southwest Poland it occupies the space from Olkusz to Wielun, and consists of brown and white "Jura," the whitish crags of which give pleasing landscapes at Ojcowo and on the Pilica. The Oolite crags of Ojcowo contain numerous caverns, renowned for their bone deposits, worked out for manure, and for their numerous and remarkable Quaternary fossils. That of Jerzmanowice, close by Ojcowo, the largest of the series, has a length of 750 feet. The Cretaceous formation, which covers very large tracts throughout Poland, consists of lower series of sandstones, and of an upper series containing chalk and limestone, and yielding very fertile marls. They are covered with Tertiary limestones and gypsums, which, together with Cretaceous deposits, cover nearly the whole of the central plain and the northern provinces. The layers of sulphur at Kielce, 7 to 70 feet thick, belong to the Tertiary.

The whole is covered with Quaternary deposits, reaching at several places a very great thickness. They are chiefly made up of boulder clay containing Scandinavian erratics of all sizes up to 5 and 7 feet in diameter. The Baltic ridge is quite covered with them, their southern limit extending to 51° N. lat., or perhaps even to 50°, as the longitudinal valleys of the Kielce hills also contain layers of Scandinavian boulders. Diluvial and alluvial sands and clays cover the glacial deposits; and everywhere in Poland one meets with remains of extensive lakes that filled up all depressions of the country during the post-Glacial period. Thick peat-bogs are being formed in the moister depressions, and cover an aggregate surface of no less than 2,800,000 acres.

In these lacustrine deposits numerous traces of prehistoric man have been found, but the old lake beds still await a more thorough exploration. The bone caves at Ojcowo have yielded rich finds of extinct mammals, thirty-two species of which are familiar to explorers of British caverns; the cave-bear alone has yielded full four thousand canine teeth, while the mammoth, the woolly rhinoceros, the cave hyæna, and especially the reindeer, are represented by numerous remains. The bones of extinct mammals have been found in association with very numerous relics of man, some of which are most probably Palæolithic, while the great number belong to the Neolithic period,—those cave-inhabitants being in some instances dolichocephalic, like those of the shores of post-Glacial lakes, and in others mesocephalic.

Minerals.

Southern Poland is rich in minerals, especially in the Kielce mountains and the region adjacent to Prussian Silesia. The Devonian sandstones contain malachite ores at Medziana Góra, near Kielce, and copper has been worked there since the 15th century. In the years 1816–1826, 65,000 cwts. of copper ore were extracted but the mines are now neglected. The brown iron ores, also Devonian, of Kielce, and especially those of Daleszyc, contain no less than 40 per cent. of iron. The Triassic zinc ores of the Olkusz district, more than 50 feet thick at Bolsław, contain 8 to 14 per cent., sometimes 25 per cent., of zinc; and in 1879, 2,866,000 cwts. of ore were extracted from nine pits, yielding about 100,000 cwts. of zinc. The tin ores of Olkusz, also Triassic, are still more important, and were extensively wrought as early as the 16th century, notwithstanding the difficulties arising from the presence of water; they are reported to have then yielded more than 35,000 cwts. per annum. In 1878 the very fluctuating yield reached only 8,960 cwts. Brown iron ores appearing in the neighborhood of Będzin as lenses 55 feet thick, and containing 25 to 33 per cent. of iron accompany the Triassic zinc ores. Spherosiderites and brown iron ores are also widely spread in the "Keuper." Sulphur is wrought at Czarkowa, in the district of Pinczow; the deposits, which contain 25 per cent. of sulphur, reach a thickness of 7 to 70 feet, and the amount of sulphur is estimated at 1,300,000 cwts.

Carboniferous coal is spread in southwest Poland over a surface of about 200 square miles in the districts of Będzin and Olkusz, which are estimated to contain 732,000,000 cubic yards of coal. The Triassic brown coal, which appears in the Olkusz district in layers 3 to 7 feet thick, has lately been worked out, the single pit of St. John yielding in 1879 204,200 cwts. of coal. Of other mineral produce, chalk exported from Lublin, a few quarries of marble, and many of building stones are worthy of notice. Mineral waters are used medicinally at Ciechocin and Nałęchow.

Climate. With the exception of the Lysa Góra hilly tracts (Kielce and South Radom), which lie within the isotherms of 41° and 42°, Poland is situated between the isotherms of 42° and 46°. The isotheres and isocheims (*i. e*, lines of equal mean summer and winter temperature) crossing one another at right angles, and the former running east northeast, Poland is included between the isotheres of 64° and 61° and the isocheims of 35.7° and 39.2°. The prevailing winds are westerly, with north-northeast and south winds in autumn and winter, and east winds in spring. The number of rainy and snowy days varies from 152 to 158, increasing towards the Baltic, with an average of 21.7 to 23.6 inches of rainfall in central Poland, which figures slowly increase also towards the south on account of the proximity of the Carpathians, where they reach 30.3 inches. Of the above amounts, about 17 per cent. fell in spring, 29 per cent. in summer, 21 per cent. in autumn, and 33 per cent. in winter. Owing to this distribution the snow-covering in Poland is not very thick, and the spring sets in early. Still frosts, lowering the thermometer to - 4° and - 22° Fahr. are not uncommon, and the rivers are covered with ice for two and a half to three months,—the Warta being under ice for 70 and 80 days, the Vistula at Warsaw for 80 days and (exceptionally) even for 116, and the Nieman for 100 (exceptionally for 140).

The following averages may help to give a more adequate idea of the climate of Poland:

	Warsaw.	Vilna.
Earliest frost..................................	Oct. 18	Oct. 17
Latest frost..................................	Mar. 15	Mar. 25
Average maximum temperature...	85.7°	85.1°
Average minimum " ...	1.7°	—9.6°
Absolute maximum " ...	95.5°	89.3°
Absolute minimum " ...	37.6°	—39.0°
Bright days..................................	40	23
Cloudy days..................................	154	175
Annual rainfall (total)..................	22.8 in.	7.6 in.
Rainfall—November to March......	6.7 in.	4.7 in.
Prevailing winds in January	S.E.	S.
" " in July.....	W.	W.
" " during the year..	S.E.	W.

Flora. The flora of Poland is more akin to that of Germany than to that of Russia, several middle European species finding their northeast limits in the basin of the Niemen or in the marshes of Lithuania. Coniferous forests consisting mostly of pine (*Pinus sylvestris*), and birch cover large tracts in Mazovia, extending over the Baltic lake-ridge, reaching southwards as far as the junction of the Bug with the Narew, and joining in the southeast the "Polyesie" of the Pripet. The pine covers also the Lysa Góra hills and those on the San. The larch (*Larix europæa*), which three centuries ago covered large tracts has almost entirely disappeared; it is now met with only in the Samsonowski forests of Sandomeria. The *Pinus Cembra* is only remembered, as also the *Taxus baccata*, which has but a few representatives in Sandomerian forests, on the Pilica, on the *puszczas* of Ostrołęka, and in the Preny forests on the Niemen. The *Picea obovata* is cultivated.

Of leaf-bearing trees, the common beech (*Fagus sylvatica*) is the most typical of the Polish flora; it extends from the Carpathians to 52° N. lat., and three degrees farther north in small groups or isolated specimens; the confluence of the Bug and Narew may still be regarded as its eastern limit. The white beech (*Carpinus Betulus*), the aspen (*Populus tremula*), and two elms (*Ulmus campestris, U. effusa*) are found nearly everywhere, mingled with other trees in forests. The same is true with regard to the lime-tree (*Tilia parvifolia*), which appears in groves only in the east (Niemen, Pripet, Lublin). It is the most popular tree with the Poles, as the birch with the Russians; judgment of old was pronounced under its shade, and all the folk-lore songs repeat its name. The oak—a highly venerated tree in Poland, though not so much as in Lithuania—grows in forests only on the most fertile patches of land, but it is of common occurrence in conjunction with the beech, elm, etc. The maples (*Acer platanoides* and *A. pseudoplatanus*) are somewhat rare; the black alder (*Alnus glutinosa*) covers the banks of the rivers and canals, and the *Alnus incana* is common. The willow, and the orchard trees—apple, pear, plum, and cherry—are cultivated everywhere.

The flora of Poland contains 12 per cent. of *Compositæ*, 6 per cent. of *Leguminosæ*, 2 per cent. of *Labiatæ*, 4 per cent. of *Umbelliferæ*, 5 per cent. of *Cruciferæ*, and 2 per cent. of *Coniferæ*.

The wheat frontier coincides very nearly with that of the leaf-bearing forests. It yields good crops on the fertile tracts of Sandomeria and Lublin, and on the plains of the Vistula and Wartha, but does not thrive very well beyond 52° N. lat. Rye, oats, barley, buckwheat, and hemp are cultivated everywhere, and flax in the east; hops are very common, and tobacco-culture has been begun in the south. Some attemps in sericulture have been made with success.

Fauna. The fauna of Poland belongs to the middle European zoological group; within the historical period it has lost such species as formerly gave it a subarctic character. The reindeer now occurs only as a fossil; the sable mentioned in the annals, has migrated eastwards; the wild horse, also, described by the annals as intermediate between the horse and the ass—probably like the recently discovered *Equus przewalskii*—is said to have been met with in the 13th century in the basin of the Warta, and two centuries later in the forests of Lithuania. The wild goat, bison, and elk have migrated to the Lithuanian forests. The lynx and beaver have also disappeared. The brown bear continues to haunt the forests of the south, but it is becoming rarer in Poland; the wolf, the wild boar, and the fox are most common throughout the great plain, as also the hare and several species of *Arvicola*. The mammals in Poland, however, do not exceed fifty species. The avi-fauna, which does not differ from that of central Europe, is represented by some one hundred and twenty species, among which the singing birds (*Dentirostræ* and *Conirostræ*) are the most numerous. On the whole Poland lies to the westward of the great line of passage of the migratory birds, and is less frequented by them than the steppes of southwest Russia. Still, numerous aquatic birds breed on the waters of the Baltic lake-region.

Population. The population of Poland, 6,193,710 in 1871, reached 7,319,980 in 1881, showing an increase of 1.8 per cent. per annum during the ten years, and an average of 15 persons per square mile. Of these 17 per cent lived in towns. They were distributed as follows:

Governments.	Area, Square Miles.	Total Population, 1881.	Urban Population.	Per Square Mile.
Kalisz.........	4,391	765,403	96,848	17.4
Kielce.........	3,897	622,842	38,493	16.0
Łomża.........	4,667	538,588	51,554	11.5
Lublin	6,499	860,382	78,867	13.2
Piotrków.....	4,730	837,928	144,246	17.7
Płock.........	4,200	538,141	78,797	12.8
Radom	4,769	633,715	69,058	13.3
Siedlce.........	5,535	616,649	117,011	11.1
Suwałki	4,846	603,174	61,827	12.4
Warsaw.......	5,623	1,303,158	485,852	23.2
Total......	49,157	7,319,980	1,222,553	14.9

The bulk of the population are Poles. During prehistoric times the basin of the Vistula seems to have been inhabited by a dolichocephalic race, different from the brachycephalic Poles of the present day; but from the dawn of history the Slavonians (Poles), mixed to some extent with Lithuanians, are found on the plains of the Vistula and Warta. The purest Polish type is found in the basin of the middle Vistula and in Posen; in the northeast there is a Lithuanian admixture, and in the southeast a Little Russian. The geographical domain of the Poles corresponds approximately with the limits of Russian Poland. Some 250,000 Lithuanians (277,000 or 284,000, according to other enumerations) occupy the north part of Suwałki, their southern limit being the Hancza river and the towns Seino and Suwałki; while the Ruthenians (about 560,000 in 1873) appear in compact masses in the east and southeast, occupying the whole space between the Bug and the Wieprz as far as Siedlce, as also the region between the upper Wieprz and the San. The White Russians number 27,000 in the north-east and east, and the Great Russians 12,000. The Poles extend but little beyond the limits of Russian Poland. In east Prussia they occupy the southern slope of the Baltic ridge (the Mazurs); and on the left bank of the lower Vistula they spread to its mouth (the Kaszubes). Westward they occupy a strip of land of an average breadth of 50 miles in Brandenburg, Posen, and Silesia, stretching down the Warta as far as to Birnbaum (100 miles east of Berlin); and in the south they extend along the right bank of the Vistula in western Galicia to the San. In Russia they constitute, with Jews, Lithuanians, Ruthenians, and White Russians, the town population, as also the landed nobility and *szlachta*, in several provinces west of the Dwina and the Dnieper. Their numbers in these provinces may be seen from the following figures:

Governments.	Population (1867).	Number of Poles.	Percentage of Poles.	Probable No. of Poles in 1881.
Vilna...........	973,570	143,290	14.7	175,000
Podolia........	1,946,760	233,650	12.0	269,000
Volhynia......	1,643,270	172,405	10.5	215,000
Minsk	1,135,590	117,750	10.4	160,500
Grodno........	958,850	89,850	9.3	112,700
Vitebsk........	838,050	40,725	4.9	54,950
Kieff............	2,144,280	71,640	3.3	87,650
Moghileff.....	908,860	26,115	2.9	32,700
Kovno....	1,131,250	30,875	2.7	38,950
Courland......	597,290	13,155	2.2	14,000
Smolensk.....	1,163,590	1,450	0.1	1,600
Total......	13,441,360	940,905	7.00′	1,162,050

According to the localities which they inhabit, the Poles take different names. They are called Wielkopolanie on the plains of middle Poland, while the name of Małopolanie is reserved for those on the Warta. The name of Łęczycanie is given to the inhabitants of the marshes of the Ner, that of Kurpie to those of the Podlasie; Kujawiący, Szlący in Silesia, Górale in the Carpathians.

The Kaszubes, and especially the Mazurs, may be considered as separate stocks of the Polish family. The Mazurs (whose northern limits may be thus described—Przerosl in Suwałki, Goldap, Rastenburg, and Bischofsburg in Prussia, and Mława in Płock) are distinguished from the Poles by their lower stature, broad shoulders and massive structure, and still more by their national dress, which has nothing of the smartness of that of the southern Poles, and by their ancient customs; they have also a dialect of their own, containing many words now obsolete in Poland, and several grammatical forms bearing witness to the Lithuanian influence. They submit without difficulty to German influence, and already are Lutherans in Prussia. The language of the Kaszubes can also be considered as a separate dialect. The Poles proper are on the whole of medium stature (5 feet 4.6 inches), finely built, dark in the south and fair in the north, richly endowed by nature, inclined to deeds of heroism, but perhaps deficient in that energy which characterizes the northern races of Europe, and in that sense of unity which has been the strength of their present rulers.

The German element is annually increasing both in numbers and in influence, especially during the last twenty years. The Łódz manufacturing district, the Polish Birmingham, is becoming more German than Polish; and throughout the provinces west of the Vistula German immigration is going on at a steadily increasing rate, especially in the governments of Płock, Calisz, Piotrków, and Warsaw. It is estimated that a strip of land 35 miles wide along the Prussian frontier is already in the hands of Germans, whose advance is further favored by the rapid transference of landed property into German hands in Posen. In Russian Poland associations of four to six men, supported by German banks, purchase large numbers of properties belonging to the members of the Polish nobility who have been ruined since the last insurrection. No fewer than 30,736 German landholders, owning 5433 estates, were enumerated last year in the provinces west of the Vistula; while 13,714 foreign proprietors, farmers, and laborers (11,497 Prussians and 1914 Austrians) were at the same time owners of 1,857,900 acres, valued at 135,000,000 roubles ($103,950,000). According to other statistics, the foreigners in Poland, mostly Germans, who remained foreign subjects, numbered 170,000 in 1881 (5.15 per cent. of the population). Of these, 91,440 (families included) hold landed property to the amount of 2,605,500 acres, or 8.3 per cent. of the area of the kingdom. The aggregate number of Germans in Russian Poland, estimated at 370,000 in 1873, must now exceed 450,000, thus constituting about one-fifteenth of the population.

The Jews, who are found everywhere throughout Poland, are still more numerous, and must now exceed a million. They are nowhere agricultural; in the larger towns many of them are artisans, but in the villages they are almost exclusively engaged as shopkeepers, second-hand traders, dealers on commission, innkeepers, and usurers. In the country, both commerce and agriculture are in the hands of their intimately connected trading associations. Their relations with Poles and Ruthenians are anything but cordial, and "Jew-baiting" is of frequent occurrence. They are increasing much more rapidly than the Slavs.

The relative numbers of the various inhabitants of Poland may be seen from the following figures:

	According to Galkin (1868).	According to Rittich (1873).	Per cent.
Poles.....................	3,900,580	4,375,840	68.4
Jews	764,950	860,330	13.4
Little Russians......	428,380	505,960	8.5
White Russians	33,520	26,865	
Great Russians......	11,065	12,155	
Germans................	234,150	370,360	5.8
Lithuanians...........	277,050	241,150	3.8

Religion.

The prevalent religion is the Roman Catholic, to which, in 1870, 4,596,956 out of a population of 6,034,430 belonged; at the same date 246,485 were adherents of the United Church, 327,845 were Lutherans, 34,135 were of the Greek Church, and 4926 Nonconformists. The Jews at the same date were reckoned (certainly an under-estimate) at 815,443, and the Mohammedans at 426. The number of followers of the United Church has much diminished since 1873, when they were compelled to join the Greek Church.

Since the last insurrection a series of measures have been taken to reduce the numbers of the Roman Catholic clergy in Poland; in 1883 there remained 1313 churches out of 1401, 1544 priests out of 2322, 10 monasteries out of 29 and 8 convents out of 30. One diocese (Podlasie) having been abolished, and a new one established at Kielce, while several bishops had been sent out of the country, the whole situation remained unsettled until 1883, when the pope recognized the new diocesan subdivisions introduced by the Russian Government. Poland is now divided into four dioceses (Warsaw, Sędomierz, Lublin, and Płock).

Agriculture.

From remote antiquity Poland has been celebrated for the production and export of grain. Both, however, greatly declined in the 18th century; and towards the beginning of this century the peasants, ruined by their proprietors, or abandoned to the Jews, were in a more wretched state than even their Russian neighbors. Serfdom was abolished in 1807; but the liberated peasants received no allotments of land, and a subsequent law (1808) rendered even their transference from one landlord to another almost impossible; the old patrimonial jurisdictions were also retained. Compelled to accept the conditions imposed by the landlords, they had to pay rack-rents and to give compulsory labor in various forms for the use of land. Only a limited number were considered as permanent farmers, while nearly one-half of the peasants became mere *prolétaires;* in 1864 1,338,830 farmer peasants had ceased to have land rights at all. Pursuing a policy intended to reconcile the peasantry to Russian rule and to break the power of the Polish nobility, the Russian Government promulgated, during the outbreak in 1864, a law by which those peasants who were holders of land on estates belonging to private persons, institutions (such as monasteries and the like), or the crown were recognized as proprietors of the soil,—the state paying compensation to the landlords in bonds, and the peasants having to pay a yearly annuity to the state until the debt thus contracted had been cleared. The valuation of these allotments was made at a rate much more advantageous than in Russia, and the average size of holding reached 15 acres per family. Of those who held no land a number received it out of the confiscated estates of the nobility and monasteries. At the same time the self-government of the peasant was organized on democratic principles. The so-called "servitudes," however, that is, the right to pasture on and take wood from the landlord's estates, were maintained for political reasons, becoming a source of great inconvenience both to landlords and peasants.

Whatever be the opinion held as to the intention of these reforms, there can be no doubt that they resulted in a temporary increase of prosperity, or at any rate an alleviation of the previous misery of the peasants. In 1864 there were 342,500 peasant families, holding an aggregate of 8,300,000 acres of land; but only 22,000 peasants, that is, less than one-half per cent. of the agricultural population, were proprietors, the remainder (218,500) being nobles, while 2,000,000 peasants were *czinszewiki*, that is, tenants at will, and 1,338,000 had no land at all. In 1872 there were already 572,100 free peasant estates, occupying 13,000,000 acres. In ten years (1864–73) the area of cultivated soil had increased by 1,350,000 acres, while during the fourteen years 1845–59 its increase was only 540,000 acres. The crops, which stood in 1846–60 at an average of 9,360,000 quarters [74,880,000 bu.] of corn and 6,500,000 quarters [52,000,000 bu.] of potatoes, reached respectively 15,120,000 and 14,400,000 quarters [120,960,000 and 115,200,000 bu.]. The yearly increase, which was only 2.2 per cent. for corn and 1.3 per cent. for potatoes during the years 1846–60, became respectively 4.7 and 8.3 per cent. during the years 1864–75, and the average crop per head rose from 1.93 quarters [15.44 bu.] in 1850 to 2.52 [20.16 bu.] in 1872. The annual increase of horses, which formerly was 1 per cent., reached 2.7 per cent. in 1864–70, while the yearly increase of cattle remained almost stationary (1.2 per cent., against 1.1 per cent.). In fact, Poland had in 1870 only 37 head of cattle for each 100 persons, against 41 head in 1860. Another consequence of these measures was a notable decrease of crime, and a rapid increase of village-primary schools, maintained by the peasants themselves.

It must be acknowledged, however, that the maintenance of the "servitudes" has become a serious evil. Moreover, the want of pasture-land, the want of money for improvements, quite insufficiently supplied by the joint-stock banks in the villages, and the very rapid increase in the price of land, from 50 roubles [$38.50 silver roubles] per morgen (1.3835 acre) to 120 [$92.40 silver roubles] and 250 roubles, [$192.50] have all helped to lessen the benefits of the agrarian measures of 1864. The peasants are unable to purchase land proportionately with the increase of population; and, while a few of them buy, many others are compelled to sell to the Jews (notwithstanding the law which prohibits the purchase of land by Jews) or to German immigrants. The estates of the nobility do not pass into the hands of the Polish peasants as they are sold, and still less to Russians, but largely into those of German immigrants.

Agriculture in Poland is carried on with more perfect methods on the whole than in Russia. The extensive cultivation of beetroot, of potatoes for distilleries, and of grasses has led to the introduction of a rotation of several years instead of the former "three-fields" system; and agricultural machinery is in more general use, especially on the larger estates of the west. Winter wheat is extensively cultivated, especially in the south, the Sandomir wheat having a wide repute. In 1873 50 per cent. (15,728,000 acres) of the surface of Poland was under crops, 9 per cent. (2,929,000 acres) under meadows, and 26 per cent. (8,242,000 acres) under forests. The first of these figures exceeds now 54 per cent. In 1881 the crops reached 19,050,000 quarters [152,400,000 bu.] of corn, 21,151,000 quarters [169,208,000 bu.] of potatoes, and 14,368,000 cwts. of beetroot (14,365,950 cwts. in 1882). The corn crops were distributed as follows: wheat, 11 per cent.; rye, 38; oats, 29; barley, 12; buckwheat, 4; various, 6 per cent.,—3 per cent. being used for manufactures, 22 per cent. for seed, 60 per cent. for home consumption, and 15 per cent. for export. The potatoes were used almost entirely for distilleries. The culture of tobacco is successfully carried on (about 3500 acres), especially in Warsaw, Płock, and Lublin.

Cattle rearing is an important source of income. In 1881 there were approximately 3,300,000 cattle, 4,500,000 sheep (including 2,500,000 of the finer breeds), and 1,000,000 horses. Fine breeds of horses and cattle occur on the larger estates of the nobility, and cattle are exported to Austria. Bee-keeping is widely spread, especially in the southeast. Fishing is carried on remuneratively, especially on the Vistula and its tributaries.

Manufactures and mines.

Manufactures have shown a rapid increase during the last twenty years. While in 1864 the annual production was only 50,000,000 roubles, [$38,500,000] it now exceeds 150,000,000 [$115,500,000] —the manufactures of Poland yielding one-eighth of the total production of the Russian empire.

Mining has shown a still more rapid development within the same period. While in 1862 only 154,100 cwts. of pig iron and 100,900 cwts. of iron and steel were made, these figures respectively reached 947,800 and 1,742,500 cwts. in 1881; and, whereas the highest figure in the annual returns of the coal-mining industry from 1867 to 1873 was only 2,494,000 cwts., the average for 1876–80 was 17,157,000, and the amount reached 27,659,000 cwts. in 1881. The zinc mines yielded in 1881 89,640 cwts., and the extraction of tin reached 7,580 cwts. in 1878. Sulphur was obtained to the amount of 6450 cwts. in 1879.

The development of the leading manufactures may be seen from the following figures:

	1866.		1879.	
	Produce in Roubles.	Hands.	Produce in Roubles.	Hands.
Woollen stuffs	7,134,483	7,579	26,833,000	12,716
Linen and hemp stuffs	1,151,382	6,669	2,294,000	6,900
Cottons	6,099,474	9,578	22,492,000	16,949
Silks	61,785	100	533,000	350
Preparation, dyeing, hats	606,656	165	4,318,000	906
Paper wares	587,552	1,083	1,343,000	1,289
Produce from wood	311,126	379	2,665,000	2,497
Animal produce	4,150,756	5,579	8,572,000	3,182
Mineral produce	1,591,833	5,583	4,469,000	7,096
Metallic wares	5,654,496	7,149	9,426,000	7,899
Chemical produce	443,980	368	900,000	443
Total	27,793,523	44,232	83,845,000	60,227
Average production per hand	628 [$483.56]	......	1,375 [$1058.75]	......

Thus, while the number of hands occupied in these industries has increased by 40 per cent., the production has nearly trebled, showing a corresponding improvement in the machinery employed. The chief manufacturing centres are the Łódź region in the government of Piotrków (woollen stuffs, cotton, sugar, corn-flour, wine-spirit, coal-mines) and Warsaw (linen stuffs, leather, machinery, sugar, wine-spirits, tobacco, and all kinds of grocery and mercery wares). Mining is chiefly concentrated in the southwest. The annual production for separate governments (exclusive of mining, flour-mills, and breweries, and the number of hands employed by distilleries remaining unknown) was given in 1879 as follows:

	Roubles.	Hands.
Piotrków	60,900,000	36,550
Warsaw	42,110,000	37,605
Kalisz	14,670,000	9,159
Lublin	10,495,000	5,577
Łomża	4,543,000	581
Kielce	2,919,000	2,337
Radom	2,121,000	1,708
Płock	2,109,000	1,747
Siedlce	1,862,000	1,815
Suwałki	684,000	403
Total	142,413,000 [$109,658,010]	97,482
Russia in Europe	1,102,949,000 [$849,270,730]	711,097

These figures, however, have already increased considerably, especially with regard to distilleries, which yielded, in 1882–83, 6,269,500 gallons of pure alcohol; while the sugar-works, which occupied in 1882–83 9774 men, 2636 women, and 2403 children, produced 315,460 cwts. of rough sugar and 425,800 cwts. of refined sugar. In 1882 the production reached 66,291,700 roubles [$51,044,609] in Piotrków, 3,948,200 [$3,040,114] in Siedlce, and 1,240,230 [$954,977.10] in Suwałki.

Communication.

The railways of Poland have an aggregate length of 888 miles. A line of great importance, connecting Vienna with St. Petersburg, crosses the country from southwest to northeast, passing through the mining district and Warsaw, and sending a short branch to Łódź. Another important line connecting Dantzic with Odessa, crosses Poland from northwest to southeast. A branch line, parallel to this last connects Skiernewice with Thorn and Bromberg; while a military railway connects the fortresses of Warsaw and Ivangorod with Brest-Litowsky, *via* Siedlce and Łukow, and a side line will soon connect Siedlce with Małkin on the lower Bug. The great line from Berlin to St. Petersburg crosses North Suwalki for 54 miles, between Eydtkunen and Kovno. The aggregate length of the macadamized roads, increased by 2110 miles since 1864, is now about 6700 miles.

Commerce.

The traffic on the Polish railways is very brisk. In 1880 the aggregate amount of merchandise brought to and sent from Warsaw reached respectively 36,055,000 and 18,248,000 cwts.; and the whole amount of merchandise conveyed on Polish railways within Poland (exclusive of the Eydtkunen and Kovno line) amounted to 81,469,000 cwts.

The chief custom-houses of the Russian empire—Wierzbolowo, Sosnowice, Granica, Warsaw—and many minor ones are situated on the frontiers of Poland. Their aggregate imports and exports reached respectively 127,414,054 [$98,108,821.58] and 146,320,921 roubles [$112,667,109.17] in 1882.

Administration.

The "primary cell" of the administrative organization of Poland is the *gmina*,—formerly a village commune for the common possession and partly also for the common cultivation of land, which lost its characters with the introduction of serfdom, but has been taken by the law of 1864 as the basis of the organization of the peasantry in Poland. Each district is subdivided into twelve to twenty *gminas*, including several villages and all farms on its territory, and having a population of from 2000 to 10,000 inhabitants. All landholders of the *gmina* who are in possession of at least 4 acres constitute the communal assembly of the *gmina*. Only the clergymen and the police officials are excluded from it. Each member has but one vote, however extensive his property. The *gmina* differs thus from the Russian *volost* in its including, not only peasants, but also all landed proprietors of the territory. The assembly elects the *woit*, or elder (the executive of the *gmina*), a clerk, a *sołtys* in each village, and a tribunal consisting of *ławniki*, who judge all matters of minor importance, according to local customs. It also allocates the taxation among the members of the *gmina*, administers the common property (pasturage, grazing lands, forests), has charge of the poor, and generally deals with all questions educational, hygienic, and economic which concern the *gmina*. The cost of administration of each *gmina* varies from 1000 [$770] to 3000 [$2,310] roubles. In reality, the powers of the *gmina* are, however, very much limited in all but purely economical questions by a numerous bureaucracy, and especially by the "chief of the district" nominated by the crown; there is also a general tendency towards transforming it into a mere auxiliary to the Russian administration, the clerk or secretary becoming its chief organ.

The provincial administration is regulated by the law of December 31, 1866. Each government being subdivided into ten or twelve districts, the district administration consists of an *ouyezdnyi natchalnik*, or "chief of the district," with a number of secretaries and "chancelleries" (military, for recruiting; philanthropic; for mutual assurance against fire; for finance, and for gendarmerie). The provincial administration, under a military governor, consists in each of the ten governments of the following institutions:—(1) "chancellery" of the governor; (2) a provincial "college," with councillors corresponding to the following departments—administration, military and police, finance, state domains, law, medicine, and insurance; (3) a philanthropic committee; (4) a postal department; (5) a "college" for finance; (6–10) departments of excise, customs, forests, control, and education. There is also in each government a special institution for the affairs of peasants.

The entire administration of Poland is under the governor-general, residing at Warsaw, whose power is limited only by "collegiate" institutions corresponding to the different branches of administration. He is at the same time the commander of the entire military force of the "Warsaw military district." Justice is represented by the *gmina* tribunals; the justices of the peace (nominated by government); the *syezd*, or "court" of the justices of the peace; the district tribunals (assizes) in each government; and the Warsaw courts of appeal and cassation. The prisons of Poland, with exception of a reformatory for boys at Studzieniec, are in a very bad state. With an aggregate capacity for only 4050 prisoners, they had in 1883 7210 inmates. Poland constitutes also a separate educational district, a district of roads and communications, an administration of justice district, and two mining districts.

Finances.

Poland has had no separate budget since 1867; its income and expenditure are included in those of the empire, and since 1881 they have ceased to appear under separate heads. The peasants' arrears, which reached 663,685 [$511,027.45] in 1878, have notably increased since then, ranging from 200,000 [$154,000] to 600,000 [$462,000] roubles in each government.

Municipal institutions.

Perhaps no other country in Europe had so many towns (453), for the most part enjoying municipal rights according to the Magdeburg and Lithuanian law, as Poland. A large number of them (228) remained, however, private property or property of the crown. In some of them the proprietors only levied rents on the holders of land that had been built upon; while in others the *dominium supremum* was maintained, and the proprietor exacted, not only rents, but also taxes from the inhabitants and visitors, claiming also the monopoly of selling spirits, etc.

After the last insurrection, all towns with less than 2000 inhabitants were deprived of their municipal rights, and were included, under the designation of *posads*, in the *gminas*. The seignorial rights were abolished or redeemed, and those inhabitants who lived on agriculture received allotments of land redeemed by the state. But the spirit-selling monopoly was maintained, as also the "servitudes." Viewed with suspicion by the Russian Government, the Polish towns received no self-government like the villages. Instead of the former elective municipal councils (which enjoyed *de jure* very large rights, including that of keeping their own police, while in reality they were under the rule of the nobility), Russian officials were nominated and entrusted with all the rights of the former municipal councils. These last were, however, maintained to carry out the orders of the military chiefs. The new municipal law of 1870, first introduced at Warsaw and then applied to other towns, reduced the functions of the municipal council almost to nothing, depriving it even of the right of discussing the general budget, which is established by a special administrative committee aided by three to four citizens nominated by the governor. The burgomaster, chosen by Government out of three candidates, and the members of the municipality (*ławniki*) elected by one section of the citizens, mostly from the poorest classes, have no authority. The burgomaster, who often is a retired private soldier, very badly paid (£18 [$87.48] to £45 [$218.70] per year), is entirely dependent upon the police and the chief of the district, and has to discharge all sorts of functions (bailiff, policeman, etc.,) which have nothing to do with municipal affairs.

Fortresses.

Poland naturally contains the first line of the fortifications of the Russian empire on its western frontier. These fortifications, however, are intended only to protect the country to the east of the Vistula, the region to the west of it, which contains the chief mining and manufacturing districts of Poland, remaining quite open to invasion. The marshy lowlands, covered with forests on the western bank of the Vistula, are a natural defence against an army advancing from the west, and they are supported by the fortresses on the Vistula connected by the Vistula railway. Their centre is at Warsaw, with Novogeorgievsk, formerly Modlin, in the north, at the mouth of the Bug, and Ivangorod, formerly Demblin, in the south, at the mouth of the Wieprz. Novogeorgievsk is a strongly fortified camp, which requires a garrison of 12,000 men, and may shelter an army of 50,000 men. The town Sierock, at the junction of the Bug and Narew, is now fortified to protect the rear of Novogeorgievsk.

The citadel of Warsaw protects the railway bridge over the Vistula, and six forts—rather out of date, however—protect the capital. The fortress of Ivangorod, on the right bank of the Vistula, is now supported by six forts, four of which are situated on the right bank and two on the left. The Vistula line of fortresses has, however, the great disadvantage of being easily taken from the rear by armies advancing from East Prussia or Galicia. Brest-Litowsky, at the western issue from the marshes of the Pripet, the towns of Dubno and Lutsk, now about to be fortified, and Bobruisk constitute the second line of defence.

Education.

The educational institutions of Poland are represented by a university with 1000 students in 1881; 18 gymnasiums and 8 pro-gymnasiums for boys, with 8269 scholars in 1878; 3 "real-schulen," with 914 scholars; and 3279 primary schools, with 113,084 boys and 57,260 girls. There are also excellent technical schools, an institute of agriculture and forestry at Nowa-Alexandrya, and several seminaries for teachers. In 1881 the number of scholars was 1 to 35 of the aggregate population, only 19 per cent. of the children of school age receiving instruction in school. The Jewish children mostly are taught in the *heders*, where they receive almost no instruction at all.

"Russification."

The school is the great means used by the Russian Government for the so-called "Russification" of Poland. The teaching in the former *Szkoła Główna*, now the university of Warsaw (even that of Polish literature), has been carried on in Russian since 1873, both by a few Polish professors and by the new Russian ones. Polish is taught in primary and secondary schools only twice a week, in the lower classes; and the scholars are prohibited from speaking Polish within the walls of the lyceums. In all official communications Russian is obligatory, and a gradual elimination of Poles from the administration is steadily going on, Polish employés being either limited in number (to a fourth, for instance, for the examining magistrates), or else totally excluded from certain administrations (such as that of certain railways). The vexatious measures of Russian rule keep up a continuous feeling of discontent; and, though it was allowed in 1864 that the agrarian measures would conciliate the mass of the peasantry with the Russian Government, it now appears that the peasants, while gaining in those feelings of self-respect and independence which were formerly impossible to them, are not accommodating themselves to Russian rule; the national feeling is rising into activity with them as formerly with the *szlachta*, and it grows every day.

Towns.

There are 27 towns the population of which exceeded 10,000 inhabitants in 1880–82, and 66 towns having a population of more than 5000. The list of the former is as follows: Warsaw (1882), 406,260; Augustow, 11,100; Biała, 19,450; Częstochowo, 15,520; Garwolin, 14,620; Kalisz, 16,400; Kalwarya, 10,610; Kielce, 10,050; Konska Wola, 14,300; Kutno, 13,210; Łask, 10,810; Łódź, 49,590; Łomża, 15,000; Lublin, 34,980; Łukow, 11,030; Mława, 10,010; Piotrków, 23,050; Płock (1883), 19,640; Radom (1883), 19,870; Sędomierz, 14,080; Siedlce, 12,320; Sieradz, 15,040; Suwałki, 18,640; Turek, 11,500; Włocławek, 20,660; Włodawa, 17,980; Zgerz, 13,360. (P. A. K.)

POLARITY AND ENANTIOMORPHISM. Any figure, such as a solid of revolution, which has one line in it in reference to which the figure is symmetrical may be said to have an axis, and the points at which the axis cuts the surface of the figure are poles. But the term polarity when applied to material figures or substances is usually confined to cases where there are not only a definite axis and poles, but where the two poles have distinct characters which enable us to recognize them and say which is which. It is in this sense that the word is used here.

Two figures or two portions of matter are said to be *enantiomorph* to each other when these forms are not superposable, *i.e.*, the one will not fit into a mould which fits the other, but the one is identical in form with the mirror image of the other.

Polarity.—As examples of polarity we may take an awn of barley or a cat's tail, in which we recognize the distinction between the two poles or ends, which we may call A and B by finding that it is easy to stroke from say A to B, but not in the opposite direction. As an example of enantiomorphism we may take our two hands, which will not fit the same mould or glove, but the one of which resembles in figure the mirror image of the other.

It will be seen by and by that there is a close relation between polarity and enantiomorphism.

In the examples of polarity just given the condition occurs because the parts of the body are arranged in the direction of the axis in a particular order which is different when read backwards. The simplest expression for such a state of matters will be found in the case of a substance composed of equal numbers of three different kinds of particles, these particles being arranged along the axis in the order

A | *abcabc* . . . . *abc* | B,

where A and B are poles and a, b, c particles of three different kinds. Of course the same may occur with a more complicated constitution, the condition being that the cyclical order read from A to B is different from that read from B to A. Even with particles all of the same kind we can imagine this sort of polarity produced by such an arrangement as

A | *aa a a a aa a a a aa a a a* | B,

where the destiny varies periodically as we pass along the axis, but so that the order of variation is different in passing from A to B and from B to A. There is another sort of polarity produced also by an arrangement such as that described above, but here not along the axis but about it. As we took a cat's tail as an example of the one, so we may take a sable muff as an example of the other. As we stroke the tail in one direction along the axis, so we stroke the muff in one sense about the axis. This arrangement also produces polarity, for there is a real difference between the two ends of the muff. The one is that into which we put our right hand, the other that into which we put our left hand if the fur is to lie downwards in front. If we reverse the ends we find the fur sticking up in front, and we have thus as little difficulty in distinguishing the two poles from one another in this as in the former sort of polarity.

We can easily imagine the particles of a compound substance to be arranged so as to produce this polarity. To take a simple case—the molecules of the substance may be formed of three atoms, a, b, and c, arranged $\begin{matrix} & b \\ a & \\ & c \end{matrix}$ with the planes of the molecules all at right angles to the axis, so that on turning the substance about the axis in one sense the atoms in every molecule follow each other in the order *abc*, and of course in the opposite order when the rotation is reversed.

In these examples the polarity is due to an arrangement of the matter at rest, but both kinds of polarity may be produced by motion. Thus a rotating body has polarity of the second kind; the axis is the axis of rotation, and the two poles differ from each other as the two ends of a muff do. A wire along which a current of electricity is passing has polarity of the first kind; and a magnet, in which currents of electricity may be supposed to circulate about the axis, has polarity of the second kind.

There is an important difference between these two kinds of polarity. We have seen that they depend on two different conditions—the one on an arrangement of matter or motion along the axis, the other on a similar arrangement about the axis. This gives rise to a difference in their relation to their mirror image.

If we hang up a cat's tail by one end, say the A end, in front of a mirror, we see in the mirror the image of a cat's tail hanging by its A end. But if we hang up a muff by one end, say the right-hand end, before a mirror, we see in the mirror the image of a muff hanging by its left-hand end. If we put our hands into the muff in the usual way and stand before the mirror we see a person with his hands in a muff in the usual way. But his right and left hands correspond to our left and right hands respectively, and the right and left ends of the muff in the mirror are the images of the left and right ends respectively of the real muff. Thus the mirror image of a body having polarity of the second kind has its polarity reversed.

But the muff and its image are not truly enantiomorph. They differ in position but in nothing else. Turn the one round and it will fit the other.

Magnetic and electric polarity having been already discussed under ELECTRICITY and MAGNETISM, we shall here consider some cases of crystalline polarity.

Both kinds of polarity occur in crystals.

We have no direct means of ascertaining how the ultimate particles of a crystal are arranged, but it seems reasonable to suppose that there is a relation between the form of the crystal and the structure of its smallest parts; and, when we find the crystals of particular substances always showing polarity of the one or the other kind, we naturally suspect that this is the external indication of such an arrangement of the particles as has been shown above to be capable of producing structural polarity. Of crystalline polarity of the first kind the most striking instances are tourmaline and electric calamine (hydrated silicate of zinc), forms of which are shown in Figs. 1 and 2, in which it will be seen that the crystals are not similarly terminated at the two ends. It is this kind of crystalline polarity (often called "hemimorphism") which (as was first observed by Haüy and more fully investigated by Gustav Rose and by Hankel) is associated with pyroelectricity (see MINERALOGY, vol. xvi. p. 391). It is worthy of note that the crystalline polarity and the physical (electric) polarity occurring in the same substances are both of the kind not inverted by reflection in a mirror.

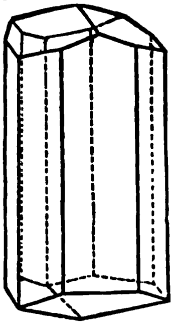
FIG. 1.—Tourmaline.

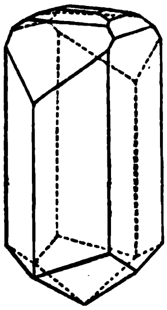
FIG. 2.—Electric Calamine.

As an instance of the same kind of crystalline polarity of a somewhat more complicated character, also associated with pyroelectricity, we may take boracite. The crystals of this mineral exhibit combinations of the cube, the rhombic dodecahedron, and the tetrahedron, as shown in Fig. 3. If four lines are drawn corresponding to the four diagonals of the cube, it will be observed that at the two ends of each of these axes the crystal is differently developed. (In the figure one of these axes is indicated by the dotted line.) These axes, therefore, resemble the single axis in tourmaline and electric calamine, and are also axes of pyroelectricity, the end at which the tetrahedral face is situated being the antilogous pole.[1]

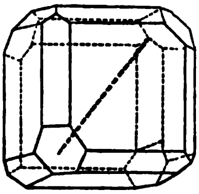
FIG. 3.—Boracite.

Scheelite, apatite, ilmenite, and fergusonite are examples of crystalline polarity of the second kind. Figs. 4, 5, and 6 are representations of forms of ilmenite, apatite, and fergusonite.

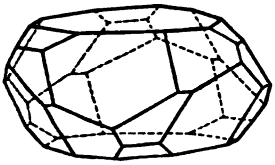
FIG. 4.—Ilmenite.

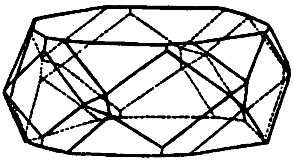
FIG. 5.—Apatite.

Crystalline polarity of both kinds, no doubt, depends on the arrangement of the molecules and on their structure; it manifests itself by the occurrence of hemihedral or hemimorphic forms. A crystal may have a polar structure although these external marks of polarity are absent, just as the faces parallel to planes of cleavage do not appear on every crystal.

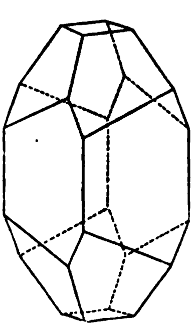
FIG. 6.—Fergusonite.

Another kind of contrast between the two complementary hemihedral forms of the same substance may be mentioned here. Marbach observed that different specimens of iron pyrites (and also of cobalt glance) have very different thermoelectric characters, differing indeed from one another more than bismuth and antimony. Gustav Rose showed that these thermoelectrically opposite kinds are also crystallographically opposite. There is indeed no geometrical difference between two opposite hemihedral forms in the regular system, but Rose detected a difference in the lustre and striation of the faces of the two kinds, and by examining the rare cases in which the two opposite pentagonal dodecahedra or tetragonal icositetrahedra occur on the same crystal proved that the one surface character belongs to the one, the other surface character to the other of the two complementary hemihedra.

Enantiomorphism.—A figure having polarity of the first kind gives a mirror image resembling itself in form and in position; a figure having polarity of the second kind gives a mirror image resembling itself in form but not in position—the poles being inverted. A figure the axis of which has both kinds of polarity will therefore give a mirror image not superposable to the figure itself, because the polarity of the second kind is reversed while that of the first kind remains unchanged. The figure and its mirror image are enantiomorph, as well as polar. We can construct a figure which is enantiomorph to its mirror image but not polar. Imagine a muff so made that in one half the fur lies the one way, and the opposite way in the other half (Fig. 7, where the arrowheads indicate the lie of fur). In whichever way we put our hands into this muff one end will be wrong; the muff in the figure has, in fact, two right-hand ends. It has therefore no polarity; the two ends are exactly alike. But there are two ways in which such a non-polar muff could be made—with two right-hand ends as in the figure, or with two left-hand ends, and these two forms are enantiomorph. A helix or screw has similar properties (compare Fig. 8 with Fig. 7); if uniform it is non-polar, but is either right- or left-handed. Hence the property which each of two enantiomorph bodies possesses has been called by Sir William Thomson "helicoidal asymmetry."

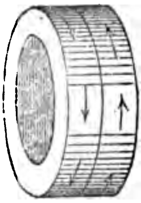
Fig. 7.

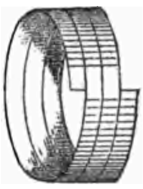
Fig. 8.

As we have crystals exhibiting polarity of both kinds, so we have also enantiomorph crystals; indeed, the word enantiomorph was first used by Naumann to express the relation between such crystals. The crystallographic theory of enantiomorph crystals has been very fully worked out. We may divide them into two groups—(1) those in which the helicoidal asymmetry depends on the presence of tetartohedral forms of the regular or of the hexagonal system, and (2) those in which it depends on the presence of hemihedral forms of the rhombic system or hemimorphic forms of the monoclinic system.

In the first group the asymmetry seems to be produced by the manner in which the molecules, themselves symmetrical, are arranged in the crystal. In the second group the molecules themselves appear to have helicoidal asymmetry. This is shown by the action of these substances on polarized light. We shall take examples from each group. If we allow a solution of sodium chlorate to crystallize, we find that the crystals, which belong to the regular system, are of two kinds, enantiomorph to each other. These are represented in Fig. 9. The enantiomorphism depends on the combination of the tetrahedron and the pentagonal dodecahedron.[1] Now when a ray of plane polarized light is passed through one of these crystals the plane of polarization is rotated, the amount of rotation being proportional to the length of the path in the crystal. The crystals having the form *a* rotate to the right, those having the form *b* to the left. They are therefore optically as well as crystallographically enantiomorph. But a solution of sodium chlorate is without action on the plane of polarization, even if the solution be made by dissolving only right-handed or only left-handed crystals, and if a crystal be fused the fused mass is optically inactive, so that it would seem that the optical activity depends on the arrangement of the molecules in the crystal, and not on any enantiomorphism in the molecules. The enantiomorphism of quartz crystals is indicated by the presence of faces of a tetartohedral form (vol. xvi. p. 404). The two kinds of crystals rotate the plane of polarization equally, but in opposite senses, when a plane polarized ray is passed through a section cut at right angles to the axis of the crystal. Here also the optical activity ceases when crystalline structure is destroyed by fusion or solution.

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[1] Upon some crystals of boracite the faces of both tetrahedra occur. They can, however, be easily distinguished from one another. The faces of the tetrahedron represented in the figure are smooth and shining, while those of the opposite tetrahedron are rough and usually much smaller. It has been suggested that boracite is only apparently regular, and that each crystal is really a group of eight pyramids with their apices in the centre of the group. For a full discussion of the relation between pyroelectricity and crystalline form the reader is referred to a series of papers by Prof. Hankel in *Trans. R. Saxon Soc. of Sciences*, 1857-79.

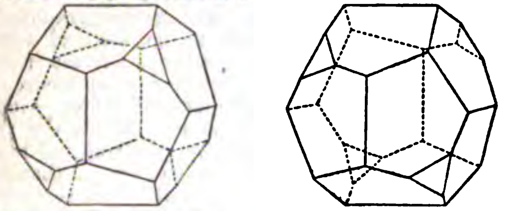

FIG. 9.—Sodium Chlorate. *a*, right-handed; *b*, left-handed.

Right-handed and left-handed tartaric acids crystallize in enantiomorph forms (Fig. 10). Their solutions are optically active, the amount of the rotation for the same strength of solution and the same length of path in it being the same in both acids, but the sense of the rotation is right-handed in the one and left-handed in the other. It is clear that here we have to do with enantiomorph molecules. In ordinary physical properties such as density, solubility, refracting power—in short, in everything *not involving right- or left-handedness*—the acids are identical. When mixed in equal proportions they unite and form racemic acid which is optically inactive, and from racemic acid we can by various means recover unchanged the right and left-handed tartaric acids. We now know a considerable number of cases where, as in that of the two tartaric acids, both enantiomorphs have been discovered, and many where only one has as yet been found.

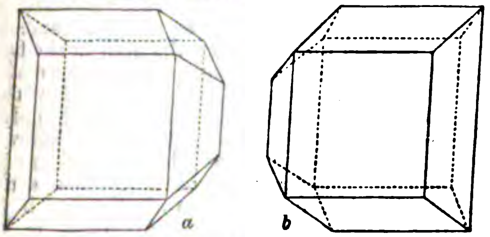

FIG. 10.—Tartaric Acid. *a*, right-handed; *b*, left-handed.

It is natural that we should ask what peculiarity of constitution can give a molecule this helicoidal asymmetry? A very ingenious answer to this question was given simultaneously and independently by the French chemist Le Bel and the Dutch chemist Van't Hoff. We shall give a short statement of the essential points of this interesting theory.

All the known substances which are optically active in solution are compounds of carbon, and may be regarded as derived from marsh gas, a compound of one atom of carbon and four of hydrogen, by the replacement of hydrogen by other elements or compound radicals. Now we do not know how the atoms of hydrogen are actually arranged relatively to each other and to the atom of carbon in the molecule of marsh gas, but, if we may make a supposition on the subject, the most simple is to imagine the four hydrogen atoms at the apices of a regular tetrahedron in the centre of which is the carbon atom as in the diagrams (Fig. 11),

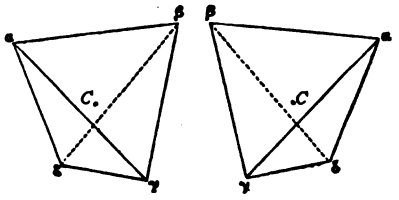

FIG. 11.

where C represents the position of the carbon atom and α, β, γ, δ that of the four atoms of hydrogen.

If these hydrogen atoms are replaced by atoms of other elements or by compound radicals we should expect a change of form of the tetrahedron. If two or more of the atoms or radicals united to the carbon atom are similar there is only one way of arranging them, but if they are all different there are two ways in which they may be arranged, as indicated in the figures. It will be seen that these two arrangements are enantiomorph. In the figures the tetrahedron is represented as regular, but if the distance from C depends on the nature of the atom, the tetrahedron, when α, β, γ, and δ are all different, will not be symmetrical, but its two forms will be enantiomorph. A carbon atom combined with four different atoms or compound radicals may therefore be called an asymmetric carbon atom.

Now all substances of ascertained constitution, the solutions of which are optically active, contain an asymmetric carbon atom, and their molecules should therefore, on the above hypothesis, have helicoidal asymmetry.

The converse is not generally true. Many substances contain an asymmetric carbon atom but are optically inactive. It is easy to reconcile this with the theory; indeed, a little consideration will show that it is a necessary consequence of it.

Let us suppose that we have the symmetrical combination of C with α, α, β, γ and that we treat the substance in such a way that one α is replaced by δ. The new arrangement is asymmetrical, and will be right or left as the one or the other α is replaced. But the chances for the two are equal, and therefore, as the number of molecules in any quantity we can deal with is very great, the ratio of the number of right-handed molecules in the new substance to the number of left-handed ones will be sensibly that of unity. It is therefore evident that by ordinary chemical processes we cannot expect to produce optically active from optically inactive substances; all that we can get is an inactive mixture of equal quantities of the two oppositely active substances.

As these two substances have identical properties in every respect where right- or left-handedness is not involved, the problem of separating them is a difficult one. We may note three distinct ways in which the separation can be effected.

(1) By crystallization. For example, the right and left double tartrates of soda and ammonia crystallize in enantiomorph forms (Fig. 12) and are less soluble in water than the double racemate formed by their union. If therefore racemic acid (the optically inactive compound of equal quantities of right and left tartaric acids) is half neutralized with soda and half with ammonia, we obtain an optically inactive solution con-

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[1] This combination is regarded as tetartohedral, because the tetrahedron and the pentagonal dodecahedron belong to two different classes of hemihedral forms.

taining a mixture of the two double salts. If this solution is allowed to crystallize each salt crystallizes independently, and the crystals can be separated by picking them out. Further, a supersaturated solution of the one double salt is not made to crystallize by contact with a crystal of the other, so that if we make a supersaturated solution of the inactive mixture and drop into the vessel, at different places, two crystals one of the right the other of the left salt, crystallization occurs at each place, at the one of the one kind and at the other of the other.

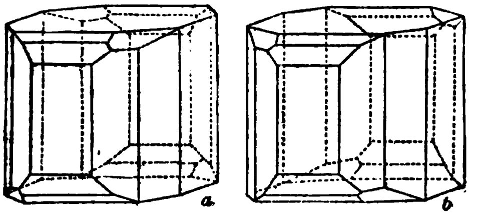


Fig. 12.—Double Tartrate of Soda and Ammonia. *a*, right-handed; *b*, left-handed.

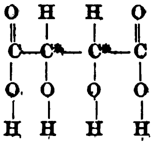
(2) By the action of another optically active substance. While the salts of the two opposite tartaric acids with an inactive base are precisely alike in solubility, density and other physical characters, and, if they crystallize, crystallize in the same form (or in enantiomorph forms), it is not at all so when the base is optically active; thus right tartaric acid forms a crystalline salt with left asparagine, while with the same base left tartaric acid gives an uncrystallizable compound.

(3) By the action of living ferments. The minute fungi which act as ferments do not show any right- or left-handedness as far as their obvious anatomical structure is concerned, but Pasteur has shown that some of them are, if we may use the expression, physiologically asymmetrical. As an example we may give the very interesting case of mandelic acid. This acid, which stands to benzoic aldehyde (bitter almond oil) in the same relation as lactic acid does to common aldehyde, contains one asymmetric carbon atom in its molecule. It is optically inactive, and therefore, if Le Bel and Van 't Hoff's theory is true, it must be a mixture of two oppositely active acids. Now Lewkowitsch found that when *Penicilium glaucum* is cultivated in a solution of mandelic acid fermentation takes place. This goes on until exactly half of the acid is decomposed, and what remains has all the properties of mandelic acid, but is optically active; it is the right-handed component of the mixture, the growing fungus having consumed the other.

There is an interesting peculiarity of tartaric acid discovered by Pasteur (to whom we owe nearly all our knowledge of the relations between optical activity and crystalline form in tartaric acid) which is of importance in connection with the theory we have just been explaining.

We have not only right and left tartaric acid and racemic acid, the inactive compound of the two, but also a kind of tartaric acid which is inactive, but incapable of being separated into the two oppositely active acids.

Now the chemical formula of tartaric acid is



$$\begin{array}{cccc} O & H & H & O \\ \| & | & | & \| \\ C- & C^*- & C^*- & C \\ | & | & | & | \\ O & O & O & O \\ | & | & | & | \\ H & H & H & H \end{array}$$

It will be observed that the carbon atoms marked * are asymmetric, and that they occupy precisely similar positions in the molecule. Each of them is combined with H, OH, COOH and CH(OH)COOH. If in both of them these four things are arranged in the same order there is helicoidal asymmetry—the one order giving the one, the other the other enantiomorph form. But if the one has one order and the other the opposite, then there is in the whole molecule no helicoidal asymmetry, as the two halves exactly balance one another. There is not, as in racemic acid, a compound of one moleule of each of the two opposite active acids, but rather a compound of half a molecule of each, and we should not expect such a compound to be easily separable. Jungfleisch has shown that if any one of the four tartaric acids (right, left, racemic and inactive) is mixed with a little water and kept for some time at a temperature of about 200° C., it is converted into a mixture of racemic and inactive tartaric acids, so that, as racemic acid can be divided into right and left tartaric acids, it is possible to prepare any one of the four from any other. (A. C. B.)

POLARIZATION OF LIGHT. See Light and Wave Theory.

POLAR REGIONS.

THE polar regions extend respectively from the Arctic and Antarctic Circles, in 66° 32′ N. and S. to the north and south poles, the circles being 1,408 geographical miles from the poles. The intense cold and the difficulties of ice navigation have made the discovery and examination of these regions a slow and hazardous task. Millions of square miles are still entirely unknown. In the present article the history of the progress of discovery within the north polar region will be traced and some account of its physical geography will follow. A similar review of work in the south polar region will conclude the article.

Plate II.

North Polar Region.

Extent.

The Arctic Circle is a ring running a little south of the northern shores of America, Asia and Europe, so that those shores form a fringe within the polar region and are its boundary to the south, except at three openings—those of the North Atlantic, of Davis Strait and of Behring's (more, properly Bering's) Strait.

Approaches.

The width of the approach to this region by the Atlantic Ocean, in its narrowest part, is 660 miles, from the Norwegian islands of Lofoten to Cape Hodgson on the east coast of Greenland. The width of the approach by Davis Strait in the narrowest part, which is nearly on the Arctic Circle, is 165 miles, and the width of Behring's Strait is 45 miles. Thus out of the whole ring of 8,640 miles along which the Arctic Circle passes about 900 miles is over water. This great environment of land is an important feature in the physical condition of the north polar region. It influences the currents and the movements of ice, which are still further affected by the archipelagoes lying to the northward of the fringing coast-lines. The larger opening into the north polar region by way of the Atlantic is divided from Davis Strait by the vast mass of Greenland, which, extending for an unknown distance to the north, crosses the Arctic Circle and ends in a point at Cape Farewell in 59° 48′ N. lat. It was inevitable that the routes across the Arctic Circle by the Atlantic and Davis Strait should first become known, because these openings to the polar regions are nearest to the temperate regions inhabited by the exploring nations of Europe.

Thule. A rumor respecting Thule, an island on the Arctic Circle, first brought by Pytheas (*q.v.*), and afterwards doubted, was the extent of the knowledge of the north polar regions with which the ancients can be credited. But in the 9th century some Irish monks really appear to have visited Iceland. The monk Dicuil, writing about 825, says that he had information from brethren who had been at Thule during several months and they reported that there was no darkness at the summer solstice.

Other. King Alfred told the story of the first polar voyages undertaken for discovery and the acquisition of knowledge, in his very free translation of Orosius. In the first book he inserted the narrative of the voyages of Other and Wulfstan, related to him by the former explorer himself. The localities mentioned in the story cannot now be identified, but it seems probable that Other rounded the North Cape, and visited the coast of Lapland.

Norsemen. The Norsemen of the Scandinavian peninsula, after colonizing Iceland, were the first to make permanent settlements on the shores of Greenland, and to extend their voyages beyond the Arctic circle along the western coast of that vast glacier-covered land. See Greenland. The Norse colonies in Greenland at Brattelid and Einarsfjord did not extend farther north than 65°, but in the summer time the settlers carried on their seal hunting far beyond the Arctic circle. One of their runic stones was found in a cairn in latitude 73° N., the inscription showing that the date of its being left there was 1235. Another expedition is believed, on good grounds, to have reached a latitude of 75° 46′ N. in Barrow Strait, about the year 1266. Their ordinary hunting grounds were in 73° N., to the north of the modern Danish settlement of Upernivik. For the visits of the Greenlanders to the American coasts see **America,** vol. i. p. 620.

The last trace of communication between Greenland and Norway was in 1347. The black death broke out in Norway and the far off colony was forgotten; while the settlers were attacked by Skrellings or Eskimo, who overran the West Bygd in 1349. Ivar Bardsen, the steward to the bishopric of Gardar in the East Bygd, and a native of Greenland, was sent to convey help to the sister colony. A document, of which Ivar Bardsen was the author, has been preserved. It consists of sailing directions for reaching the colony from Iceland, and a chorography of the colony itself. It is the oldest work on arctic geography, and is still valuable in the study of all questions relating to the early settlements in Greenland. From 1400 to 1448 there was some communication, at long intervals, with the Greenland settlers, but during the latter half of that century it entirely ceased. Here then the ancient portion of polar history comes to an end. The next period, comprised in the 16th and 17th centuries, was that in which expeditions were despatched across the Arctic Circle to discover a shorter route to India.

Willoughby. Sebastian Cabot, whose own northern voyages have been spoken of in the article Cabot, was the chief promoter of the expedition which sailed under Sir Hugh Willoughby and Richard Chancellor on the 20th May, 1553, "for the search and discovery of the northern parts of the world, to open a way and passage to our men, for travel to new and unknown kingdoms." Willoughby, after discovering Nova Zembla (Novaya Zemlya) by sighting the coast of Goose Land, resolved to winter in a harbor of Lapland, where he and all his men perished of starvation and cold. **Chancellor.** Chancellor reached the Bay of St. Nicholas, and landed near Archangel, which was then only a castle. He undertook a journey to Moscow, made arrangements for commercial intercourse with Russia, and returned safely. His success proved the practical utility of polar voyages. It led to a charter being granted to the association of Merchant Adventurers, of which Cabot was named governor for life, and gave fresh impulse to arctic discovery.

Burrough. In the spring of 1556 Stephen Burrough, who had served with Chancellor, sailed in a small pinnace called the "Searchthrift," and kept a careful journal of his voyage. He went to Archangel, and discovered the strait leading into the Kara sea, between Nova Zembla and the island of Waigat. **Pet.** In May, 1580, the company fitted out two vessels under Arthur Pet and Charles Jackman, with orders to pass through the strait discovered by Burrough, and thence to sail eastward beyond the mouth of the river Obi. Pet discovered the strait into the Kara Sea, between Waigat and the mainland, and made a persevering effort to push eastward, returning to England in safety. Jackman, after wintering in a Norwegian port, sailed homeward but was never heard of again.

The Zeni. In 1558 a narrative and map were published at Venice which profoundly affected the system of polar cartography for many years afterwards. The publication was the handiwork of a Venetian nobleman named Niccolò Zeno. Towards the close of the 14th century his ancestor, also named Niccolò, made a voyage into the northern seas, and entered the service of a chief named Zichnmi as pilot. He was eventually joined by his brother Antonio, and four years afterwards died in the country he called Frislanda. Antonio remained ten years longer in the service of Zichnmi, and then returned to Venice. The younger Niccolò found the mutilated letters of these brothers in the Zeni palace, with a map; and out of these materials he prepared the narrative and map which he published, adding what he considered improvements to the map. It was accepted at the time as a work of high authority, and the names on it continued to appear on subsequent maps for at least a century, puzzling both geographers at home and explorers in the field. After a very exhaustive study of the subject, Mr. Major has identified the names on the Zeni map as follows: Engronelant, Greenland; Islanda, Iceland; Estland, Shetlands; Frisland, Faroe Isles;[1] Markland, Nova Scotia; Estotiland, Newfoundland; Drogeo, coast of North America; Icaria, coast of Kerry in Ireland.

Frobisher. We now come to the voyages of Frobisher, undertaken to obtain the means for equipping an expedition for the discovery of a shorter route to India by the northwest. Aided by Michael Lok, an influential merchant and diligent student of geography, Frobisher sailed, in the spring of 1576, with two small vessels of 20 to 25 tons, called the "Gabriel" and "Michael." But the "Michael" parted company in the Atlantic, the voyage being continued in the "Gabriel" alone. On 20th July, Frobisher sighted high land, which he called Queen Elizabeth's Foreland; and the next day he entered the strait to which he gave his own name, calling the land "Meta Incognita." On his return in the autumn, with various specimens of plants and stones, the "goldfinders" in London took it into their heads that a glittering piece of mica-schist contained gold ore. This caused great excitement, and much larger expeditions were fitted out, in the two following years, to collect these precious ores. As many as fifteen vessels formed the third expedition of 1578, and one of them, a busse (small ship) of Bridgwater, called the "Emma," reported that on her voyage home she had sighted land in the Atlantic and sailed along it for three days. It was never seen again, and may have been only a large ice-field; but it soon found its place on maps and charts under the name of Busse Island, and afterwards as "sunken land of Busse." For a long time Frobisher Strait was supposed to pass through Greenland, and, the map of the Zeni adding to the confusion, the land to the south was called Frislanda. It is now clear that Frobisher never saw Greenland, and that his strait and "Meta Incognita" are on the American side of Davis Strait. What Frobisher really did was to establish the fact that there were two or more wide openings leading to the westward, between latitudes 60° and 63°, on the American coast.

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[1] Admiral Irminger of Copenhagen holds the opinion that Frisland is not the Faroe Isles, but Iceland.

Davis.

John Davis, who made the next attempt to discover a northwest passage, was one of the most scientific seamen of that age. He made three voyages in three successive years, aided and fitted out by William Sanderson and other merchants. Sailing from Dartmouth on the 7th June, 1585, he was the first to visit the west coast of Greenland subsequent to the abandonment of the Norse colonies. He called it "The Land of Desolation." He discovered Gilbert's Sound in 64° 10′ (where now stands the Danish settlement of Godthaab), and then, crossing the strait which bears his name, he traced a portion of its western shore. In the second voyage Davis noted what he calls "a furious overfall," which was the tide flowing into Hudson Strait; and in his third voyage, in 1587, he advanced far up his own strait, and reached a lofty granite island in 72° 41′ N., which he named Sanderson's Hope. He considered that there was good hope of advancing farther, and reported "no ice towards the north, but a great sea, free, large, very salt and blue, and of an unsearchable depth." The results of his discoveries are shown on the Molyneaux globe which is now in the library of the Middle Temple; but he found it impossible to reconcile his work with that of Frobisher, and with the Zeni map. In 1595 Davis published a tract entitled *The World's Hydrographical Description*, in which he ably states the arguments in favor of the discovery of a northwest passage.

Barents.

The Dutch also saw the importance of a northern route to China and India, especially as the routes by the Cape of Good Hope and Magellan's Strait were jealously guarded by Spaniards and Portuguese. Their plan was to proceed by the northeast along the coast of Asia. As early as 1578 Dutch merchants had opened a trade with Kola and Archangel, but it was Peter Plancius, the learned cosmographer of Amsterdam, who conceived the idea of discovering a northeast passage. In 1594 the Amsterdam merchants fitted out a vessel of 100 tons, under the command of Willem Barents. The coast of Nova Zembla was sighted on the 4th July, and from that date until the 3d of August Barents continued perseveringly to seek a way through the ice-floes, and discovered the whole western coast as far as Cape Nassau and the Orange Islands at the northwest extremity. The second voyage in which Barents was engaged merely made an unsuccessful attempt to enter the Kara Sea. The third was more important. Two vessels sailed from Amsterdam on May 13, 1596, under the command of Jacob van Heemskerck and Corneliszoon Rijp. Barents accompanied Heemskerck as pilot, and Gerrit de Veer, the historian of the voyage, was on board as mate. The masses of ice in the straits leading to the Sea of Kara, and the impenetrable nature of the pack near Nova Zembla, had suggested the advisability of avoiding the land, and, by keeping a northerly course, of seeking a passage in the open sea. They sailed northwards, and on 9th June discovered Bear Island. Continuing on the same course they sighted the northwestern extreme of Spitzbergen, soon afterwards being stopped by the polar pack ice. This important discovery was named "Nieue Land," and was believed to be a part of Greenland. Arriving at Bear Island again on 1st July, Rijp parted company, while Heemskerck and Barents proceeded eastward, intending to pass round the northern extreme of Nova Zembla. On the 26th August they reached Ice Haven, after rounding the northern extremity of the land. Here they wintered in a house built out of driftwood and planks from the wrecked vessel. In the spring they made their way in boats to the Lapland coast; but Barents died during the voyage. This was the first time that an arctic winter was successfully faced. The voyages of Barents stand in the first rank among the polar enterprises of the 16th century. They led directly to the flourishing whale and seal fisheries which long enriched the Netherlands.

Waymouth.

The English enterprises were continued by the Muscovy Company, and by associations of patriotic merchants of London; and even the East India Company sent an expedition under Captain Waymouth in 1602 to seek for a passage by the opening seen by Davis, but it had no success.

Hudson.

The best servant of the Muscovy Company in the work of Polar discovery was Henry Hudson. His first voyage was undertaken in 1607, when he discovered the most northern known point of the east coast of Greenland in 73° N. named "Hold with Hope," and examined the edge of the ice between Greenland and Spitzbergen, reaching a latitude of 80° 23′ N. On his way home he discovered the island now called Jan Mayen, which he named "Hudson's Tutches." In his second expedition, during the season of 1608, Hudson examined the edge of the ice between Spitzbergen and Nova Zembla. In his third voyage he was employed by the Dutch East India Company, and he explored the coasts of North America, discovering the Hudson river. In 1610 he discovered Hudson's Strait, and the great bay which bears and immortalizes his name (see HUDSON, vol. xii. p. 346).

Spitzbergen whale fishery.

The voyages of Hudson led immediately to the Spitzbergen whale fishery. From 1609 to 1612 Jonas Poole made four voyages for the prosecution of this lucrative business, and he was followed by Fotherby, Baffin, Joseph and Edge. These bold seamen, while in the pursuit of whales, added considerably to the knowledge of the archipelago of islands known under the name of Spitzbergen, and in 1617 Captain Edge discovered a large island to the eastward, which he named Wyche's Land.

Danish voyages.

At about the same period the kings of Denmark began to send expeditions for the rediscovery of the lost Greenland colony. In 1605 Christian IV. sent out three ships, under the Englishmen Cunningham and Hall, and a Dane named Lindenov, which reached the western coast of Greenland and had much intercourse with the Eskimo. Other expeditions followed in 1606–7.

Button.

Meanwhile the merchant adventurers of London continued to push forward the western discovery. Sir Thomas Button, in command of two ships, the "Resolution" and "Discovery," sailed from England in May, 1612. He entered Hudson's Bay, crossed to its western shore, and wintered at the mouth of a river in 57° 10′ N. which was named Nelson's river after the master of the ship, who died and was buried there. Next year Button explored the shore of Southampton Island as far as 65° N., and returned home in the autumn of 1613. An expedition under Captain Gibbons, despatched in 1614, was a miserable failure; but in 1615 Robert Bylot as master and William Baffin as pilot and navigator in the "Discovery" examined the coasts of Hudson's Strait, and Baffin, who was the equal of Davis as a scientific seaman, made many valuable observations. In 1616 Bylot and Baffin again set out in the "Discovery." Sailing up Davis Strait they passed that navigator's farthest point at Sanderson's Hope, and sailed round the great channel with smaller channels leading from it which has been known ever since as Baffin's Bay. Baffin named the most northern opening Smith Sound, after the first governor of the East India Company, and the munificent promoter of the voyage, Sir Thomas Smith. Wolsten-

Baffin.

holme Sound, Cape Dudley Digges, Hakluyt Island, Lancaster Sound, Jones Sound, and the Cary Islands were named after other promoters and friends of the voyage. The fame of Baffin mainly rests upon the discovery of the great channel extending north from Davis Strait; but it was unjustly dimmed for many years, owing to the omission of Purchas to publish the skilful navigator's tabulated journal and map in his great collection of voyages. It may be mentioned, as an illustration of the value of these early voyages to modern science, that Professor Hansteen of Christiania made use of Baffin's magnetic observations in the compilation of his series of magnetic maps.

Luke Fox. In 1631 two expeditions were despatched, one by the merchants of London, the others by those of Bristol. In the London ship "Charles" Luke Fox explored the western side of Hudson's Bay as far as the place called "Sir Thomas Roe's Welcome." **James.** In August he encountered Captain James and the Bristol ship "Maria" in the middle of Hudson's Bay, and went north until he reached "Northwest Fox his furthest," in 66° 47′ N. He then returned home and wrote the most entertaining of all the Polar narratives. Captain James was obliged to winter off Charlton Island, in the southern extreme of Baffin's Bay, and did not return until October, 1632. Another English voyager, Captain Wood, attempted, without success, to discover a northeast passage in 1676.

The 16th and 17th centuries were periods of discovery and daring enterprise, and the results gained by the gallant seamen of those times are marvellous when we consider their insignificant resources and the small size of their vessels. Hudson's Strait and Bay, Davis Strait, and Baffin's Bay, the icy seas from Greenland to Spitzbergen and from Spitzbergen to Nova Zembla, had all been discovered. The following century was rather a period of reaping the results of former efforts than of discovery. It saw the settlement of the Hudson's Bay Territory and of Greenland, and the development of the whale and seal fisheries.

The Hudson's Bay Company was incorporated in 1670, and Prince Rupert sent out Zachariah Gillan, who wintered at Rupert's river. At first very slow progress was made. A voyage undertaken by Mr. Knight, who had been appointed governor of the factory at Nelson river, was unfortunate, as his two ships were lost and the crews perished. This was in 1719. **Scroggs.** In 1722 John Scroggs was sent from Churchill river in search of the missing ships, but merely entered Sir Thomas Roe's Welcome and returned. His reports were believed to offer decisive proofs of the existence of a passage into the Pacific; and a naval expedition was despatched under the command of Captain Christopher Middleton, consisting of the "Discovery" pink and the "Furnace" bomb. **Middleton.** Wintering in Churchill river, Middleton started in July, 1742 and discovered Wager river and Repulse Bay. **Moor.** In 1746 Captain W. Moor made another voyage in the same direction, and explored the Wager Inlet. **Coats.** Captain Coats, who was in the service of the company 1727–51, wrote a useful account of the geography of Hudson's Bay. Later in the century the Hudson's Bay Company's servants made some important land journeys to discover the shores of the American polar ocean. **Hearne.** From 1769 to 1772 Samuel Hearne descended the Coppermine river to the polar sea; and in 1789 Alexander Mackenzie discovered the mouth of the Mackenzie river. **Mackenzie.**

The establishment of the modern Danish settlements in Greenland has already been spoken of under the heading GREENLAND (*q.v.*).

Dutch whale fishery. The countrymen of Barents vied with the countrymen of Hudson in the perilous calling which annually brought fleets of ships to the Spitzbergen seas during the 18th century. The Dutch had their large summer station for boiling down blubber at Smeerenberg, near the northern extreme of the west coast of Spitzbergen. Captain Vlamingh, in 1664, advanced as far round the northern end of Nova Zembla as the winter quarters of Barents. In 1700 Captain Cornelis Roule is said by Witsen to have sailed north in the longitude of Nova Zembla, and to have seen an extent of 40 miles of broken land. But Theunis Ys, one of the most experienced Dutch navigators, was of opinion that no vessel had ever been north of the 82d parallel. **Martens.** In 1671 Frederick Martens visited the Spitzbergen group, and wrote the best account of its physical features and natural history that existed previous to the time of Scoresby. In 1707 Captain Gilies and Outsger Rep went far to the eastward along the northern shores of Greenland, and saw very high land in 80° N., which has since been known as Gilies Land. The Dutch geographical knowledge of Spitzbergen was embodied in the famous chart of the Van Keulens (father and son), 1700–1728. The Dutch whale fishery continued to flourish until the French Revolution, and formed a splendid nursery for training the seamen of the Netherlands. From 1700 to 1775 the fleet numbered 100 ships and upwards. In 1719 the Dutch opened a whale fishery in Davis Strait, and continued to frequent the west coast of Greenland for upwards of sixty years from that time. In the course of 6372 Dutch whaling voyages to Davis Strait between 1719 and 1775 only 38 ships were wrecked.

English whale fishery. The most flourishing period of the English fishery in the Spitzbergen seas was from 1752 to 1820. Bounties of 40s. per ton were granted by Act of Parliament; and in 1778 as many as 255 sail of whalers were employed. In order to encourage discovery £5000 were offered in 1776 to the first ship that should sail beyond the 89th parallel (16 Geo. III. c. 6). **Scoresby.** Among the numerous daring and able whaling captains, Captain Scoresby takes the first rank, alike as a successful fisher and a scientific observer. His admirable *Account of the Arctic Regions* is still a text book for all students of the subject. In 1806 he succeeded in advancing his ship "Resolution" as far north as 81° 12′ 42″. In 1822 he forced his way through the ice which encumbers the approach to land on the east coast of Greenland, and surveyed that coast from 75° down to 69° N., a distance of 400 miles. Scoresby combined the closest attention to his business with much valuable scientific work and no insignificant amount of exploration.

Russians. The Russians, after the acquisition of Siberia, succeeded in gradually exploring the whole of the northern shores of that vast region. As long ago as 1648 a Cossack named Simon Deshneff equipped a boat expedition in the river Kolyma, passed through the strait afterwards named after Bering, and reached the Gulf of Anadyr. In 1738[1] a voyage was made by two Russian officers from Archangel to the mouths of the Obi and Yenisei. Efforts were then made to effect a passage from the Yenisei to the Lena. **Tchelyuskin.** In 1735 Lieutenant T. Tchelyuskin got as far as 77° 25′ N. near the cape which bears his name; and in 1743 he reached that most northern point of Siberia in sledges, in 77° 41′ N. **Bering.** Captain Vitus Bering, a Dane, was appointed by Peter the Great to command an expedition in 1725. Two vessels were built at Okhotsk, and in July, 1728, Bering ascertained the existence of a strait between Asia and America. In 1740 Bering was again employed. He sailed from Okhotsk in a vessel called the "St. Paul," with G. W. Steller on board as naturalist. Their object was to discover the American side of the strait, and they sighted that magnificent peak named by Bering Mount St. Elias. The Aleutian Islands were also explored, but the ship was wrecked on an island named after the ill-fated discoverer, and scurvy broke out amongst his crew. Bering himself died there on December 8, 1741.

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[1] ["Lieutenants Paulov and Muravjev left Archangel on 15 (N. S.) July, 1734." This expedition with some changes of commanders reached the Obi river 22 (N. S.) September, 1737. *Voyage of the Vega*, by A. E. Nordenskiöld. London, 1881.—AM. ED.]

Liakhoff.

Hedenström.

Thirty years after the death of Bering a Russian merchant named Liakhoff discovered the New Siberia or Liakhoff Islands, and in 1771 he obtained the exclusive right from the empress Catherine to dig there for fossil ivory. These islands were more fully explored by an officer named Hedenström in 1809, and seekers for fossil ivory annually resorted to them. A Russian expedition under Captain Tchitschakoff, sent to Spitzbergen in 1764, was only able to attain a latitude of 80° 30′ N.

Phipps.

Cook.

Since the year 1773 the objects of polar exploration, at least so far as England is concerned, have been mainly the acquisition of knowledge in various branches of science. It was on these grounds that the Honorable Daines Barrington and the Royal Society induced the Government to undertake arctic exploration once more. The result was that two vessels, the "Racehorse" and "Carcass" bombs, were commissioned, under the command of Captain Phipps. The expedition sailed from the Nore on the 2d June, 1773, and was stopped by the ice to the north of Hakluyt Headland, the northwestern point of Spitzbergen. They reached the Seven Islands and discovered Walden Island; but beyond this point progress was impossible. When they attained their highest latitude in 80°48′ N., north of the central part of the Spitzbergen group, the ice at the edge of the pack was 24 feet thick. Captain Phipps returned to England in September, 1773. Five years afterwards Captain Cook received instructions to proceed northward from Kamchatka and search for a northeast or northwest passage from the Pacific to the Atlantic. In accordance with these orders Captain Cook, during his third voyage, reached Cape Prince of Wales, the western extremity of America, on August 9, 1778. His ships, the "Resolution" and "Discovery," arrived at the edge of the ice, after passing Behring Strait, in 70° 41′ N. On August 17th the farthest point seen on the American side was named Icy Cape. On the Asiatic side Cook's survey extended to Cape North. In the following year Captain Clerke, who had succeeded to the command, made another attempt, but his ship was beset in the ice, and so much damaged that further attempts were abandoned.

Barrow.

The wars following the French Revolution put an end to voyages of discovery till, after the peace of 1815, north polar research found a powerful and indefatigable advocate in Sir John BARROW (*q.v.*). Through his influence a measure for promoting polar discovery became law in 1818 (58 Geo. III. c. 20), by which a reward of £20,000 was offered for making the northwest passage, and of £5000 for reaching 89° N., while the commissioners of longitude were empowered to award proportionate sums to those who might achieve certain portions of such discoveries. In 1817 the icy seas were reported by Captain Scoresby and others to be remarkably open, and this circumstance enabled Barrow to obtain sanction for the dispatch of two expeditions, each consisting of two whalers—one to attempt discoveries by way of Spitzbergen and the other by Baffin's Bay. The vessels for the Spitzbergen route, the "Dorothea" and "Trent," were commanded by Captain David Buchan and Lieutenant John Franklin, and sailed in April, 1818. Driven into the pack by a heavy swell from the south, both vessels were severely nipped, and had to return to England. The other expedition, consisting of the "Isabella" and "Alexander," commanded by Captain John Ross and Lieutenant Edward Parry, followed in the wake of Baffin's voyage of 1616. Ross sailed from England in April, 1818. The chief merit of his voyage was that it vindicated Baffin's accuracy as a discoverer. Its practical result was that the way was shown to a very lucrative fishery in the "North Water" of Baffin's Bay, which continued to be frequented by a fleet of whalers every year. Captain Ross thought that the inlets reported by Baffin were merely bays, while the opinion of his second in command was that a wide opening to the westward existed through Lancaster Sound of Baffin.

Parry's first and second voyages.

Franklin's first journey.

Parry was consequently selected to command a new expedition in the following year. His two vessels, the "Hecla" and "Griper," passed through Lancaster Sound, the continuation of which he named Barrow Strait, and advanced westward, with an archipelago on his starboard hand, since known as the Parry Islands. He observed a wide opening to the north, which he named Wellington Channel, and sailed onwards for 300 miles to Melville Island. He was stopped by that impenetrable polar pack of vast thickness which appears to surround the archipelago to the north of the American continent, and was obliged to winter in a harbor on the south coast of Melville Island. Parry's sanitary arrangements during the winter were very judicious, and the scientific results of his expedition were most valuable. The vessels returned in October, 1820; and a fresh expedition in the "Fury" and "Hecla," again under the command of Captain Parry, sailed from the Nore on May 8, 1821, and passed their first winter on the coast of the newly discovered Melville Peninsula in 66° 11′ N. Still persevering, Parry passed his second winter among the Eskimo at Igloolik in 69° 20′ N., and discovered a channel leading westward from the head of Hudson's Bay, which he named Fury and Hecla Strait. The expedition returned in the autumn of 1823. Meantime Parry's friend Franklin had been employed in attempts to reach by land the northern shores of America, hitherto only touched at two points by Hearne and Mackenzie. Franklin went out in 1819, accompanied by Dr. Richardson, George Back, and Hood. They landed at York factory, and proceeded to the Great Slave Lake. In August of the following year they started for the Coppermine river, and, embarking on it, reached its mouth on July 18, 1821. From that point 550 miles of coast-line were explored, the extreme point being called Cape Turnagain. Most frightful sufferings, from starvation and cold, had to be endured during the return journey; but eventually Franklin, Richardson, and Back arrived safely at Fort Chippewyan. It was now thought desirable that an attempt should be made to connect the Cape Turnagain of Franklin with the discoveries made by Parry during his second voyage; but the first effort, under Captain Lyon in the "Griper," was unsuccessful.

Parry's third voyage.

Beechey.

Franklin's second journey.

In 1824 three combined attempts were organized. While Parry again entered by Lancaster Sound and pushed down a great opening he had seen to the south named Prince Regent's Inlet, Captain Beechey was to enter Behring's Strait, and Franklin was to make a second journey to the shores of Arctic America. Parry was unfortunate, but Beechey entered Behring Strait in the "Blossom" in August, 1826, and extended our knowledge as far as Point Barrow in 71° 23′ 30″ N. lat. Franklin, in 1825–26, descended the Mackenzie river to its mouth, and explored the coat for 374 miles to the westward; while Dr. Richardson discovered the shore between the mouths of the Mackenzie and Coppermine, and sighted land to the northward, named by him Wollaston Land, the dividing channel being called Union and Dolphin Strait. They returned in the autumn of 1826.

Lutke.

Work was also being done in the Spitzbergen and Barents Seas. From 1821 to 1824 the Russian Captain Lutke was surveying the west coast of Nova Zembla as far as Cape Nassau, and examining the ice of the adjacent sea. **Clavering.** In May, 1823, the "Griper" sailed, under the command of Captain Clavering, to convey Captain Sabine to the polar regions in order to make pendulum observations. Clavering pushed through the ice in 75° 30′ N., and succeeded in reaching the east coast of Greenland, where observations were taken on Pendulum Island. He laid down the land from 76° to 72° N.

Parry's attempt to reach the pole. Parry's attempt in 1827 to reach the pole from the northern coast of Spitzbergen, by means of sledge-boats, has been described under the heading PARRY. The highest latitude reached was 82° 45′ N.; and the attempt showed that it is useless to leave the land and trust to the drifting pack in polar exploration.

Graah. In 1829 the Danes undertook an interesting piece of exploration on the east coast of Greenland. Captain Graah of the Danish navy rounded Cape Farewell in boats, with four Europeans and twelve Eskimo. He advanced as far as 65° 18′ N. on the east coast, where he was stopped by an insurmountable barrier of ice. He wintered at Nugarlik in 63° 22′ N., and returned to the settlements on the west side of Greenland in 1830.

The Rosses. In the year 1829 Captain John Ross, with his nephew James, having been furnished with sufficient funds by a wealthy distiller named Felix Booth, undertook a private expedition of discovery in a small vessel called the "Victory." Ross proceeded down Prince Regent's Inlet to the Gulf of Boothia, and wintered on the eastern side of a land named by him Boothia Felix. In the course of exploring excursions during the summer months James Ross crossed the land and discovered the position of the north magnetic pole on the western side of it, on June 1, 1831. He also discovered a land to the westward of Boothia which he named King William Land, and the northern shore of which he examined. The most northern point, opposite the magnetic pole, was called Cape Felix, and thence the coast trended southwest to Victory Point. James Ross was at Cape Felix on May 29, 1830. The Rosses never could get their little vessel out of its winter quarters. They passed three winters there, and then fell back on the stores at Fury Beach, where they passed their fourth winter of 1832–33. Eventually they were picked up by a whaler in Barrow Strait, and brought home. Great anxiety was naturally felt at their prolonged absence, **Back.** and in 1833 Sir George Back, with Dr. Richard King as a companion, set out by land in search of the missing explorers. Wintering at the Great Slave Lake, he left Fort Reliance on June 7, 1834, and descended the Great Fish River, which is obstructed by many falls in the course of a rapid and tortuous course of 530 miles. The mouth was reached in 67° 11′ N., when the want of supplies obliged them to return. In 1836 Sir George Back was sent, at the suggestion of the Royal Geographical Society, to proceed to Repulse Bay in his ship, the "Terror," and then to cross an assumed isthmus and examine the coast-line thence to the mouth of the Great Fish River; but the ship was obliged to winter in the drifting pack, and was brought back across the Atlantic in a sinking condition.

Simpson and Dease. The tracing of the polar shores of America was completed by the Hudson's Bay Company's servants. In June, 1837, Messrs. Simpson and Dease left Chippewyan, reached the mouth of the Mackenzie, and connected that position with Point Barrow, which had been discovered by the "Blossom" in 1826. In 1839 Simpson passed Cape Turnagain of Franklin, tracing the coast eastward so as to connect with Back's work at the mouth of the Great Fish River. He landed at Montreal Island in the mouth of that river, and then advanced eastward as far as Castor and Pollux river, his farthest eastern point. On his return he travelled along the north side of the channel, which is in fact the south shore of the King William Island discovered by James Ross. The southwestern point of this island was named Cape Herschel, and there Simpson built a cairn on August 26, 1839. Very little more remained to be done in order to complete the delineation of the northern shores of the American continent. **Rae.** This was entrusted to Dr. John Rae, a Hudson's Bay factor, in 1846. He went in boats to Repulse Bay, where he wintered in a stone hut nearly on the Arctic Circle; and he and his six Orkney men maintained themselves on the deer they shot. During the spring of 1847 Dr. Rae explored on foot the shores of a great gulf having 700 miles of coast-line. He thus connected the work of Parry, at the mouth of Fury and Hecla Strait, with the work of Ross on the coast of Boothia, proving that Boothia was part of the American continent.

While the English were thus working hard to solve some of the geographical problems relating to Arctic America, the Russians were similarly engaged in Siberia. **Anjou.** In 1821 Lieutenant Anjou made a complete survey of the New Siberia Islands, and came to the conclusion that it was not possible to advance far from them in a northerly direction, owing to the thinness of the ice and to open water within 20 or 30 miles. **Wrangell.** Baron Wrangell prosecuted similar investigations from the mouth of the Kolyma between 1820 and 1823. He made four journeys with dog sledges, exploring the coast between Cape Tchelagskoi and the Kolyma, and making attempts to extend his journeys to some distance from the land. He was always stopped by thin ice, and he received tidings from a native chief of the existence of land at a distance of several leagues to the northward. **Middendorf.** In 1843 Middendorf was sent to explore the region which terminates in Cape Tchelyuskin. He reached the cape in the height of the short summer, whence he saw open water and no ice blink in any direction. The whole arctic shore of Siberia had now been explored and delineated, but no vessel had yet rounded the extreme northern point, by sailing from the mouth of the Yenisei to that of the Lena. When that feat was achieved the problem of the northeast passage would be solved.

Franklin expedition. The success of Sir James Ross's Antarctic expedition and the completion of the northern coast-line of America by the Hudson's Bay Company's servants gave rise in 1845 to a fresh attempt to make the passage from Lancaster Sound to Behring Strait. The story of this unhappy expedition of Sir John Franklin, in the "Erebus" and "Terror," has already been told under FRANKLIN (*q.v.*); but some geographical details may be given here.

To understand clearly the nature of the obstacle which finally stopped Sir John Franklin, and which also stopped Sir Edward Parry in his first voyage, it is necessary to refer to the map. Westward of Melville and Baring Islands, northward of the western part of the American coast, and northward of the channel leading from Smith Sound, there is a vast unknown space, the ice which encumbers it never having been traversed by any ship. All navigators who have skirted along its edge describe the stupendous thickness and massive proportions of the vast floes with which it is packed. This accumulation of ice of enormous thickness, to which Sir George Nares has given the name of a "Palæocrystic Sea," arises from the absence of direct communication between this portion of the north polar region and the warm waters of the Atlantic and Pacific. Behring Strait is the only vent in a southwesterly direction, and that channel is so shallow that the heavy ice grounds outside it. In other directions the channels leading to Baffin's Bay are narrow and tortuous. In one place only is there a wide and straight lead. The heavy polar ice flows southeast between Melville and Baring Islands, down what is now called M'Clintock Channel, and impinges on the northwest coast of the King William Land discovered by James Ross. It was this branch from the palæocrystic sea which finally stopped the progress of Franklin's expedition. On leaving the winter-quarters at Beechey Island in 1846, Franklin found a channel leading south, along the western shore of the land of North Somerset discovered by Parry in 1819. If he could reach the channel on the American coast, he knew that he would be able to make his way along it to Behring Strait. This channel leading south, now called Peel Sound, pointed directly to the south. He sailed down it towards King William Island, with land on both sides. But directly they passed the southern point of the western land, and were no longer shielded by it, the great palæocrystic stream from Melville Island was fallen in with, pressing on King William Island. It was impassable. The only possibility of progress would have been by rounding the eastern side of King William Island, but its insularity was then unknown.

Search expeditions.

Ross.

It was not until 1848 that anxiety began to be felt about the Franklin expedition. In the spring of that year Sir James Ross was sent with two ships, the "Enterprise" and "Investigator," by way of Lancaster Sound. He wintered at Leopold Harbor, near the northeast point of North Devon. In the spring he made a long sledge journey with Lieutenant M'Clintock along the northern and western coasts of North Somerset.

Austin.

On the return of the Ross expedition without any tidings, the country became thoroughly alarmed. An extensive plan of search was organized,—the "Enterprise" and "Investigator" under Collinson and M'Clure proceeding by Behring Strait, while the "Assistance" and "Resolute" with two steam tenders, the "Pioneer" and "Intrepid," sailed May 3, 1850, to renew the search by Barrow Strait, under Captain Austin. Two brigs, the "Lady Franklin" and "Sophia," under Captain Penny, a very energetic and able whaling captain, were sent by the same route. He had with him Dr. Sutherland, a naturalist, who did much valuable scientific work. Austin and Penny entered Barrow Strait, and Franklin's winter quarters of 1845–46 were discovered at Beechey Island; but there was no record of any kind indicating the direction taken by the ships. Stopped by the ice Austin's expedition wintered (1850–51) in the pack off Griffith Island, and Penny found refuge in a harbor on the south coast of Cornwallis Island. Austin, who had been with Parry during his third voyage, was an admirable organizer. His arrangements for passing the winter were carefully thought out and answered perfectly. In concert with Penny he planned a thorough and extensive system of search by means of sledge travelling in the spring; and Lieutenant M'Clintock superintended every minute detail of this part of the work with unfailing forethought and consummate skill. Penny undertook the search by Wellington Channel. M'Clintock advanced to Melville Island, marching over 770 miles in eighty-one days; Captain Ommanney and Sherard Osborn pressed southward and discovered Prince of Wales Island. Lieutenant Brown examined the western shore of Peel Sound. The search was exhaustive; but, except the winter quarters at Beechey Island, no record, no sign was discovered. The absence of any record made Captain Austin doubt whether Franklin had ever gone beyond Beechey Island. So he also examined the entrance of Jones Sound, the next inlet from Baffin's Bay north of Lancaster Sound, on his way home, and returned to England in the autumn of 1851. This was a thoroughly well-conducted expedition,—especially as regards the sledge travelling, which M'Clintock brought to great perfection. So far as the search for Franklin was concerned, nothing remained to be done west or north of Barrow Strait.

Kennedy.

Bellot.

In 1851 the "Prince Albert" schooner was sent out by Lady Franklin, under Captain Kennedy, with Lieutenant Bellot of the French navy as second. They wintered on the east coast of North Somerset, and in the spring of 1852 the gallant Frenchman, in the course of a long sledging journey, discovered Bellot Strait separating North Somerset from Boothia,—this proving that the Boothia coast facing the strait was the northern extremity of the continent of America.

Collinson.

The "Enterprise" and "Investigator" sailed from England in January, 1850, but accidentally parted company before they reached Behring Strait. On May 6, 1851, the "Enterprise" passed the strait, and rounded Point Barrow on the 25th. Collinson then made his way up the narrow Prince of Wales Strait, between Baring and Prince Albert Island, and reached Princess Royal Islands, where M'Clure had been the previous year. Returning southwards, the "Enterprise" wintered in a sound in Prince Albert Island in 71° 35′ N. and 117° 35′ W. Three travelling parties were despatched in the spring of 1852,—one to trace Prince Albert Land in a southerly direction, while the others explored Prince of Wales Strait, one of them reaching Melville Island. In September, 1852, the ship was free, and Collinson pressed eastward along the coast of North America, reaching Cambridge Bay (September 26), where the second winter was passed. In the spring he examined the shores of Victoria Land as far as 70° 26′ N. and 100° 45′ W. He was within a few miles of Point Victory, where the fate of Franklin would have been ascertained. The "Enterprise" again put to sea on August 5, 1853, and returned westward along the American coast, until she was stopped by ice and obliged to pass a third winter at Camden Bay, in 70° 8′ N. and 145° 29′ W. In 1854 this most remarkable voyage was completed, and Captain Collinson brought the "Enterprise" back to England.

M'Clure.

Meanwhile M'Clure in the "Investigator" had passed the winter of 1850–51 at the Princess Royal Islands, only 30 miles from Barrow Strait. In October M'Clure ascended a hill whence he could see the frozen surface of Barrow Strait which was navigated by Parry in 1819–20. Thus, like the survivors of Franklin's crews when they reached Cape Herschel, M'Clure discovered a northwest passage. It was impossible to reach it, for the branch of the palæocrystic ice which stopped Franklin off King William Land was athwart their northward course. So, as soon as he was free in 1851, M'Clure turned southwards, round the southern extreme of Baring Island, and commenced to force a passage to the northward between the western shore of that land and the enormous fields of ice which pressed upon it. The cliffs rose up like walls on one side, while on the other the stupendous ice of the palæocrystic sea rose from the water to a level with the "Investigator's" lower yards. After many hair-breadth escapes M'Clure took refuge in a bay on the northern shore of Bank's Land, which he named "The Bay of God's Mercy." Here the "Investigator" remained, never to move again. After the winter of 1851–52 M'Clure made a journey across the ice to Melville Island, and left a record at Parry's winter harbor. Abundant supplies of musk ox were fortunately obtained, but a third winter had to be faced. In the spring of 1853 M'Clure was preparing to abandon the ship with all hands, and attempt, like Franklin's crews, to reach the American coast. But succor providentially arrived in time.

Rae's Journeys.

The Hudson's Bay Company assisted in the search for Franklin. In 1848 Sir John Richardson and Dr. Rae examined the American coast from the mouth of the Mackenzie to that of the Coppermine. In 1849 and 1850 Rae continued the search; and by a long sledge journey in the spring of 1851, and a boat voyage in the summer, he examined the shores of Wollaston and Victoria Lands, which were afterwards explored by Captain Collinson in the "Enterprise."

Belcher.

Kellett.

In 1852 the British Government resolved to despatch another expedition by Lancaster Sound. Austin's four vessels were recommissioned, and the "North Star" was sent out as a depôt ship at Beechey Island. Sir Edward Belcher commanded the "Assistance," with the "Pioneer" under Sherard Osborn as steam tender. He went up Wellington Channel to Northumberland Bay, where he wintered, passing a second winter lower down in Wellington Channel, and then abandoning his ships and coming home in 1854. But Sherard Osborn and Commander Richards did good work. They made sledge journeys to Melville Island, and thus discovered the northern side of the Parry group. Captain Kellett received command of the "Resolute," with M'Clintock in the steam tender "Intrepid." Among Kellett's officers were the best of Austin's sledge travellers, M'Clintock, Mecham, and Vesey Hamilton, so that good work was sure to be done. George Nares, the future leader of the expedition of 1874–75, was also on board the "Resolute." Kellett passed onwards to the westward and passed the winter of 1852–53 at Melville Island. During the autumn Mecham discovered M'Clure's record, and the position of the "Investigator" was thus ascertained. The safety of her crew was consequently assured, for it was only necessary to send a message across the strait between two fixed positions. This service was performed by Lieutenant Pim early in the following spring. The officers and crew of the "Investigator," led by M'Clure, arrived safely on board the "Resolute" on June 17, 1853, and they reached England in the following year. They not only discovered but traversed a northwest passage, though not in the same ship, and partly by travelling over ice. For this great feat M'Clure received the honor of knighthood,—a reward of £10,000 being granted to himself, the other officers, and the crew, by a vote of the House of Commons.

Sledge travelling.

The travelling parties of Kellet's expedition, led by M'Clintock, Mecham, and Vesey Hamilton, completed the discovery of the northern and western sides of Melville Island, and the whole outline of the large Island of Prince Patrick, still further to the westward. M'Clintock was away from the ship with his sledge party for one hundred and five days and travelled over 1328 miles. Mecham was away ninety-four days and travelled over 1163 miles. Sherard Osborn, in 1853, was away ninety-seven days and travelled over 935 miles. The "Resolute" was obliged to winter in the pack in 1853–54, and in the spring of 1854 Mecham made a most remarkable journey in the hope of obtaining news of Captain Collinson at the Princess Royal Islands. Leaving the ship on 3d April he was absent seventy days, out of which there were sixty-one and a half days of travelling. The distance gone over was 1336 statute miles. The average rate of the homeward journey was 23½ miles a day, the average time of travelling each day nine hours twenty-five minutes. This journey is without a parallel in arctic records.

Inglefield.

Fearing detention for another winter, Sir Edward Belcher ordered all the ships to be abandoned in the ice, the officers and crews being taken home in the "North Star," and in the "Phœnix" and "Talbot" which had come out from England to communicate. They reached home in October, 1854. In 1852 Captain Inglefield, R.N., had made a voyage of Baffin's Bay in the "Isabel" as far as the entrance of Smith Sound. In 1853 and 1854 he came out in the "Phœnix" to communicate with the "North Star" at Beechey Island.

Drift of the "Resolute."

The drift of the "Resolute" was a remarkable proof of the direction of the current out of Barrow Strait. She was abandoned in 74° 41′ N. and 101° 11′ W. on May 14, 1854. On September 10, 1855, an American whaler sighted the "Resolute" in 67° N. lat. about twenty miles from Cape Mercy, in Davis Strait. She was brought into an American port, and eventually presented to the British Government. She had drifted nearly a thousand miles.

Relics of Franklin's expedition.

In 1853 Dr. Rae was employed to connect a few points which would quite complete the examination of the coast of America, and establish the insularity of King William Land. He went up Chesterfield Inlet and the river Quoich for a considerable distance, wintering with eight men at Repulse Bay in a snow house. Venison and fish were abundant. In 1854 he set out on a journey which occupied fifty-six days in April and May. He succeeded in connecting the discoveries of Simpson with those of James Ross, and thus established the fact that King William Land was an island. Rae also brought home tidings and relics of Franklin's expedition gathered from the Eskimo; and this led to the expedition of M'Clintock in the "Fox," already described in the article **Franklin** (vol. ix. p. 635). While M'Clintock was prosecuting his exhaustive search over part of the west coast of Boothia, the whole of the shores of King William Island, the mouth of the Great Fish River, and Montreal Island, Allen Young completed the discovery of the southern side of Prince of Wales Island. The "Fox" returned to England in the autumn of 1859.

Work of the search expeditions.

The catastrophe of Sir John Franklin's expedition led to 7000 miles of coast-line being discovered, and to a vast extent of unknown country being explored, securing very considerable additions to geographical knowledge. Much attention was also given to the collection of information, and the scientific results of the various search expeditions were considerable. The catastrophe also afforded a warning which would render any similar disaster quite inexcusable. If arrangements are always carefully made for a retreat beforehand, if a depôt ship is always left within reach of the advancing expedition as well as of the outer world, and if there is annual communication, with positive rules for depositing records, no such catastrophe can ever happen again.

Grinnell expedition.

Kane.

The American nation was first led to take an interest in polar research through a very noble and generous feeling of sympathy for Franklin and his brave companions. Mr. Grinnell of New York gave practical expression to this feeling. In 1850 he equipped two vessels, the "Advance" and "Rescue," to aid in the search, commanded by Lieutenants DeHaven and Griffith, and accompanied by Dr. Kane. They reached Beechey Island on August 27, 1850, and assisted in the examination of Franklin's winter-quarters, but returned without wintering. In 1853 Dr. Kane, in the little brig "Advance" of 120 tons, undertook to lead an American expedition up Smith Sound, the most northern outlet from Baffin's Bay. The "Advance" reached Smith Sound on the 7th August, 1853, but was stopped by ice in 78° 45′ N., only seventeen miles from the entrance. He described the coast as consisting of precipitous cliffs 800 to 1200 feet high, and at their base there was a belt of ice about 18 feet thick, resting on the beach. Dr. Kane adopted the Danish name of "ice foot" (*is fod*) for this permanent frozen ridge. He named the place of his winter-quarters Van Rensselaer Harbor. In the spring some interesting work was done. A great glacier was discovered and named the Humboldt glacier, with a sea face 45 miles long. Dr. Kane's steward, Morton, crossed the foot of this glacier with a team of dogs, and reached a point of land beyond named Cape Constitution. But sickness and want of means prevented much from being done by travelling parties. Scurvy attacked the whole party during the second winter, although the Eskimo supplied them with fresh meat and were true friends in need. On May 17, 1855, Dr. Kane abandoned the brig, and reached the Danish settlement of Upernivik on 6th August. Lieutenant Hartstene, who was sent out to search for Kane, reached Van Rensselear Harbor after he had gone, but took the retreating crew on board on his return voyage.

Hayes.

On July 10, 1860, Dr. Hayes,[1] who had served with Kane, sailed from Boston for Smith Sound in the schooner "United States" of 130 tons and a crew of fifteen men. His object was to follow up the line of research opened by Dr. Kane. He wintered at Port Foulke, in 78° 17′ N., and about ten miles from Cape Alexander, which forms the eastern portal of Smith Sound. Dr. Hayes crossed Smith Sound in the spring with dog-sledges, but his observations are not to be depended on, and it is very uncertain how far he advanced northwards on the other side. He returned to Boston on October 23, 1861.

Hall.

The story of Charles Hall of Cincinnati, who was led to become an arctic explorer through his deep interest in the search for Franklin, has been told in the article devoted to him (vol. xi. p. 347). In his first journey (1860-62) he discovered the interesting remains of a stonehouse which Sir Martin Frobisher built on the Countess of Warwick Island in 1578. In his second expedition (1864-69), Hall by dint of the most unwearied perseverance at length reached the line of the retreat of the Franklin survivors at Todd's Island and Peffer river, on the south coast of King William Island. He heard the story of the retreat and of the wreck of one of the ships from the Eskimo; he was told that seven bodies were buried at Todd Island; and he brought home some bones which are believed to be those of Lieutenant Le Vescomte of the "Erebus." Finally, in 1871, he took the "Polaris" for 250 miles up the channel which leads northwards from Smith Sound. The various parts of this long channel are called Smith Sound, Kane Basin, Kennedy Channel, and Robeson Channel. The "Polaris" was beset in 82° 16′ N. on 30th August; and her winter-quarters were in 81° 38′ N., called Thank God Bay. The death of Hall and the subsequent fortunes of the expedition have been described in the article above cited.

Norwegian explorers.

The Spitzbergen seas have been explored, in recent years, by Norwegian fishermen as well as by Swedish and German expeditions and by English yachtsmen. The Norwegian Spitzbergen fishery dates from 1820, but it is only in recent years that Professor Mohn of Christiania has watched over the voyages and carefully collected information from the captains. In 1863 Captain Carlsen circumnavigated the Spitzbergen group for the first time in a brig called the "Jan Mayen." In 1864 Captain Tobiesen sailed round Northeast Land. In 1872 Captains Altmann and Nils Johnsen visited Wiche's Land, which was discovered by Captain Edge in 1617. In that year there were twenty-three sailing vessels from Tromsö, twenty-four from Hammerfest, and one from Vardö engaged in the arctic sealing trade. They average from 35 to 40 tons, and carry a dozen men. There were also eight vessels from Tromsö shark-fishing for cod-liver oil, and fifty from Hammerfest and Vardö. Since 1869 the Norwegians have extended their voyages to Nova Zembla. In that year Carlsen crossed the sea of Kara and reached the mouth of the Obi. In 1870 there were about sixty Norwegian vessels in the Barents Sea, and Captain Johannesen circumnavigated Nova Zembla. In 1873 Captain Tobiesen was unfortunately obliged to winter on the Nova Zembla coast, owing to the loss of his schooner, and both he and his young son died of scurvy in the spring. Two years previously Captain Carlsen had succeeded in reaching the winter-quarters of Barents, the first visitor since 1597, an interval of two hundred and seventy-four years. He landed on September 9, 1871, and found the house still standing and full of interesting relics, which are now in the naval museum at the Hague.

Swedish expeditions.

Between 1858 and 1872 the Swedes sent seven expeditions to Spitzbergen and two to Greenland. All returned with valuable scientific results. That of 1864 under Nordenskiöld and Duner made observations at eighty different places on the Spitzbergen shores, and fixed the heights of numerous mountains. In 1868, in an iron steamer, the "Sophia," the Swedes attained a latitude of 81° 42′ N. on the meridian of 18° E. during the month of September. In 1872 an expedition consisting of the "Polhem" steamer and brig "Gladen," commanded by Professor Nordenskiöld and Lieutenant Palander, wintered in Mussel Bay, on the northern shore of Spitzbergen. In the spring an important sledging journey of sixty days' duration was made over Northeast Land. The expedition was in some distress as regards provisions owing to two vessels, which were to have returned, having been forced to winter. But in the summer of 1873 they were visited by Mr. Leigh Smith, in his yacht "Diana," who supplied them with fresh provisions.

Koldewey.

Dr. Petermann of Gotha urged his countrymen to take their share in the noble work of polar discovery, and at his own risk he fitted out a small vessel called the "Germania," which sailed from Bergen, in May, 1868, under the command of Captain Koldewey. His cruise extended to Hinlopen Strait in Spitzbergen, but was merely tentative; and in 1870 Baron von Heuglin with Count Zeil explored the Stor Fjord in a Norwegian schooner, and also examined Walter Thymen's Strait. After the return of the "Germania" in 1868 a regular expedition was organized under the command of Captain Koldewey, provisioned for two years. It consisted of the "Germania" a screw steamer of 140 tons, and the brig "Hansa" commanded by Captain Hegemann. Lieutenant Payer, the future discoverer of Franz Josef Land, gained his first arctic experience on board the "Germania." The expedition sailed from Bremen on the 15th June, 1869, its destination being the east coast of Greenland. But in latitude 70° 46′ N. the "Hansa" got separated from her consort and crushed in the ice. The crew built a house of patent fuel on the floe, and in this strange abode they passed their Christmas. In two months the current had carried them south for 400 miles. By May they had drifted 1100 miles on their ice-raft, and finally, on June 14, 1870, they arrived safely at the Moravian mission station of Friedriksthal, to the west of Cape Farewell. Fairer fortune attended the "Germania." She sailed up the east coast of Greenland as high as 75° 30′ N., and eventually wintered at the Pendulum Islands of Clavering in 74° 30′ N. In March, 1870, a travelling party set out under Koldewey and Payer, and reached a distance of 100 miles from the ship to the northward, when want of provisions compelled them to return. A grim cape, named after Prince Bismarck, marked the northern limit of their discoveries. As soon as the vessel was free, a deep branching fjord was discovered in 73° 15′ N. stretching for a long distance into the interior of Greenland. Along its shore are peaks 7000 and 14,000 feet high. The expedition returned to Bremen on September 11, 1870.

Payer and Weyprecht.

Lieutenant Payer was resolved to continue in the path of polar discovery. He and a naval officer named Weyprecht freighted a Norwegian schooner called the "Isbjörn," and examined the edge of the ice between Spitzbergen and Nova Zembla, in the summer of 1871. Their observations led them to select the route by the north end of Nova Zembla with a view to making the northeast passage. It was to be an Austria-Hungarian expedition, and the idea was seized with enthusiasm by the whole empire. Weyprecht was to command the ship, while Julius Payer conducted the sledge parties. The steamer "Tegethoff," of 300 tons, was fitted out in the Elbe, and left Tromsö on July 14, 1872. The season was exceptionally severe, and the vessel was closely beset near Cape Nassau, at the northern end of Nova Zembla, in the end of August. The summer of 1873 found her still a close prisoner drifting, not with a current, but in the direction of the prevailing wind. At length, on the 31st August, a mountainous country was sighted about 14 miles to the north. In October the vessel was drifted within 3 miles of an island lying off the main mass of land. Payer landed on it, and found the latitude to be 79° 54′ N. It was named after Count Wilczek, one of the warmest friends of the expedition. Here the second winter was passed. Bears were very numerous and as many as sixty-seven were killed, their meat proving to be a most efficient remedy against scurvy. In March, 1874, Payer made a preliminary sledge journey in intense cold (thermometer at —58° F.). On 24th March he started for a more prolonged journey of thirty days. Payer found that the newly discovered country equalled Spitzbergen in extent, and consisted of two or more large masses—Wilczek Land to the east, Zichy Land to the west, intersected by numerous fjords, and skirted by a large number of islands. A wide channel, named Austria Sound, separates the two main masses of land, and extends to 82° N., where Rawlinson Sound forks off to the northeast. The mountains attain a height of 2000 to 3000 feet, the depressions between them being covered with glaciers; and all the islands even are covered with a glacial cap. The whole country was named Franz-Josef Land. Payer returned to the "Tegethoff" on 24th April; and a third journey was undertaken to explore a large island named after M'Clintock. It then became necessary to abandon the ship and attempt a retreat in boats. This perilous voyage was commenced on 20th May. Three boats stored with provisions were placed on sledges. It was not until 14th August that they reached the edge of the pack in 77° 40′ N., and launched the boats. Eventually they were picked up by a Russian schooner and arrived at Vardö on September 3, 1874. This great achievement is one of the most important connected with the north polar region that has been made in the present century, and will probably lead in due time to still further discoveries in the same direction.

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[1] [Isaac I. Hayes (1832-81), a Pennsylvania physician, Union army surgeon in the Civil War, explored in Greenland (1869), published books of his adventures. Died in New York.—Am. Ed.]

Robert Brown.

Norden-skiöld in Greenland.

One of the most interesting problems connected with the physical geography of the polar regions is the history and actual condition of the vast interior of Greenland, which is generally believed to be one enormous glacier. In 1867 Mr. Edward Whymper carefully planned an expedition to solve the question, and went to Greenland, accompanied by Dr. Robert Brown;[1] but the season was too late, and progress was stopped, after going a short distance, by the breaking down of the dog-sledges. But Dr. Brown made most valuable geological and natural history collections, chiefly in the neighborhood of Disco, and still more valuable observations, the publication of which has added considerably to our knowledge. Dr. Rink, for many years royal inspector of South Greenland and the most distinguished authority on all Greenlandic questions, has also visited the inland ice, and has given his stores of information to the world. The most important inland journey was undertaken by Professor Nordenskiöld in 1870, accompanied by Dr. Berggren, the professor of botany at Lund. The difficulty of traversing the inland ice of Greenland is caused by the vast glacier being in constant motion, advancing slowly towards the sea. This movement gives rise to huge chasms and clefts, which from their almost bottomless depth close the traveller's way. The chasms occur chiefly where the movement of the glacier is most rapid, near the ice streams which reach the sea and discharge glaciers. Nordenskiöld, therefore, chose for a starting point the northern arm of a deep inlet called Auleitsivikfjord, which is 60 miles south of the discharging glacier at Jakobshavn and 240 north of that at Godthaab. He commenced his inland journey on 19th July. The party consisted of himself, Dr. Berggren, and two Greenlanders; and they advanced 30 miles over the glaciers to a height of 2200 feet above the sea.

English expedition of 1875.

The gallant enterprises of other countries rekindled the zeal of England for arctic discovery; and in October, 1874, the prime minister announced that an expedition would be despatched in the following year. The route by Smith Sound was selected because it gave the certainty of exploring a previously unknown area of considerable extent, because it yielded the best prospect of valuable scientific results, and because it offered, with proper precautions, reasonable security for a safe retreat in case of disaster.

Two powerful screw steamers, the "Alert" and "Discovery," were selected for the service, and Captain Nares was selected as leader. Commander Markham, who had made a cruise up Baffin's Bay and Barrow Strait in a whaler during the previous year, Lieutenant Aldrich, an accomplished surveyor, and Captain Feilden, R.A., as naturalist, were also in the "Alert." The "Discovery" was commanded by Captain Stephenson, with Lieutenant Beaumont as first lieutenant. The expedition left Portsmouth on the 29th May, 1875, and entered Smith Sound in the last days of July. After much difficulty with the drifting ice Lady Franklin Bay was reached in 81° 44′ N., where the "Discovery" was established in winter-quarters. The "Alert" pressed onwards, and reached the edge of the palæocrystic sea, the ice-floes being from 80 to 100 feet in thickness. Leaving Robeson Channel, the vessel made progress between the land and the grounded floe pieces, and passed the winter off the open coast and facing the great polar pack in 82° 27′ N. Autumn travelling parties were despatched in September and October to lay out depôts; and during the winter a complete scheme was matured for the examination of as much of the unknown area as possible, by the combined efforts of sledging parties from the two ships, in the ensuing spring. The parties started on April 3, 1876. Captain Markham with Lieutenant Parr advanced, in the face of almost insurmountable difficulties, over the polar pack to the high latitude of 83° 20′ 26″ N. Lieutenant Aldrich explored the coast-line to the westward, facing the frozen polar ocean, for a distance of 220 miles. Lieutenant Beaumont made discoveries of great interest along the northern coast of Greenland. The parties were attacked by scurvy, which, while increasing the difficulty and hardships of the work a hundredfold, also enhanced the devoted heroism of these gallant explorers. Captain Feilden was indefatigable in making collections, and was zealously assisted by all the officers. The expedition returned to England in October, 1876. The "Alert" reached the highest northern latitude ever attained by any ship, and wintered further north than any ship had ever wintered before. The results of the expedition were the discovery of 300 miles of new coast-line, the examination of this part of the frozen polar ocean, a series of meteorological, magnetic, and tidal observations at two points farther north than any such observations had ever been taken before, and large geological and natural history collections.

Voyages of the "Pandora."

In the same year, 1875, Sir Allen Young undertook a voyage in his steam yacht the "Pandora" to attempt to force his way down Peel Sound to the magnetic pole, and if possible to make the northwest passage by rounding the eastern shore of King William Island. The "Pandora" entered Peel Sound on August 29, 1875, and proceeded down it much farther than any vessel had gone before since it was passed by Franklin's two ships in 1846. Sir Allen reached a latitude of 72° 14′ N., and sighted Cape Bird, at the northern side of the western entrance of Bellot Strait. But here an ice-barrier right across the channel barred his progress, and he was obliged to retrace his steps, returning to England on October 16, 1875. In the following year Sir Allen Young made another voyage in the "Pandora" to the entrance of Smith Sound.

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[1] Born 23d Mar., 1842, died 26th Oct., 1895. He traveled extensively in N. Africa and elsewhere; lectured on Botany, Zoology and Geology in various institutions; wrote about 30 vols. on scientific subjects, and nearly 4000 articles for reviews, etc.

Dutch expeditions.

Lieutenant Koolemans Beynen, a young Dutch officer, who had shared Young's two polar voyages, on his return successfully endeavored to interest his countrymen in polar discovery. It was wisely determined that the first expeditions of Holland should be summer reconnaissances on a small scale. A sailing schooner of 79 tons was built at Amsterdam, and named the "Willem Barents." In her first cruise she was commanded by Lieutenant A. de Bruyne, with Koolemans Beynen as second, and she sailed from Holland on the 6th May, 1878. Her instructions were to examine the ice in the Barents and Spitzbergen Seas, take deep-sea soundings, and make natural history collections. She was also to erect memorials to early Dutch polar worthies at certain designated points. These instructions were ably and zealously carried out. Beynen died in the following year, but the work he initiated has been continued. Every year from 1878 to 1884 the "Willem Barents" has made a polar voyage, and has brought back useful scientific results. In 1879 the Dutch succeeded in sighting the coast of Franz-Josef Land.

Gore-Booth and Markham.

In 1879 Sir Henry Gore-Booth, Bart., and Captain A. H. Markham, R. N., undertook a polar cruise in the Norwegian schooner "Isbjörn." They sailed along the west coast of Nova Zembla to its most northern point, passed through the Matotchkin Shar to the east coast, and examined the ice in the direction of Franz-Josef Land as far as 78° 24′ N. Captain Markham brought home collections in various branches of natural history, and made useful observations on the drift and nature of the ice in the Barents and Kara Seas.

Leigh Smith.

In 1880 Mr. Leigh Smith, who had previously made three voyages to Spitzbergen, reached Franz-Josef Land in the screw steamer "Eira." It was observed that, while the Greenland icebergs are generally angular and peaked, those of Franz-Josef Land are vast masses quite flat on the top, like the Antarctic bergs, and from 150 to 200 feet high. The "Eira" sailed along the land to the westward, and discovered 110 miles of new coast line as far as the western extreme of the south side of Franz-Josef Land, whence the land trended northwest. A landing was effected at several points, and valuable collections were made in natural history. In the following year the same explorer left Peterhead on July 14; Franz-Josef Land was once more sighted on the 23d July, and the "Eira" reached a point farther west than had been possible in her previous voyage. But in August the ship was caught in the ice, was nipped, and sank. A hut was built on shore in which Mr. Leigh Smith and his crew passed the winter of 1881–82; and on June 21, 1882, they started in four boats, to reach some vessels on the Nova Zembla coast. It was a most laborious and perilous voyage. They were first seen and welcomed by the "Willem Barents" on 2d August, and soon afterwards were taken on board the "Hope," a whaler which had come out for their rescue under the command of Sir Allen Young.

Nordenskiöld and the N. E. passage.

Professor Nordenskiöld, when he projected the achievement of the northeast passage, was a veteran polar explorer, for he had been in six previous expeditions to Greenland and Spitzbergen. In 1875 he turned his attention to the possibility of navigating the seas along the northern coast of Siberia. Captain Wiggins of Sunderland was a pioneer of this route, and his voyages in 1874, 1875, and 1876 led the way to a trade between the ports of Europe and the mouth of the Yenisei river. In June, 1875, Professor Nordenskiöld sailed from Tromsö in the "Proven," reached the Yenisei by way of the Kara Sea, and discovered an excellent harbor on the eastern side of its mouth, which was named Port Dickson in honor of Mr. Oscar Dickson of Gothenburg, the munificent supporter of the Swedish expeditions. It having been suggested that the success of this voyage was due to the unusual state of the ice in 1875, Nordenskiöld undertook a voyage in the following year in the "Ymer" which was equally successful. By a minute study of the history of former attempts, and a careful consideration of all the circumstances, Professor Nordenskiöld convinced himself that the achievement of the northeast passage was feasible. The king of Sweden, Mr. Oscar Dickson, and M. Sibiriakoff, a wealthy Siberian proprietor, supplied the funds, and the steamer "Vega" was purchased. Nordenskiöld was leader of the expedition, Lieutenant Palander was appointed commander of the ship, and there was an efficient staff of officers and naturalists, including Lieutenant Hovgaard of the Dutch and Lieutenant Bove of the Italian navy. A small steamer called the "Lena" was to keep company with the "Vega" as far as the mouth of the Lena, and they sailed from Gothenburg on 4th July, 1878. On the morning of 10th August they left Port Dickson, and on the 19th they reached the most northern point of Siberia and of the Old World, Cape Severo or Tchelyuskin, in 77° 41′ N. On leaving the extreme northern point of Asia a southeasterly course was steered, the sea being free from ice and very shallow. This absence of ice is due to the mass of warm water discharged by the great Siberian rivers during the summer. On 27th August the mouth of the river Lena was passed, and the "Vega" parted company with the little "Lena," continuing her course eastward. Professor Nordenskiöld very nearly made the northeast passage in one season. Towards the end of September the "Vega" was frozen in off the shore of a low plain in 67° 7′ N. and 173° 20′ W. near the settlements of the Tchuktches. During the voyage very large and important natural history collections were made, and the interesting aboriginal tribe among whom the winter was passed was studied with great care. The interior was also explored for some distance. On July 18, 1879, after having been imprisoned by the ice for two hundred and ninety-four days, the "Vega" again proceeded on her voyage and passed Behring Strait on the 20th. Sir Hugh Willoughby made the first attempt in 1553. After a lapse of three hundred and twenty-six years, the northeast passage had at length been accomplished without the loss of a single life and without damage to the vessel. The "Vega" arrived at Yokohama on September 2, 1879.

Schwatka.

In 1879 an enterprise was undertaken in the United States, with the object of throwing further light on the sad history of the retreat of the officers and men of Sir John Franklin's expedition, by examining the west coast of King William Island in the summer, when the snow is off the ground. The party consisted of Lieutenant Schwatka of the United States army and three others. Wintering near the entrance of Chesterfield Inlet in Hudson's Bay, they set out overland for the estuary of the Great Fish River, assisted by Eskimo and dogs, on April 1, 1879. They only took one month's provisions, their main reliance being upon the game afforded by the region to be traversed. The party obtained, during the journeys out and home, no less than five hundred and twenty-two reindeer. After collecting various stories from the Eskimo at Montreal Island and at an inlet west of Cape Richardson, Schwatka crossed over to Cape Herschel on King William Island in June. He examined the western shore of the island with the greatest care for relics of Sir John Franklin's parties, as far as Cape Felix, the northern extremity. The return journey was commenced in November by ascending the Great Fish River for some distance and then marching over the intervening region to Hudson's Bay. The cold of the winter months in this country is intense, the thermometer falling as low as — 70°,—so that the return journey was most remarkable, and reflects the highest credit on Lieutenant Schwatka and his companions. As regards the search little was left to be done after M'Clintock, but some graves were found, as well as a medal belonging to Lieutenant Irving of H.M.S. "Terror," and some bones believed to be his, which were brought home and interred at Edinburgh.

De Long.

Mr. Gordon Bennett, the proprietor of the *New York Herald*, having resolved to despatch an expedition of discovery at his own expense by way of Behring Strait, the "Pandora" was purchased from Sir Allen Young, and rechristened the "Jeannette." Lieutenant De Long of the United States navy was appointed to command, and it was made a national undertaking by special Act of Congress, the vessel being placed under martial law and officered from the navy. The "Jeannette" sailed from San Francisco on July 8, 1879, and was last seen steaming towards Wrangell Land on the 3d September. This land had been seen by Captain Kellett, in H.M.S. "Herald" on August 17, 1879, but no one had landed on it, and it was shown on the charts by a long dotted line. The "Jeannette" was provisioned for three years, but as no tidings had been received of her up to 1881, two steamers were sent up Behring Strait in search. One of these, the "Rodgers," under Lieutenant Berry, anchored in a good harbor on the south coast of Wrangell Land, in 70° 57′ N. on the 26th August, 1881. The land was explored by the officers of the "Rodgers" and found to be an island about 70 miles long by 28, with a ridge of hills traversing it east and west, the 71st parallel running along its southern shore. Lieutenant Berry then proceeded to examine the ice to the northward, and attained a higher latitude by 21 miles than had ever been reached before on the Behring Strait meridian, namely 73° 44′ N. Sir R. Collinson, in 1850, had reached 73° 23′ N. No news was obtained of the "Jeannette," but soon afterwards melancholy tidings arrived from Siberia. After having been beset in heavy pack ice for twenty-two months, the "Jeannette" was crushed and sunk on the 12th June, 1881, in 77° 15′ N. lat. and 155°[1] E. long. The officers and men dragged their boats over the ice to an island which was named Bennett Island, where they landed on the 29th July. They reached one of the New Siberia Islands on the 10th September, and on the 12th they set out for the mouth of the Lena. But in the same evening the three boats were separated in a gale of wind. A boat's crew with Mr. Melville, the engineer, reached Irkutsk, and Mr. Melville set out in search of Lieutenant De Long and his party, who had also landed. The other boat was lost. Eventually Melville discovered the dead bodies of De Long and two of his crew on March 23, 1883. They had perished from exhaustion and want of food. The "Rodgers" was burnt in its winter quarters, and one of the officers, Mr. Gilder, made a hazardous journey homewards through northeast Siberia.

Work of Danes in Greenland.

The Danes had been very active in prosecuting discoveries and scientific investigations in Greenland, since the journey of Nordenskiöld in 1870. Lieutenant Jensen made a gallant attempt to penetrate the inland ice in 1878, and Professor Steenstrup, with Lieutenant Hammer, closely investigated the formation of ice masses at Omenak and Jacobshavn. In 1883 an expedition under Lieutenants Holm and Garde began to explore the east coast of Greenland, the discovery of the outline of which was completed in 1879. In the summer of that year Captain Mourier, of the Danish man of war "Ingulf," sighted the coast from the 6th to the 10th of July, and was enabled to observe and delineate it from 68° 10′ N. to 65° 55′ N., being exactly the gap left between the discoveries of Scoresby in 1822 and those of Graah in 1829. Lieutenant Hovgaard of the Danish navy, who accompanied Nordenskiöld in his discovery of the northeast passage, planned an expedition to ascertain if land existed to the north of Cape Tchelyuskin. He fitted out a small steamer called the "Dymphna" and sailed from Copenhagen in July, 1882, but was unfortunately beset and obliged to winter in the Kara Sea. In 1883 Baron Nordenskiöld undertook another journey over the inland ice of Greenland. Starting from Auleitsivikfjord on 4th July, his party penetrated 84 miles eastward, and to an altitude of 5000 feet. The Laplanders who were of the party were sent on snow-shoes 143 miles further, travelling over a desert of snow to a height of 7000 feet. Results in physical geography and biology were obtained which will render this unparalleled journey memorable.

Weyprecht's plan.

On September 18, 1875, Lieutenant Weyprecht, one of the discoverers of Franz-Josef Land, read a thoughtful and carefully prepared paper before a large meeting of German naturalists at Gratz on the scientific results to be obtained from polar research and the best means of securing them. He urged the importance of establishing a number of stations within or near the Arctic Circle, in order to record complete series of synchronous meteorological and magnetic observations. Lieutenant Weyprecht did not live to see his suggestions carried into execution, but they bore fruit in due time. The various nations of Europe were represented at an international polar conference at Hamburg in 1879, and at another at St. Petersburg in 1882; and it was decided that each nation should establish one or more stations where synchronous observations should be taken from August, 1882. This useful project was matured and executed. The stations were at the following localities round the Arctic Circle:

Norwegians...	*Bosekop*, Alten Fjord, Norway,	M. Aksel S. Steen.
Swedes..........	*Ice Fjörd*, Spitabergen.	Mr. Ekholm.
Dutch............	*Dickson Harbor*, mouth of Yenisei, Siberia,	Dr. Smaller.
Russian......	*Sagastyr Island*, mouth of Lena, Siberia,	Lieut. Jürgens.
	Möller Bay, Nova Zembla,	Lieut. Andreif.
Americans.	*Point Barrow*, North America,	Lieut. Ray, U.S.A.
	Lady Franklin Bay, 81° 44′ N.,	Lieut. Greely, U.S.A.
English.........	*Great Slave Lake*, Dominion of Canada,	Lieut. Dawson.
Germans.......	*Cumberland Bay*, west side of Davis Strait,	Dr. Giese.
Danes..........	*Godthaab*, Greenland,	A. Paulsen.
Austrians......	*Jan Mayen*, North Atlantic, 71° N.,	Lieut. Wohlgemuth.

The whole scheme was successfully accomplished with the exception of the part assigned to the Dutch at Dickson Harbor. They started in the "Varna" but were beset in the Kara Sea and obliged to winter there. The "Varna" was lost, and the crew took refuge on board Lieutenant Hovgaard's vessel, which was also forced to winter in the pack during 1882–83.

Greely.

The American stations commenced work in 1882. Lieutenant Greely's party consisted of two other lieutenants, of twenty sergeants and privates of the United States army, and of Dr. Pavy, an enthusiastic explorer who had been educated in France, and had passed the previous winter among the Eskimo of Greenland. On August 11, 1881, the steamer "Proteus" conveyed Lieutenant Greely and his party to Lady Franklin Bay during an exceptionally favorable season; a house was built at the "Discovery's" winter-quarters, and they were left with two years' provisions. The regular series of observations was at once commenced, and two winters were passed without accident. Travelling parties were also sent out in the summer, dogs having been obtained at Disco. Lieutenant Lockwood made a journey along the north coast of Greenland, and reached a small island in 83° 24′ N. and 44° 5′ W.[1] Dr. Pavy and another went a short distance beyond the winter-quarters of the "Alert," and a trip was made into the interior of Grinnell Land. But all this region had already been explored and exhaustively examined by the English expedition in 1875–76.[2] The real value of the work of Lieutenant Greely's party will consist in the synchronous observations taken during 1882. As no succor arrived in the summer of 1883—though relieving vessels were dispatched both in 1882 and in 1883—Lieutenant Greely started from Lady Franklin Bay with his men on the 9th August, expecting to find a vessel in Smith Sound. On the 21st October they were obliged to encamp at Cape Sabine, on the western shore of Smith Sound, and build a hut for wintering. A few depôts were found, which had been left by Sir George Nares and Lieutenant Beebe, but all was exhausted before the spring. Then came a time of indescribable misery and acute suffering. The poor fellows began to die of actual starvation; and, when the relieving steamers "Thetis" and "Bear" reached Cape Sabine, Lieutenant Greely and six suffering companions were found just alive. If the simple and necessary precaution had been taken of stationing a depôt ship in a good harbor at the entrance of Smith Sound, in annual communication with Greely on one side and with America on the other, there would have been no disaster. If precautions proved to be necessary by experience are taken, there is no undue risk or danger in polar enterprise.

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[1] [Melville gives long. 157°. *Our Lost Explorers*, R. L. Newcomb. Hartford, 1883, p. 85.—Am. Ed.]

There is now no question as to the value and importance of polar discovery, and as to the principles on which expeditions should be sent out. Their objects are explorations for scientific purposes and the encouragement of maritime enterprise. The main principles have been briefly and clearly stated by Lieutenant Weyprecht: (1) arctic research is of the highest importance for a knowledge of nature's laws; (2) geographical research is valuable in proportion as it opens the field to scientific research generally; (3) the north pole has, for science, no greater significance than any other point in the higher latitudes. Lieutenant Weyprecht thus contends, as the council of the Royal Geographical Society has contended for years, that the attainment of the highest possible latitude or of the pole itself is not the object to be sought, but the exploration of the unknown area with a view to scientific results.

In planning a new polar expedition on an adequate scale it will be necessary to profit by the lessons of experience. This experience may be summed up in a few words. Any advanced ship or party must have a depôt ship to fall back upon which is within reach, and also in communication with the outer world. This makes disaster on a large scale, humanly speaking, impossible. Every precaution that medical science can suggest must be taken against scurvy. An advancing expedition must always follow a coast line, because an entry into the drifting pack entails failure and probably loss of the ship. The coast-line should trend north with a westerly aspect, because a general motion of the sea towards the west causes the ice to set in that direction, unless deflected from purely local causes. Hence there are usually open lanes of water along the west sides of polar lands at some time of the navigable season, while the eastern sides are usually closed with ice. These well established canons point to the western side of Franz-Josef Land as the next region to be explored.

Physical Geography of the North Polar Regions.—Our ignorance of about 3,000,000 square miles within the north polar circle, out of a total area of 8,201,883, debars us from the possibility of considering the physical geography of the polar region as a whole. We can merely take stock of the isolated facts which our limited knowledge enables us to register.

Temperature.

As the physical condition of the whole area is mainly affected by the movements and positions of the ice masses, the temperature, and the circumstances which affect it, become the first and most fundamental elements for consideration. An examination of Dove's isothermal charts shows that the isotherms about the pole form ellipses tending to arrange themselves between two poles of cold, one in North America and the other in eastern Siberia. The mildest winters appear to be in the meridians of Behring Strait and the Spitzbergen seas. These temperatures appear to be mainly influenced by the extent of frozen land or fixed ice on the one hand and the neighborhood of open water and moving ice on the other. The following table shows the mean temperatures for the summer months, winter months, and whole year, at various stations in the archipelago north of the American continent:

Expedition.	Locality.	Latitude and Longitude.	Three Summer Months.	Three Winter Months.	Year.
		° ′ °	°	°	°
M'Clure	Banks Island.........	74 0 N. 118 W.	+35	— 5.7	+1.8
Parry..........	Melville Island......	74 25 N. 111 W.	+37	—10.6	+1.4
Sutherland..	Cornwallis Island..	74 45 N. 94 W.	+36	— 8.6	+2.5
Belcher	Northumberland Sound..	77 0 N. 97 W.	+30.8	—11.8	—1.1
Parry..........	Port Bowen...	73 25 N. 80 W.	+36.9	— 6.7	+4.8

At the Great Slave Lake in North America, Sir John Richardson found the mean of the three summer months to be +49°, of the three winter months —0.8°, and of the year +9°. On the west coast of Greenland the climate of the southernmost part resembles that of Iceland or the northern shores of Norway. It exhibits a gradually decreasing temperature throughout the whole of its extent to the north. The annual mean temperature at the southernmost station of Julianshaab is +33°, and at the northernmost of Upernivik +13°. The mean temperature of the three summer months for Julianshaab is +48° and for Upernivik +48°; for the three winter months respectively +20° and —7°. The lowest temperature ever known at the Danish Greenland stations occurred at Upernivik and was —47°. Farther north on the west coast the "North Star," in 1851-52, observed the temperature for the year in Wolstenholme Sound (lat. 76° 30′ N.). For the three summer months the mean was +37.8°, for the winter months —6.8°, and for the year +4.5°. The most northern observations ever taken for a complete year were those of H.M.S. "Alert," at Floeberg Beach in 82° 27′ N. Synchronous observations were taken by H.M.S. "Discovery," in Lady Franklin Bay, lat. 81°44′ N. The results were as follows:

Ship.	Latitude.	Summer.	Winter.	Year.
	° ′	°	°	°
"Alert"...........	82 27 N.	+34	—36	—3
"Discovery".....	81 44 N.	+33	—37	—4

The minimum temperatures were —73°, registered at Floeberg Beach in March, and —70°, at Lady Franklin Bay in the same month. These temperatures can be compared with the observations taken at Mossel Bay, on the north coast of Spitzbergen, by Nordenskiöld (lat. 79° 54′ N.), and on the south coast of Franz-Josef Land by Weyprecht and Leigh Smith. At these stations the winters are less severe on account of the closer proximity of open water. In Franz-Josef Land the minimum in the winter months was —43°, and the mean was —26°; in May the mean was +22°. The climate on the coast of Siberia was registered at the winter quarters of the "Vega" in 67° 7′ N., the mean temperature of the three winter months being —10°, minimum —51°, and the mean of the three summer months +36°; but the Siberian cold is far more intense inland.

Winds.

The direction of the winds affects the temperatures and the movements of ice, but no general remarks upon them can be usefully made until our knowledge of the polar area is more complete. One of the most interesting features in polar winds is the instability of the temperature caused by them over certain areas during the winter months. At Jacobshavn, in Greenland, the mean temperature in February was +16° in one year (1872), and —25° in another (1863), a difference of 41°. It was remarked that great rises in the winter temperatures occurred at a time when the wind was blowing from the interior glacier. This wind often turns into a sudden gale. Greenland is surrounded by regions which have extremely different winter temperatures. While on one side there is the intense cold of Arctic America and the Parry Islands, on the other, to the east-southeast, there is the warm temperature caused by the Gulf Stream; so that the Greenland climate is at all times dependent on the direction of the winds. All winds from south through west to northwest bring cold weather, but the east and southeast winds raise the temperature. The hot southeast winds of Greenland are caused in the same way as the "föhn" of the Alps. The interior glacier of Greenland rises to a height of at least 7000 feet. A warm wind from the Atlantic saturated with moisture could afford to lose considerably by cooling on its journey of 400 miles over the lofty ice deserts of Greenland, and yet arrive on the west coast with a comparatively high temperature. The influence of the Greenland föhns extends over a wide area. In 1875 there was a great rise of temperature at the Danish stations of Greenland; and Sir George Nares observed the same phenomenon, at nearly the same time, at his winter quarters in 82° 17′ N. In Franz-Josef Land there are also great rises of temperature during the winter, with southerly winds accompanied by heavy falls of snow, as these winds come direct from expanses of open water caused by the current from the Atlantic.

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[1] [Lockwood Island is in long. 40° 46′ W., and more than 100 miles by coast N.E. of Cape Britannia. Sighted by Nares's expedition, 1875-6. See *Rescue of Greely*, by Schley and Soley, N. Y., 1885. Map. —Am. Ed.]

[2] [The Greely expedition added to the Map of Grinnell Land Lake Hazen, a glacial lake connecting with Chandler Fiord, the Very river to a lake at the foot of Mt. Arthur, and Greely Fiord discovered by Lockwood, from the shores of which he sighted Cape Brainard which seemed to mark the western limit of Grinnell Land.—Am. Ed.]

Ice.

Sea water, in the process of congelation, expels the salt, and its freezing point is about 28°. The ice first forms in thin, irregular flakes called "sludge," and when this is compact enough to hold snow it is known as "brash." Gathered into rounded masses it becomes "pancake ice," and soon it becomes thicker. The first thin covering is called by the whalers "bay ice." A "floe" is a sheet of ice the limits of which are visible. An "ice-field" differs from a floe in being so extensive that its limits cannot be seen. "Pack ice" consists of broken floes forced together by the wind or currents. When the pack is loosened and scattered by a wind from an opposite direction the pieces are called "sailing ice." The greatest thickness attainable by ice in one season is about 7 feet. The results of observations made by Sir George Nares in 82° 17′ N. on the west side of Greenland and by Captain Koldewey on the east side in 74° 30′ N. were identical, namely 6 feet 7 inches. Old ice is believed to become thicker in a second winter, and even to attain a thickness of 10 feet. In the palæocrystic sea there are floes from 80 to 100 feet thick, but these must be considered rather as sea-glaciers, formed by accumulations of snow on the ice year after year; and the smaller pieces broken from them have been very appropriately named floebergs. These mighty floes are sea-borne glaciers, perpetually wasted beneath and restored from above.

Icebergs.

Icebergs are only met with where there are great discharging glaciers on the land, or in currents leading from them. Greenland is the principal mother of icebergs. This immense mass covers an area of about 512,000 square miles, and has 3400 miles of coastline. It is indented by deep channels or fjords, often extending more than 60 miles, with many islands and rocks along the coast. The whole of the interior is believed to be capped by an enormous glacier always moving towards the coast, and at certain points reaching the sea where masses break off in the shape of icebergs. These icebergs rise to a height of from 60 to 300 feet above the sea, with a circumference from several hundred to several thousand yards; and from seven to eight times the bulk seen above water is submerged, so that the weight of a large berg is millions of tons. When pieces break off from a parent iceberg the process is called "calving," and the pieces are "calf ice." Recent observasion of one of the principal discharging glaciers of Greenland shows it to be 920 feet thick, and 18,400 feet wide, and that it advances at a rate of 47 feet a day during the summer season. In Spitzbergen and Nova Zembla there are much smaller glaciers discharging smaller berg pieces. The Franz-Josef Land glaciers produce large flat-topped icebergs, which do not, however, float southwards.

Currents.

The movements of the polar seas are influenced by the currents of seas and rivers which are constantly flowing northwards, and by ice-laden countercurrents which press through every strait and channel in the opposite direction. On the fringe of land forming the northern shores of Asia and America are the mouths of several great rivers. Of the Siberian rivers the Obi, with its affluent the Irtish, has a basin covering 60,000 square miles, the Yenisei 50,000, and the Lena 40,000; but these areas are almost entirely within the temperate zone. In America the rivers Mackenzie, Coppermine, and Great Fish (or Black) also pour their waters into the polar sea. The enormous volume of warm water which these rivers send into the ocean drives the heavy ice from the coast and, owing to the influence which the rotatory motion of the earth exercises, receives an easterly direction along the coast. Behring Strait is too narrow and too shallow to admit of any large flow from the Pacific, still there is a warm current which keeps the heavy ice at some distance and also flows easterly, its influence being felt beyond Point Barrow. The Norwegian current, usually considered to be a continuation of the Gulf Stream, conveys a large volume of water northwards along the coasts of Norway and Lapland, and keeps the ice at a distance from that shore throughout the winter. The polar currents flow southwards in the direction of the two great openings by Davis Strait and the sea on the east coast of Greenland, but the whole body appears eventually to find its way southwards by the former outlet. The current flowing south along the east coast of Greenland brings with it immense quantities of heavy ice, and when it reaches the south point of the land it turns westward and northward round Cape Farewell, until about 64° N., when it unites with the current coming from Baffin's Bay, and the united current, with its enormous quantity of ice and icebergs, flows south along the Labrador coast to Newfoundland. The other polar current flows southwards through all the channels and straits among the Parry Archipelago, and through Fury and Hecla Strait, down Baffin's Bay and Davis Strait.

Palæocrystic sea.

The observations of various explorers lead to the conclusion that these outlets are insufficient to carry off the great harvests of ice, and that, in one part of the polar region, it continues to accumulate and form sea-borne glaciers. Collinson observed this formation off the coast of North America, M'Clure found it along the west coast of Banks Island, while M'Clintock and Mecham traced it along the western side of Prince Patrick Island. "The surface of the floes resembles rolling hills, some of them a hundred feet from base to summit,—aged sea ice which may be centuries old, and from want of an outlet likely to increase yet in thickness to an unlimited degree. The accumulated action of repeated thaws and falls of snow on the upper surface gives it a peculiar hill and dale appearance." The same ice was found by Nares's expedition along the northern coast of Grant Land and Greenland 80 to 100 feet thick. A branch from it flows down M'Clure Strait and M'Clintock Channel until it impinges upon the northwest coast of King William Island. This is what Professor Haughton calls "the ice barrier placed in this position by the still waters caused by the meeting of the Atlantic and Pacific tides."

Geology.

The physical aspects of polar lands are much influenced by their geological formation. The Greenland coast consists mainly of gneiss, mica schist, hornblende schist, and syenite pierced by granite veins. In this formation are found the steatite used by the natives to make lamps, the cryolite of Ivigtut in the south, and the plumbago at Upernivik. North of 69° N. a flow of basalt extends across the Noursoak peninsula and Disco Island, covering an area of about 7000 square miles, and rising to a height of 6000 feet. With these trap rocks are associated the Miocene and Cretaceous beds. The Cretaceous rocks have only been found in the Omenak-fjord in 70° N.; while the Miocene formation is confined to the shores of the Waigat Strait, between Disco and the mainland, underlying the trap. Coal beds appear in several places along the shore, and very interesting remains of fossil plants have been discovered. At the termination of Igalliko-fjord in 61° N. a compact red sandstone is found. Pendulum Islands on the east coast are Oolitic. But with these exceptions the whole mass of Greenland is granitic or gneissose. The opposite side of Baffin's Bay is of the same character, as well as both sides of Peel Sound. The Parry Islands are partly Silurian and partly of the Carboniferous period. The eastern part, including North Somerset and Prince of Wales Land (except the shores of Peel Sound) and Cornwallis Island are of Silurian formation, with fossils, equivalents to the Wenlock and Dudley groups. This formation extends westward from Boothia Felix and King William Island over Prince Albert Land and the southern half of Banks Island. The southern halves of Bathurst, Melville, and Prince Patrick Islands, and the northern half of Banks Island consist of Lower Carboniferous sandstones with beds of coal, while Grinnell Land and the northern halves of Bathurst, Melville, and Prince Patrick Islands are Carboniferous limestone. Lias fossils (ammonites) were found at one place on the east side of Prince Patrick Island in 76° 20′ N. Sherard Osborn also found the vertebræ of a huge saurian (*Teleosaurus*) at the northwest extreme of Bathurst Island, probably of the Lower and Middle Oolitic period.

Ellesmere Land, on the western side of Smith Sound, consists of gneiss rising to heights of 2000 feet which underlie Miocene rocks at Fort Foulke. Farther north the gneiss continues with statified black slates having a very high and often vertical dip. In 82° 33′ N. these slates give place to a series of quartzites and grits rising to elevations of 2000 and 3000 feet. Silurian limestones are found on the shores of Kennedy Channel up to Cape Tyron on the Greenland side. Carboniferous limestone occurs on the north coast of Grant Land, as far west as Clements Markham Inlet, rising to a height of 2000 feet. Near Lady Franklin Bay in 81° 45′ N. a deposit of coal of the Miocene period was discovered, with a fossil flora including thirty species of plants—pines, birch, poplar, elm, and hazel. The whole of this land to the north of Baffin's Bay is slowly rising.

Spitzbergen and Nova Zembla are also composed mainly of primitive rocks. In northern Spitzbergen there are also Miocene beds with a fossil flora closely allied to that of Lady Franklin Bay, and some fossils of the Lias period. The geological characters of Franz-Josef Land and Spitzbergen are closely allied. The predominant rock is dolerite, a kind of greenstone.

The "tundra" of Siberia is a wide belt of land intervening between the line of forest and the polar shores, and intersected by the great rivers. It is frozen for immense depths below the surface, and here the remains of mammoths, generally in great landslips along the river banks, have been found. But their fossil ivory occurs in greatest quantity in the New Siberia group. On these islands also occur the "wood-hills," consisting of horizontal sandstone beds alternating with strata of bituminous tree stems, heaped on each other to the top of the hill. Ammonites of the Lias period are also found there.

Flora.

In the polar regions the line of forest seldom reaches to the Arctic Circle; low birches and willows and shrubs bearing berries occur in the south of Greenland, but farther north the creeping willow alone forms wood. There are 762 flowering plants, and 925 cryptogams within the Arctic Circle, making a total of 1687 plants. Lapland contains by far the richest arctic flora, amounting to three-fourths of the whole, while three-fifths of the species found in Arctic Asia and America also belong to Lapland. In the European arctic district 616 flowering plants have been collected, in Arctic Asia 233, in Arctic America eastward of the Mackenzie 379, and westward of that river 364, and in Greenland 207. The most arctic plants of general distribution, which are found far north in all the arctic areas, are three species of *Ranunculus*, a poppy (*Papaver nudicaule*), the *Draba alpina* and five other species, the *Braya alpina*, lady's-smock (*Cardamine pratensis*), eight species of saxifrage, two of *Potentilla*, two of *Arenaria*, the moss campion (*Silene acaulis*), the dandelion, a *Stellaria*, the *Dryas octopetala*, *Cerastium alpinum*, *Epilobium latifolium*, crowberry, dwarf willow, and rushes and grasses of the genera *Juncus*, *Carex*, and *Poa*. The most ubiquitous of all is the *Saxifraga oppositifolia*, which is considered the commonest and most arctic of the flowering plants.

Fauna.

All the arctic seas teem with the lower forms of animal life. The invertebrate animals have been enumerated and reported upon in full detail by the naturalists to whom the collections of the various expeditions have been entrusted. The fishes, birds, and mammals of the north polar region have also been studied and carefully described within the discovered areas, though the subject is far from having been exhausted.

Inhabitants.

The human race is found to exist along the whole fringe of European, Asiatic, and American coast-line within the Arctic Circle, and to have spread up the shores of Boothia, and up both sides of Davis Strait and Baffin's Bay. Living mainly on sea animals, the inhabitants of the polar regions rarely wander from the coast. Spitzbergen, Franz-Josef Land, and Nova Zembla are uninhabited, except that occasional summer visits are made to the southern shores of the latter group of islands. The Laps are the denizens of the European polar regions, and the Samoyeds succeed them along the shores of the Kara Sea and on the Yalmal peninsula. These Laps and Samoyeds possess herds of reindeer, and during the winter they withdraw from the coast. In Siberia there was once a coast population, but it has retired into the interior or died out, and inhabitants are not met with until the encampments of the Tchuktches are reached, from the Kolyma to Behring Strait. A very complete account of this interesting people has been given by Baron Nordenskiöld in his narrative of the voyage of the "Vega." The Eskimo race extends over the whole of Arctic America and along the Greenland coasts, the warlike Indian tribes preventing them from retreating inland, and forcing them to find a precarious living or starve on the shores of the polar sea. Differing in size and physical development, the individuals of the different tribes all have flat, broad faces, black coarse hair, high cheek bones, low foreheads, short flat noses, and narrow eyes sloping upwards from the nose. Their hands and feet are small. Vast tracts of country, including the archipelago to the north of America, are not inhabited, yet there are traces of Eskimo encampments along the whole line of coast from Banks Island to Baffin's Bay. This may have been the route by which Greenland was first peopled, and it suggests a continuation of land along the same parallel, from Banks Island to the Siberian coast. Yet it may be that the wanderers found their way northwards from America by Prince of Wales Strait. The most remarkable tribe is that named Arctic Highlanders by Sir John Ross in 1818, and they are the most northern people in the world. Their stations range along the Greenland coast from 76° to 79° N., a deeply-indented coast-line of gigantic cliffs broken by deep bays, with numerous rocks and islands. They have no canoes, but dogs and good sledges, and they attack the walrus at the edge of the ice with spears. They are separated from the Eskimo of Greenland farther south by the glaciers of Melville Bay. In Danish Greenland the original Eskimo were probably intermixed in blood with the old Norse settlers, and since the time of Hans Egede the number of half-breeds has increased. In 1855 the half-breeds were calculated at 30 per cent. of the inhabitants of Greenland, and the two classes have since blended almost imperceptibly, so that there are now no full-blooded Eskimo. The population of Danish Greenland in 1870 was 9588, distributed among 176 winter stations. There are a few scattered families on the east coast of Greenland.

SOUTH POLAR REGION.

The south polar region, unlike the northern region, is almost covered by the ocean, the only extensive land being far to the south. It was of course entirely unknown to the ancients and to the early navigators of modern Europe, although a theory prevailed among geographers that a great continent existed round the south pole, the "Terra Australis Incognita." Lope Garcia de Castro, the governor of Peru, sent his nephew Alvaro Mendaña in search of it, who sailed from Callao in 1567. Another expedition under Pedro Fernandez de Quiros left Callao in 1605, and discovered land in April, 1606, which he called Australia del Espiritu Santo, now known to be one of the New Hebrides group. These were the first regular expeditions in search of the supposed southern continent.

The first ship that ever approached the Antarctic Circle was one of a fleet which sailed from Rotterdam under the command of Jacob Mahu as admiral in June, 1598. She was called the "Good News," a yacht of 150 tons, with Dirk Gerritz as her captain. She was separated from the rest of the fleet in Magellan's Strait in 1599, and was carried by tempestuous weather far to the south, discovering high land in 64° S. This appears to have been the land afterwards named the South Shetlands. Gerritz and his crew were eventually captured by the Spaniards at Valparaiso. In 1671 La Roche discovered South Georgia, a solitary island in the South Atlantic, but north even of the latitude of Cape Horn. Where so little is known, and where there is so little land, the discoveries within a few hundred miles of the Antarctic Circle come to be spoken of as south polar. In this category is Kerguelen Island in 48° 41′ S., as it is at least a good base whence south polar discovery may start, though its latitude in the southern is almost the same as England in the northern hemisphere, on a meridian nearly half way between the Cape and Australia. Its discovery is due to the gallant but unfortunate Frenchman, whose name it bears, Yves J. Kerguelen. He sighted it on January 17, 1772, on the same day that his countryman Marion discovered the island named after himself, on a meridian nearer the Cape. Captain Cook, in his third voyage, visited Kerguelen Island, and Robert Rhodes in 1799 mapped a considerable portion of its coast. The Sandwich group, southeast of South Georgia, was discovered in 1762.

Captain Cook in January, 1773, sailed southwards from the Cape of Good Hope in the "Resolution" with the "Adventure" in company, and, after passing much ice, crossed the Antarctic Circle on the 17th, in longitude 39° 35′ E. In the same afternoon they sighted thirty-eight icebergs to the southward, besides much loose ice; and in 67° 15′ their progress was stopped. Cook did not think it prudent to persevere in getting farther south, and bore up for New Zealand. In December, 1773, another attempt was made to discover the supposed southern continent, by steering southwards from New Zealand. On the 20th Cook again crossed the Antarctic Circle in 147° 46′ W., and came amongst a cluster of very large icebergs with loose ice in 67° 5′ S. He got clear of them and after standing farther east he reached a latitude of 69° 45′ S. in 108° 5′ W., and still shaping a southerly course he reached 70° 23′ S. on January 29, 1774. Next day he came to icebergs forming an impenetrable barrier. He counted ninety-seven, which looked like a range of mountains, with closely packed ice around them. Cook's farthest point was in 71° 15′ S. on the meridian of 106° 54′ W. Captain Cook discovered islands in 53° to 54° 30′ S. in January, 1775, which he named Sandwich, Willis, Pickersgill, and Georgia Isles, in about 32° W. In 27° 45′ W., he reached land which he named the Southern Thule, because it was the most southern land that had ever yet been discovered. It is in 59° 13′ S. In the South Atlantic ice was met with as far north as 51°. In this second voyage Captain Cook made the circuit of the southern ocean in a high latitude, twice crossing the Antarctic Circle. He established the fact that, if there was any extensive south polar land, it must be south of the parallels along which he sailed. The Russian expedition under Bellingshausen in 1820 also sailed over a great many degrees of longitude in a high latitude, but only discovered two islets, Petra and Alexander. These islands were farther south than any land then known.

Auckland Island was discovered by Captain Bristow in 1806, and Campbell Island by Hazleburgh in 1810, both south of New Zealand, but far to the north of the Antarctic Circle. In 1818 Mr. William Smith of Blyth rediscovered the land known as South Shetland. His work was confirmed by Mr. Bransfield, the master of H.M.S. "Andromache," flag-ship on the west coast of South America, who further discovered another portion named Bransfield Land. Further coast-line was sighted by the French expedition under Dumont d'Urville in 1838, who named it Prince de Joinville and Louis Philippe Land.

The South Orkneys were discovered by Captain George Powell, in the sloop "Dove," on October 6, 1821. Mr. Weddell, R.N., with the sailing vessels "Jane" and "Beaufoy," penetrated as far south as 74° 15′ S. on the 20th February, 1823.

In the early part of this century Messrs. Enderby began to send vessels to the Antarctic regions for the whale fishery, which made several discoveries. The brig "Tula" of 148 tons and cutter "Lively" left London in July, 1830, under the command of Mr. John Biscoe, R.N., on a sealing voyage, but with special instructions to endeavor to make discoveries in high southern latitudes. In February, 1831, land was discovered in longitude 47° 20′ E. and latitude 65° 57′ S., which Biscoe named Enderby Land, in honor of his employers. He did not, however, get nearer to it than 20 or 30 miles. In February, 1831, Biscoe again discovered land in 67° 1′ S. lat. and 71° W. long., to which he gave the name of Adelaide Island. It proved to be the westernmost of a chain of islands fronting a high continuous coast, since called Graham's Land. A few days afterwards Captain Biscoe succeeded in landing on Adelaide Island. In 1833 Captain Kemp, in the sealing schooner "Magpie," discovered another point of the land to the eastward, which doubtless forms part of Enderby Land.

Messrs. Enderby sent out another expedition of discovery in 1838, consisting of the "Eliza Scott" of 154 tons, commanded by Mr. John Balleny, and the "Sabrina" cutter of 54 tons, under Mr. Freeman. In February, 1839, when on about the 163d E. meridian, they sighted high land in 66° 30′ S. On the 12th Captain Freeman managed to get on shore, but the cliffs were perpendicular, and the valleys were filled with ice. The discovery proved to be a group of volcanic islands, one of them rising to a beautiful peak estimated at 12,000 feet above the sea, named Freeman Peak. Sabrina Island was discovered in March, 1839. The other group received the name of the Balleny Islands. The Auckland Islands were ceded to Messrs. Enderby in 1849, and a whaling establishment was formed there under good auspices.

In 1839 the French expedition under Dumont d'Urville proceeded south from Tasmania and discovered two small islands on the Antarctic Circle named "Terre Adélie" and "Côte Clarie." At the same time Commander Wilkes of the United States expedition made a cruise to the southward and mapped a large tract of land in the latitude of the Antarctic Circle for which he claimed the discovery. But as a portion of it had already been seen by Balleny, and the rest has since been proved not to exist, the claim has not been admitted.[1]

The English Antarctic Expedition of 1839–43 was undertaken mainly with a view to magnetic observations, and the determination of the position of the south magnetic pole. Two old bomb vessels, the "Erebus" and "Terror," were fitted out under the command of Captain (afterwards Sir James) Ross, with Captain Crozier in the "Terror." Dr. Joseph D. Hooker accompanied the expedition as naturalist. Leaving Chatham in September, 1839, the two vessels first proceeded to the Cape, and went thence southwards to Kerguelen Island, which was reached in May, 1840, and carefully surveyed. In August Sir James Ross established a magnetic observatory at Hobart Town. The cruise for the second season was commenced from Tasmania in November, 1840. The Auckland Islands and Campbell Island were first visited and surveyed, and on New Year's day, 1841, the Antarctic Circle was crossed about 172° E. A few days afterwards the two vessels were beset in the pack and began perseveringly boring through it. By January 10th they succeeded and were clear of ice in 70° 23′ S., and next day land was sighted, rising in lofty peaks and covered with perennial snow. That day Ross passed the highest latitude reached by Cook (71° 15′ S.). On a nearer approach to the land, there was a clear view of the chain of mountains with peaks rising to 10,000 feet, and glaciers filling the intervening valleys and projecting into the sea. The south magnetic pole was calculated to be in 76° S. and 145° 20′ E., or about 500 miles southwest from the ship's position. The land interposed an insuperable obstacle to any nearer approach to it. Captain Ross landed with great difficulty, owing to the strong tide and drifting ice, on a small island near the shore, named Possession Island, in 71° 56′ S. and 171° 7′ E. Inconceivable myriads of penguins covered the surface, but no vegetation was seen. Next morning there was a southerly gale which moderated, and on 18th January they were again sailing south in an unexplored sea. On the 23d they were in 74° 20′ S., and thus passed the most southern latitude previously reached (by Captain Weddell in 1823). Sailing along the newly discovered coast, Captain Ross landed after much difficulty on an island named after Sir John Franklin in 76° 8′ S. On the 27th they came in sight of a mountain 12,400 feet above the sea, which proved to be an active volcano emitting flame and smoke in great profusion. It was named Mount Erebus, and an extinct volcano to the eastward 10,900 feet high was named Mount Terror. Along the coast as far as the eye could reach to the eastward there was a perpendicular cliff of ice from 150 to 200 feet high, perfectly level at the top, and without any fissures or promontories on its smooth seaward face. Nothing could be seen above it except the summits of a lofty range of mountains extending to the southward as far as 79° S. To this range the name of Parry was given. The most conspicuous headlands under Mount Erebus were named Capes Crozier and Bird. Captain Ross then sailed eastward along the marvellous wall of ice, in 77° 47′ S. to 78° S. This ice barrier was calculated to be 1000 feet thick, and it was followed for a distance of 450 miles without a break. The winter was now approaching, young ice was beginning to form, but luckily a strong breeze enabled them to force their way through it. The whole of the great southern land discovered by Sir James Ross was named Victoria Land.

In returning to Hobart Town the expedition visited the Balleny Islands, and searched in vain for the land which Captain Wilkes had laid down on his chart.

In November, 1841, the "Erebus" and "Terror" again shaped a southerly course, entered the pack ice on December 18th, and once more crossed the Antarctic Circle on New Year's Day. The navigation through a belt of ice 800 miles broad was extremely perilous. At length on 1st February, 1842, a clear sea was in sight, and they proceeded to the southward in 174° 31′ W. On the 22d they were surrounded by numerous lofty icebergs aground, and at midnight the Great Icy Barrier was sighted and its examination recommenced in 77° 49′ S. Next day the expedition attained a latitude of 78° 11′ S., by far the highest ever reached before or since.[1] After escaping imminent dangers in navigating through chains of huge icebergs Captain Ross took his ships northward, and wintered at the Falkland Islands.

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[1] [Yet the Royal Geographical Society of England awarded him the Founder's medal for his discoveries here.—AM. ED.]

In December, 1842, the expedition sailed from Port Louis on the third visit to the south polar region, seeing the first iceberg in 61° S. On the 28th the ships sighted the land named after the Prince de Joinville by Dumont D'Urville, and the southern side of the South Shetlands was discovered and surveyed. During February about 160 miles of the edge of the pack were examined, on March 11th the Antarctic Circle was recrossed for the last time, and the expedition returned to England in September, 1843. Thus after four years of most diligent work, this ably conducted and quite unparalleled voyage to the south polar regions came to an end.

In 1845 a merchant barque, the "Pagoda," was hired at the Cape, in order that magnetic observations might be completed south of the 60th parallel, between the meridians of the Cape and Australia. The ship's progress was stopped by an impenetrable pack in 68° S. The magnetic work was, however, completed.

H. M. S. "Challenger," the exploring ship commanded by Captain Nares, arrived at Kerguelen Island on the 6th January, 1874, where surveys were made, and the island was thoroughly examined by the naturalists of the expedition. Two islands, named Heard and M'Donald, were also visited, which had been discovered in November, 1853, by Captain Heard of the American ship "Oriental," owing to the practical application of the problem of great circle sailing. There is in fact a group of islands about 240 miles from Kerguelen. In February the "Challenger" ran south before a gale of wind and the first iceberg was sighted on the 11th in 60° 52′ S. It was 200 feet high and about 700 long. On the 19th the ship was at the edge of a dense pack in 65° 42′ S.; and on the 4th March they bore up for Australia. Several deep-sea soundings were taken, the greatest depth being 1975 fathoms. The route of the "Challenger" was much the same as that of the "Pagoda" in 1845, but more to the north. With it ends the somewhat meagre record of voyages across and towards the Antarctic Circle.

(C. R. M.)

POLE, REGINALD (1500–1558), generally known as Cardinal Pole, was born at Stourton Castle, Staffordshire, March 3, 1500. He was the son of Sir Richard Pole and Margaret, countess of Salisbury. Designed from early youth for the church, he was educated in the Carthusian monastery at Sheen, and at Magdalen College, Oxford. He was admitted to deacon's orders at the age of sixteen, and at once received high preferment, holding, among other benefices, the deanery of Exeter. He continued his studies at the university of Padua, where he made acquaintance with Erasmus and other prominent men, and after a visit to Rome in 1525, returned to England. Henry VIII. was eager to keep him at court, but Pole appears to have held aloof from politics until the question of the king's divorce drew him from his retirement. He was probably from the first opposed to Henry's policy, but we find him, nevertheless, in 1530, at Paris, charged with the duty of obtaining the decision of the Sorbonne on the question at issue. That decision given, he returned to England, but refused to approve the king's divorce, or the other measures connected with it. The king, anxious to gain his adhesion, offered him the archbishopric of York, vacant by the death of Wolsey in 1531. After some hesitation, he refused the offer and left the country.

This was the turning-point in his career, and concludes the first of the three periods into which his life may be divided. During the second period, for upwards of twenty years, he lived abroad, the declared and active enemy of the Protestant movement in his own country. After passing a year at Avignon, he took up his residence a second time at Padua. As he had not yet declared himself publicly against Henry, the latter continued favorably disposed towards him, allowing him the revenues of his deanery, and exempting him from the oath of allegiance to Queen Anne's children. In 1535, however, there came a change. The king sent to ask his formal opinion on the divorce and the ecclesiastical supremacy. Pole's answer, afterwards published, with considerable additions, under the title *Pro Unitate Ecclesiæ*, was sent to England early in the next year. It contained a vigorous attack upon Henry's policy and menaced the king with condign punishment at the hands of the emperor and the king of France if he did not return to his allegiance to Rome. Summoned to England to explain himself, he refused to come. Late in 1536 he was made cardinal, and early next year he was sent as papal legate with the object of uniting Charles V. and Francis I. in an attack upon England, which was to coincide with a rising of the Romanists in that country. The terms of peace between England and France making it impossible for him to remain in the latter country (for he was now attainted of high treason), he passed into Flanders, and soon afterwards (August, 1537) returned to Rome. A year later (November, 1538) he published his book, together with an apology for his own conduct, addressed to Charles V. In 1539, after the bull of excommunication had been issued against Henry VIII., Pole went to Spain in order to urge Charles to attack England. An invasion was threatened but given up, and Pole retired to Carpentras. From 1539 to 1542 he acted as papal legate at Viterbo. In 1543 he was contemplating an expedition to Scotland with an armed force to aid the anti-English party, and in 1545 he was corresponding with the same party and with Charles V. for a joint attack on England. In the same year he went to Trent in disguise, to avoid the danger of seizure on the way, and presided at some of the preliminary meetings of the council. On the death of Henry VIII. he made an attempt to reconcile himself with the English government, but in vain. In 1549 he was a candidate for the papacy on the death of Paul III., and at one moment was on the point of being elected, but in the end was unsuccessful, and retired to Maguzzano, on the Lake of Garda. When Edward VI. died Pole was engaged in editing his book *Pro Unitate Ecclesiæ*, with an intended dedication to that king.

The accession of Mary opens the third period of his life. The pope at once appointed him legate, and entered into negotiations with the queen. A marriage between her and Pole was at one moment contemplated, but the state of public feeling in England rendered his return impossible, and he was kept waiting for a year in Flanders and Germany. The reaction at length produced a parliament favorable to Rome, and enabled him to return (November, 1554). As legate he received the national submission, and pronounced the absolution, accepting at the same time, on behalf of the pope, the demands of parliament with respect to ecclesiastical lands, etc. Next year he was on two occasions a candidate for the papacy, but was twice disappointed. After Philip's departure, and the death of Gardiner (October, 1555), Pole became Mary's chief adviser, and, with her, must bear the blame of the persecution which followed on the reunion with Rome. On Cranmer's death (March, 1556) he became archbishop of Canterbury, but soon afterwards (May, 1557) fell into disgrace with the pope, Paul IV., who was his personal enemy. On the outbreak of the war with France, Paul, the political ally of that country, cancelled Pole's legatine powers and even charged him with heresy. No remonstrances on the part of Mary and Pole himself could induce the pope to retract this sentence, and Pole died (November 18, 1558) at enmity with the power in whose support he had spent his life.

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[1] [This expedition proceeded southward 1st February in 158° 12′ W. and reached 78° 11′ in 161° 27′ W. See *Ross's Voyage of Discovery and Research in Southern and Antarctic Regions*, 1839–43, vol. ii. p. 187–201. London, 1847.—AM. ED.]

His chief works are *Pro Unitate Ecclesiæ, ad Henricum VIII.* (ed. princ., Rome, n. d.); *Reformatio Angliæ* (Rome, 1556); *De Concilio* (Rome, 1562); *De summi Pontificis officio et potestate* (Louvain, 1569); *De Justificatione* (Louvain, 1569); *Letters*, etc., (ed. Quirini, Brescia, 1744).

See Beccadelli, *Vita Poli Cardinalis*, Venice, 1553, London, 1690; Quirini, "Vita Ricardi Poli." prefixed to the *Letters;* Phillipps, *History of the Life of R. Pole*, Oxford, 1764; also Strype's *Memorials;* Froude's *History of England;* Hook's *Archbishops of Canterbury*, etc. (G. W. P.)

POLECAT. This name is applied to one of the English members of the large Family *Mustelidæ*, which contains besides the Martens, Weasels, and Badgers (see MAMMALIA, vol. xv. p. 446, and the separate articles under these names).

Common Polecat.

In this family the Polecats, while belonging, with the stoats, weasels, and many others, to the nearly cosmopolitan genus *Putorius*, form by themselves a small group confined to the northern hemisphere, and consisting of four species, of which the best known and most widely distributed is the common polecat of Europe (*Putorius fœtidus*). This animal, at least so far as its disposition, size, and proportions are concerned, is well known in its domesticated condition as the ferret, which is but a tamed albino variety of the true polecat. The color of the latter, however, instead of the familiar yellowish white of the ferret is of a dark brown tint above, and black below, the face being variegated with dark brown and white markings. Its skull is rough, strongly ridged, and altogether of a far more powerful type than those of the stoats, weasels, or martens; the skull of the female is very much smaller and lighter than that of the male. Its fur is long, coarse, and of comparatively small value, and changes its color very little, if at all, at the different seasons of the year.

The distribution and habits of the common polecat have been well described by Blasius in his *Säugethiere Deutschlands*, and the following is an abstract of his account. The polecat ranges over the greater part of Europe, reaching northwards into southern Sweden, and in Russia to the region of the White Sea. It does not occur in the extreme south, but is common everywhere throughout central Europe. In the Alps it ranges far above the tree-line during the summer, but retreats in winter to lower ground. In fine weather it lives either in the open air, in holes, fox-earths, rabbit-warrens, under rocks, or in woodstacks; while in winter it seeks the protection of deserted buildings, barns, or stables. During the day it sleeps in its hiding place, sallying forth at night to plunder dovecots and hen-houses. It climbs but little, and shows far less activity than the marten. It feeds ordinarily on small mammals, such as rabbits, hamsters, rats, and mice, on such birds as it can catch, especially poultry and pigeons, and also on snakes, lizards, frogs, fish, and eggs. Its prey is devoured only in its lair, but, even though it can carry away but a single victim, it commonly kills everything that comes in its way, often destroying all the inhabitants of a hen-house in order to gratify its passion for slaughter. The pairing time is towards the end of the winter, and the young, from three to eight in number, are born in April or May, after a period of gestation of about two months. The young, if taken early, may be easily trained, like ferrets, for rabbit-catching. The polecat is very tenacious of life and will bear many severe wounds before succumbing; it is also said to receive with impunity the bite of the adder. Its fetid smell has become proverbial. To this it is indebted for its generic name *Putorius* (derived, as are also the low Latin *putacius*, the French *putois*, and the Italian *puzzola*, from *puteo*), as well as the designation *foumart* (*i. e.* foul marten), and its other English names *fitchet*, *fitchew*. Attempts to account for the first syllable of the word *polecat* rest entirely on conjecture.

The other species of the polecat group are the following:

The Siberian Polecat (*Putorius eversmanni*), very like the European in size, color, and proportions, but with head and back both nearly or quite white, and skull more heavily built and sharply constricted behind the orbits, at least in fully adult individuals. It inhabits the greater part of southwestern Siberia, extending from Tibet into the steppes of southeastern European Russia.

The Black-footed or American Polecat (*Putorius nigripes*), a native of the central plateau of the United States, and extending southwards into Texas. It is very closely allied to the last species, but has nevertheless been made the type of a special sub-genus named *Cynomyonax*, or "King of the Prairie Marmots," a name which expresses its habit of living in the burrows of, and feeding upon, the curious prairie marmots (*Cynomys*) of the United States. An excellent account of this species may be found in Dr. Elliott Coues's *Fur-bearing Animals of North America.*

Lastly, the Mottled Polecat (*Putorius sarmaticus*), a rare and peculiar species occurring in southern Russia and southwestern Asia, extending from eastern Poland to Afghanistan. It differs from the other polecats both by its smaller size and its remarkable coloration, the whole of its upper parts being marbled with large irregular reddish spots on a white ground, and its underside, limbs, and tail being deep shining black. Its habits, which seem to be very much those of the common polecat, have been studied in Kandahar by Captain Thomas Hutton, who has given a vivid description of them in the *Journal of the Asiatic Society of Bengal* for 1845.

POLEVOY. SEE RUSSIAN LITERATURE.

POLICE. The branch of criminal justice which comprises a methodical system for the prevention and detection of crime is commonly known by the name of "Police." With the system having these objects is combined the execution of many duties not strictly involved in the popular definition of crime, but materially affecting the security and convenience of the public. Bentham, more comprehensively, says that police is in general a system of precaution either for the prevention of crime or of calamities. It is destined to prevent evils and provide benefits. The system for the attainment of these objects and the introduction and establishment of that system in the United Kingdom form the main subject of this article; some account will afterwards be given of the police in other states.

In this view the definition and use of the word "police," as meaning the regulation and government of the city and country in relation to the inhabitants, are not sufficiently close. When Blackstone says that by the public police and economy he means "the due regulation and domestic order of the kingdom, whereby the individuals of the state, like members of a well governed family, are bound to conform their general behavior to the rules of propriety, good neighborhood, and good manners, and to be decent, industrious, and inoffensive in their respective stations," the definition is capable of an interpretation at once too wide and too narrow for the present purpose. It is vain to look for an accurate description of police, as a system, in writers of a period when the thing sought for had no existence. The system is of recent growth, and it is necessarily more associated with personal instruments for the attainment of objects than with the objects to be attained. An observation of Gibbon, referring to the ædiles and quæstors of the Roman empire, that officers of the police or revenue easily adapt themselves to any form of government, correctly presents the idea of distinctive personal elements. A system of police administration includes neither the making of the law nor the law itself. Officers of police are neither legislators nor (in the usual sense) magistrates. They are the instruments by which conformity to the rules of the commonwealth is attained.

Apart from the repression of crime as generally understood, it is plain that, at least in crowded cities, a power ought to exist for the suppression of noise and disorder, the regulation of locomotion and traffic, the correction of indecency, and the prevention of a numerous class of annoyances and impositions which can only be restrained by cognizance being taken of them at the instant. To these may be added a number of petty disputes the immediate settlement of which tends materially to the public peace. Over such subjects as these it is obviously for the general advantage the police should have a summary control. Any apprehension of danger to liberty can only be founded on its abuse and not upon its proper exercise.

The employment of persons in these various duties, as well as in the prevention and detection of graver matters of crime, constitutes a division of state labor. Therefore, while it is perfectly correct to speak of the various legislative and other measures for good order as "matters of police," the organization and management of the police forces constitute a distinct subject.

The essential features of the established police system, alike in Great Britain and in foreign states, in cities and towns as in countries and village communities, comprise the following matters:

I. A body of persons in relation to the state enforcing obedience to the criminal law, the prevention and detection of crime, and the preservation of order, over a defined area, generally divided and subdivided for the purpose of distribution and immediate government of the force, but having one jurisdiction throughout.

II. The division of that force into classes of various rank, comprising, in general, in ascending order, constables, sergeants, inspectors, and superintendents (or their equivalents),—the constables being the most numerous and themselves divided into classes.

III. General control of the entire body by heads, whether styled commissioners or chiefs, having power to make regulations for the government of the force, subject in turn to the control of state authorities.

IV. Patrol day and night of the streets, roads, and public places,—the "beats" and "tours of duty" of constables being prescribed by regulations, and actual performance and compliance being secured by the sergeants and inspectors.

V. The payment of the force, including establishment charges, out of public funds provided for the purpose.

Relation to the state.

In dealing with these subjects as nearly as may be in the order indicated, the relationship of the police force to the state is of primary importance. A general control by the executive Government of a state of the police forces, for the legitimate objects for which they are established, seems essential. In Great Britain every member of the force, from an ordinary constable upwards, stands in the direct position of a servant of the crown. On admission he makes a promissory declaration (recently substituted for an oath) that he will serve the sovereign; and it is upon the fact that a police constable has the powers, duties, and privileges of a peace officer of and for the crown that many of the incidents of his service depend, although the immediate power of dismissal is vested in heads of a force, whose orders he is bound to obey.

The state employs the police forces for the public welfare only. "There is not in England," remarked the late Chief-Justice Cockburn, "any more than in America, any system of espionage or secret police to pry into men's secret actions or to obtain information for the Government by underhand and unworthy means." The truth of this is exemplified in the present position of police administration in the metropolitan police district of England acting under the immediate control of the secretary of state. The fear expressed, and no doubt felt, on the first establishment of a regularly organized system of police, that the freedom of holding meetings and the utterance of opinion at them would be suppressed, has been dispelled. The police are expressly enjoined not to interfere with persons attending political meetings unless specially ordered, and such orders are not given unless disorder or a breach of the peace is imminent. Public addresses, even in some of the royal parks, are permitted, provided they do not cause any obstruction, and are not of an unlawful character. There are no Government police to watch the delivery of mere political opinion or the tenor of its reception by the auditory. The press is also free from Government interference, through the police, in matters short of crime or not directly incentive to crime.

The sphere of action of the police force in relation to the state has been extended by legislative enactments providing that criminals who have escaped to or from colonies may be followed and removed by process of law, and tried where the crime originated. The practical execution of the law as to these fugitive offenders rests with the police. The same observation applies to the province of police under extradition treaties. But the general action of the police force of a country is bounded by its shores. As the open sea is not the territory of any one nation, it is not competent to any one nation to preserve order or remove all delinquents on its surface, as it is in the ports, rivers, and lakes of a state. When Lord Castlereagh at the congress of Vienna spoke of the "police" to be exercised over ships carrying slaves, Talleyrand asked the precise meaning of the expression; and, on the English statesman explaining that he intended to refer to what every Government exercised in virtue of its sovereignty or under treaties with other powers, Talleyrand would not admit the existence of any maritime police, except that of each power over its own vessels.

Government supervision.

The supervision of the police by the Government stands thus: The commissioner of police of the metropolis of London is appointed by and acts under the immediate direction of the secretary of state for the home department. The commissioner of police of the city of London is in communication with the corporation, who appoint him. There is, however, a power of approval of regulations in the secretary of state. In the counties of England the appointment of the chief constable is by the county magistrates subject to the approval of the secretary of state. In municipal corporations the police, including the chief or head constable, are appointed by the watch committee. In all these cases except in the metropolis the secretary of state leaves the immediate control to local authorities and disclaims responsibility. In Scotland the secretary of state has a voice in the rules for the government, pay, and necessaries of the force. The appointment of the chief constable is subject to his approval, but practically there is no interference called for in this respect. In Ireland great authority is vested in the lord lieutenant both with respect to the police of Dublin and the royal Irish constabulary. The immediate government is vested in the heads of the forces, and the parliamentary responsibility is in the chief secretary for Ireland. Reports and returns as to the police forces of Great Britain and Ireland are laid before parliament. The immediate control and responsibility of a cabinet minister for the police of the metropolis of London makes a very important distinction between the position of that force and of the other police forces of the empire. There is, however, a general relationship of the police forces of the country to the state, arising from the contribution (not now limited to a particular proportion) made by parliament to the expenditure for a police force. Under an Act of 1856 the crown appoints three persons as paid inspectors to visit and inquire into the state and efficiency of the police appointed for every county and borough in England and Wales, and to see whether the provisions of the Acts under which they are appointed are duly observed and carried into effect; and upon the secretary of state's certificate of efficiency, laid before parliament, the contribution is made. In the same way an inspector for Scotland reports annually.

It is to be observed that the contribution cannot be made to a borough police not consolidated with the county police where the population is less than 5000. In England the state, except in the city of London, contributes about half the pay of forces which submit to certain regulations, to inspection, and to a definite amount of imperial control. In Scotland the state also contributes. About two-thirds of the cost of the Dublin metropolitan police is met by the treasury. The balance in all the above cases comes from the locality. The royal Irish constabulary is the only force whose ordinary strength is entirely supported by imperial taxation, subject, however, to payment by districts where special services are necessary.

To prevent political influence being brought to bear upon the police, they cannot vote at elections of members of parliament within their district; and the chief officers are disqualified from sitting in parliament.

Connection with the army.

The relationship of the police forces of the country to the army as a state force is satisfactory. The police is a civil force. Although constables constantly speak of the public as "civilians," the police are in turn styled civilians by soldiers. It is now only on rare occasions that soldiers are required to intervene in the case of riot or tumult, as fortunately the police force is generally sufficient for the preservation of the peace of the country. If disturbance is apprehended in any district, special constables are called upon to aid. It is no less due to the improved temper and habits of the people than to the existence of the police force that military display is rarely needed to suppress riots. In state processions and on some other occasions the police and household troops together maintain the line of route, and where troops assemble for inspection the police sometimes aid in keeping the ground. The police, as constables, are required to carry out the law as to billeting and the impressment of carriages,—at one time a very heavy incident of duty, but considerably lightened by the practice of conveying troops by railway. The police apprehend deserters on reasonable suspicion. Police in charge of a station must receive prisoners, including deserters and absentees subject to military law, if duly sent there by military authority; and, as a person subject to military law is usually left to be dealt with by the ordinary civil tribunal for offences, he is taken by the police before a magistrate. On the other hand no person subject to military law, whether an officer or a private, can neglect or refuse to deliver over to the civil magistrate any officer or soldier accused of an offence punishable in the ordinary mode, or to assist the police in his lawful apprehension; an adjustment of military and civil law is therefore effected.

The duties devolving on a police force require a fuller notice than the general remarks already made.

General duties.

A constable on ordinary patrol duty has to attend to every circumstance that a keen eye and ready ear bring under his notice. In a carefully drawn statute, although not now in general use, the general sphere of observation and duty by constables is thus summarised:

"During the time they shall be on duty, use their utmost endeavors to prevent any mischief by fire and also to prevent all robberies, burglaries and other felonies and misdemeanors and other outrages, disorders and breaches of the peace and to apprehend and secure all felons, rogues, vagabonds and disorderly persons who shall disturb the public peace, or any party or persons wandering, secreting or misbehaving himself, herself or themselves, or whom they shall have reasonable cause to suspect of any evil designs, and to secure and keep in safe custody any such person, in order that he or she may be conveyed as soon as conveniently may be before a justice of the peace, to be examined and dealt with according to law: and it shall and may be lawful to and for the said watchmen, sergeants of the watch, patrols and other person or persons to call and require any person or persons to aid and assist them in taking such felons, rogues, vagabonds and all disorderly or suspected persons as aforesaid" (3 & 4 Will. IV. c. 90, § 41).

Relation to crime.

Police action in relation to the serious matters constituting crime is familiar knowledge. It is essential to bear in mind that the powers of the police in arresting and otherwise dealing with criminals in a variety of ways is derived from and depends on police constables having been expressly invested with the powers and duties of the old parish constables. Every police force has been given these powers and duties of constables, and the possession of them is so essential that, however they may be supplemented by modern legislation, without them no police force could exist for a day.

A statistical or other inquiry into crime is necessarily beyond the limits of this article. A few facts, however, bear on the efficiency of the police forces.

The returns indicate that the apprehensions in 1881-82 were (omitting fractions) in the proportion of 41 per cent. to the number of crimes committed in England and Wales, against a like proportion in 1880-81, 42 per cent. in 1879-80, 45 in 1878-79, 44 in 1877-78, 46 for 1876-77 and 47 per cent. for 1875-76.

The director of criminal investigations reported for the year 1882 that a comparison of the statistics—which are prepared by an independent service with a scrupulous regard to accuracy—with those of foreign cities shows that the metropolis of London (metropolitan police district), with a territory nearly 700 square miles in extent, covered by more than 700,000 separate houses and inhabited by a population barely less than 5,000,000, is the safest capital for life and property in the world.

Although criminal procedure does not admit of being fully treated here as part of the police system, yet as the police by duty as well as practice are in fact prosecutors in the majority of criminal cases, the important part taken by the police force requires notice.

The efficiency of the police, as well as the exigencies of cases, has led to the arrest of offenders or suspected persons in the great majority of felonies and other crimes, where the power exists, without applying to magistrates for warrants in the first instance. Although there are some advantages attendant upon a practice under which magistrates do not hear of the matter until the accused is actually before them, it is undoubtedly better, as recently declared by the commissioners reporting on the criminal code, for the police officer to obtain a warrant where circumstances admit of his doing so. When he arrests, whether with or without a warrant, it is his duty to take the prisoner before a magistrate.

Without attempting to enter fully into the rights and duties of the police in relation to arrest, it may be mentioned that, while the important action of the police is derived from and wholly dependent (except in some cases where recent legislation has found a place) on the older powers, science has been made subservient in facilitating the application of those powers to police duties. As in old times the reasonable suspicion giving the right to arrest may still be founded on personal observation and information in the ordinary mode, but the electric telegraph and the photograph now lend their aid as recognized agents in favor of justice and truth far more than in aid of fraud and deception.

If an arrest is without a warrant, it is the officer's duty to show that he acted rightly by establishing at least that he proceeded on reasonable information. His task is generally much more. He or some police officer, whether acting under a warrant or not, has to adduce all the evidence to justify a committal for trial, or, if the case is one in which the court of summary jurisdiction has the power, for a conviction. In carrying out this duty even in simple cases a multitude of matters have to be attended to in which a number of police officers take a part. Whether the arrest is made by a constable on his beat or under other circumstances, the ordinary duty involves taking the prisoner to the police station, where the charge is entered. He is then taken before the magistrate, or, in some cases, bailed. If the charge be one of felony it generally involves a remand, not only for the attendance of witnesses, but to ascertain the prisoner's antecedents, and these remands are often multiplied in complicated cases. Every remand involves the conveyance of the prisoner to and from the prison or "lock-up"—generally the former. Detective police attend at the prison to ascertain whether the accused has been previously convicted or charged. Witnesses must be seen and their attendance secured. If the prisoner is eventually committed for trial it is the duty of the inspector or other officer having charge of the case to aid the magistrate's clerk in making out the certificate of costs, so that the proper amounts for the allowance of witnesses are inserted. Although in ordinary cases there is a nominal "prosecutor" (the person who has been wounded or lost his property), if he enters into a recognizance before the magistrate, he leaves everything to the police, who have to inform him even when and where he must attend for the trial, and the police are required in many cases to give the necessary instructions for the indictment, and when the proper time arrives for the trial at the sessions or assizes (of which public notice is given), the police must inform the witnesses and arrange for their conveyance and prompt attendance in the precincts of the court, first before the grand jury, afterwards on the trial. A police officer must attend the taxing officer, give the necessary particulars as to the witnesses and see that they receive their allowances.

The responsibilities and duties of the police may be varied, but on the whole are scarcely diminished, if there is a solicitor for a private or for the public prosecutor; the Act of 1884 relating to the public prosecutor regards the police as essential parties, and it is certain that no general system of prosecution can be carried on with diminished police intervention.

The duties of police to accused persons are too important to be passed over in complete silence. To say that they involve perfect fairness ought to be a sufficient guide, but it is right to add that the indirect as well as the direct extortion of statements, either by threat or promise, is forbidden. On the other hand, to caution accused persons is not the province of the police, as on the one hand a police officer ought not in general to put questions, so on the other hand he ought not to prevent voluntary statements. His general duty is to listen and to remember accurately what the accused says. It is often the duty of an officer to give information to the accused, as for instance of the nature of the charge on which he is arrested or to read the warrant, but information of this kind should not be given interrogatively. It sometimes happens, however, that in the course of inquiries a person makes a criminatory statement to a police officer, in consequence of which it is the duty of the officer to arrest him. This is distinct from questioning a person whom the officer has not merely suspected but predetermined to arrest.

Some other duties, the growth of modern times and unknown until recently, devolve on the police in relation to criminals. They arise from the release of offenders sentenced to penal servitude before the expiration of the period, on certain conditions, or of offenders sentenced, after the expiration of their sentence of imprisonment, to be under police supervision for a given period. Both classes of convicts involve the performance by the police of very responsible duties in reference to reporting and giving notice of changes of residence, so as to make the watch and supervision a real thing, and at the same time to give the convicts the opportunity, as intended, of gaining an honest livelihood at some labor or calling. It is a frequent source of complaint by the convicts that they are so watched that they cannot obtain employment, and are driven into the repetition of crime,—the police retorting that the allegations are untrue, and that the fresh offence is the result of the habitual offender's incurable love for crime. Any constable in any police district may, if authorized so to do (in writing) by the chief officer of police of that district, without warrant take into custody any convict who is the holder of a license if it appears to such constable that such convict is getting his livelihood by dishonest means, and may bring him before a court of summary jurisdiction. The system of "reporting" is itself a branch of police administration of great importance, and requiring considerable knowledge. Its headquarters may be said to be in the metropolis and under the superintendence of the police of that district, but it involves constant communication with other districts and observation throughout the kingdom.

The extent of police duty in respect of such offenders is shown by the fact that, according to the last published return, there were in England and Wales 1268 convicts on license and persons under sentence of supervision.

Relation to reformatories.

The police are in general the instruments for carrying out the statutory provisions respecting certified industrial schools and reformatories. Not only is the process for the most part directed to the police, but magistrates and others interested look to the force for suggestions and assistance. In some respects it would be desirable if industrial schools, as distinguished from reformatories, could be worked without the intervention of police agency, but that seems impracticable.

Execution of process.

An important police function relates to the execution of process, and is not confined to subjects or cases in which the force is collectively or individually concerned in the performance of their duty. Whether the process is a warrant or a summons, its execution or service is in the hands of the police. Magisterial warrants of apprehension and search are by law, in other than exceptional cases, necessarily directed to the police as peace officers, whether their purport be to bring the person before the tribunal or to convey him from it or from one place to another; and in other warrants of execution, although parochial officers are often joined, police are also included to prevent abuses of the law to which the poor are so much exposed. Police officers are now expressly required to have the direction of warrants of distress. The service of a magisterial summons, although not in general prescribed to be effected by a police officer, in practice properly devolves on the force. In the metropolitan police district all police service must be by its officers. In a great variety of matters where notice has to be given to persons, the duty of communicating it either verbally or in writing or in print is thrown on the police. So convenient a medium for the orderly administration of purely civil matters are the police found that, at the request of the local government board, the police are allowed to deliver and collect voting papers in the election of parochial officers.

The increased area over which a police constable as compared with the old parish constable has jurisdiction facilitates both arrests and service of process. Although stationed within a defined area of limited jurisdiction, the duties of the force often involve the operation of functions without geographical limits, requiring the actual presence of its members outside as well as the performance within the district of much that relates to the exterior.

The service of process calls for constant communication between different police forces. The law provides for the backing of warrants, by which a constable can act beyond his ordinary jurisdiction or by which the warrants can be transmitted. A magisterial summons for appearance does not require formal transmission. It is addressed not to the police but to the defendant, and can be served by an officer of any district; but, as until recently the proof of service could only be given by the personal attendance of the serving officer at the magistrate's court, great expense was incurred in travelling to effect service, and inconvenience in attending to prove it. This has been remedied in most cases by allowing service to be proved by a declaration before a magistrate.

The transmission of process, declarations of service, payment of fees, and many other incidents arising in apparently the most simple cases now involve constant communication between police forces by whatever distance they may be separated.

Miscellaneous duties.

A few lines must suffice on the general duties of the police force in relation to a variety of other matters. Some of these are closely connected with crime, others with municipal regulations only. The police, as having all the duties of constables, act as coroner's officers; they make minute inquiries as to suicides, accidents of every kind, insane persons and their apprehension, and deal with destitute persons and persons seized with sudden illness in the streets, and with vagrants.

Street traffic.

In populous districts the adjustment of street traffic, of securing the comfort as well as safety of persons in passing to and fro, whether on foot or otherwise, forms a very important branch of the constable's duty. This may be and often is effected by the mere presence of the constable passing on his round without greater exercise of his authority than a request to persons to move or to wait at crossings. Unless in crowded parts, this highway branch of duty may consist in preventing riding and driving furiously, or on footpaths. The general or local laws of each district give ample scope for the exercise of the police constable's authority and the performance of his duties in such matters, including obstructions of all kinds.

In the metropolitan police district the commissioner has large powers, including the power to prescribe special limits in the metropolis within which some acts affecting the general ease and freedom of the public are forbidden which are innocent elsewhere.

Public carriages.

On the police almost invariably devolve the licensing of public carriages and the enforcement of the great variety of regulations respecting them. In the metropolitan police district the licensing of public carriages is vested in the secretary of state, who makes numerous regulations respecting the carriages and their drivers and proprietors, and gives (under power vested in him by the legislature for that purpose) the administration of this important branch of the law to the commissioner of police. Elsewhere in England and Wales the administration of the law in relation to hackney carriages is in the hands of local authorities. The police have charge of the maintenance of good order in houses and places licensed for the sale of intoxicating liquors, including inquiries and notices as to all kinds of licenses, renewals, and transfers, and of course involving the conduct of numerous persons, not only of the licensed persons and those in their service, but of persons frequenting their houses, not excepting the members of the police force.

Licensed premises.

Regulated trades.

The laws and regulations for common lodging-houses in the metropolis are under the police. Other traders exercise their constant vigilance, including pawnbrokers, marine store dealers, pedlers, and chimney-sweepers.

Offences.

Among almost an infinity of offences may be enumerated those involving cruelty to animals, prize fights so called, and all descriptions of unlawful brawls (including brawling in places of public worship), gaming, gambling, and betting, lotteries, disorderly houses, dangerous performances, the infraction of fence months and seasons for birds and fish, the fraudulent removal of goods, violations of cattle plague orders (which the police are expressly required to observe and enforce, involving of late years most arduous duties), and the sale of unwholesome food and of poisons. The police have also to deal with the care and keeping of explosive substances, animals straying, and dogs reasonably suspected to be mad or not under proper care.

Some public offences, such as the use of inaccurate weights, adulteration of articles of food, etc., are generally dealt with by inspectors and other special officers, although it is undoubtedly the duty of the police to aid in enforcing the law, and to report to the proper quarter offences coming to their knowledge. In the metropolis smoke nuisances are dealt with as police offences.

Dog-tax.

The police aid the inland revenue in a variety of ways, and, although it is generally undesirable for the police to take part in the collection or enforcement of taxation, they are required in the metropolitan district, by order of the secretary of state, to enforce as far as lies in their power the payment of the dog tax, their other duties giving them greater knowledge on the subject.

Places of amusement.

In visiting places of amusement the police are often performing duties of a multifarious character. In general the one object is the maintenance of good order, but sometimes the observation extends to the character of the amusement and the infringement of licenses.

Lost property.

Apart from the special duties as to the restoration of property left or lost in public carriages, or with reference to prisoners' property, for which there are special provisions, the police exercise a reasonable rather than a specially assigned duty in facilitating the recovery of lost and stray property by the rightful owners.

Prostitutes.

A very few words must suffice for notice of a subject which has been a vexed question before as well as since the establishment of a police force in the country, and down to the present moment—the action of police powers as to street prostitutes. Practically this action has nearly the same limits throughout England and Wales. In the metropolitan police district and in the City of London it is an offence for a common prostitute or night-walker to loiter or to be in a public place for the purpose of prostitution or solicitation to the annoyance of the inhabitants or passengers. Elsewhere the offence is in much the same terms included in the Police of Towns' Clauses' Act, 1847, and is so applied to all urban authorities under the Public Health Act, 1875. In the practical application of the law it is generally considered that there must be some evidence of a personal annoyance by and to one or more persons to justify a conviction.

The preceding survey of some of the multifarious functions of a police force affords an illustration of Bentham's classification of the business of police into distinct branches: police for the prevention of offences; police for the prevention of calamities; police for the prevention of endemic diseases; police of charity; police of interior communications; police of public amusements, police for recent intelligence and information. No attempt, however, is made in the present article to follow such classification. It would lead the reader astray, where the object is to treat principally of the police force.

Area of action.

As to the defined area of police action, for general purposes the legal rights and powers of a police force (subject to the observations already made) are coextensive with the police district. In the metropolitan police district the members of the force have the powers of constables in the adjoining counties (10 Geo. IV. c. 44, § 4; 2 & 3 Vict. c. 47, § 5).

The determination of the geographical area of a police district is necessarily governed by a variety of circumstances. Physical features have sometimes to be taken into account as affecting the demarcations of intercourse, more frequently the occupations of the people and the amount of the population. A district may be too confined or too large for police purposes. The limited ideas of simple-minded rustics of a former generation whose views of complete independence consisted in inhabiting two adjacent rooms in different parishes, so as to effectually baffle the visits of parochial officers, is probably a notion of the past; but obstructions of a like kind may arise from too narrow boundaries. On the other hand dense populations or long-accustomed limits may outweigh convenience arising from a wide area.

In any case the making of altogether new boundaries merely for police purposes is very undesirable. The county, or divisions of a county or city, or the combination of parishes, ought to be and are sufficient for determining the boundaries of a police district. A boundary, moreover, that does not admit of ready application for rating is impracticable.

In England, Wales and Scotland, with the exception of the metropolitan police district and the area of the City of London (geographically included within but distinct from it in police government), the police districts are for the most part identical in area with the counties. Large towns have police forces distinct from the county force surrounding them. There are 290 police forces in the island,—a number liable to frequent variation, as separate forces are created or existing forces are combined, for which powers exist.

Strength of police force.

By far the largest and most important force, as regards the character of both area and numbers, is that of the metropolitan police district, comprising 20 divisions. The total number of the police (including of course the county constabulary) for England and Wales for the year ending 29th September, 1883, was 34,448, an increase on the previous year of 1315. During the last decade the increase in the total number of the police, allowing for the augmented population, is trifling.

The following are the numbers composing the different forces in 1882–83:

In boroughs under the Municipal Corporation Act and under local Acts	9,685
In counties	11,255

Metropolitan police constables, including royal dockyards..	12,663
City of London	885
Total	34,488

The total gives one constable for every 774 of the population, according to the census of 1881. In boroughs, etc., there is 1 for every 758; in counties 1 for 1231; in the metropolitan police district (deducting 807, the number employed in royal dockyards, and 446 paid for by public companies and private individuals) 1 for every 413; and in the City of London 1 for every 57 of the City population, as enumerated on the night of the census of 1881. The total number, exclusive of the commissioner and assistant commissioners, belonging to the metropolitan police force on the 1st January, 1884, was 12,404,—comprising 10,741 constables, 1028 sergeants, 608 inspectors, 24 divisional superintendents, 1 chief superintendent (of the criminal investigation department), and 2 district superintendents.

The strength of the police force in proportion to population varies considerably in each county of Scotland, ranging for the year ended 15th March, 1884, from 1 in 731 in Selkirk to 1 in 2438 in Banff. In burghs it varies from 1 in 532 in Edinburgh and 1 in 535 in Glasgow to only 1 in upwards of 1500 of the population in the smallest burghs.

The strength of the royal Irish constabulary on the 1st July, 1882, the geographical area of which comprises all Ireland, consisted of 258 officers and 13,750 men, and it was subsequently increased to 14,601 of all ranks.

Distribution.

The equal distribution of the force throughout a district—not a uniform distribution either as to area or population, but equal in accordance with wants—is one of the greatest difficulties in the administration of a police force. It is not merely that recruits must be sought for to keep pace with increase or variations of population, but daily and hourly events necessitate daily and hourly changes of distribution. The duty is not merely to draw off men from adjacent divisions to the spot for a few hours, where they can be best spared, but to fill places where required. It must be rembered that extra work by day incapacitates men for the night watch, and it takes days to restore the equilibrium. It is needless to say that, although the services of the police force may not be required to aid in the extinction of a fire, their presence is required in great numbers to preserve order; and thus men are necessarily kept on duty beyond their prescribed hours. Nor, in many of these cases, whether seen or unforeseen, is the distribution of the force self-adjusting. Let all do what they may in aid through all ranks of the force, inequalities must occur; and before the gaps are made up a fresh displacement occurs. Much may be done and is done by a system of reserves, and by averaging the yearly extra calls on the time of a force; but after all there is no perfect equality. The peacefully slumbering citizen may be startled by the announcement that, although the force of the metropolitan police district has been under anxious management for upwards of half a century, on no two nights since its formation have the beats been patrolled to precisely the same extent.

Stations.

The police system of necessity involves the existence in a district of police stations or lock-ups, for the temporary detention of prisoners; and magistrates have generally the power to remand prisoners to these for short periods. Power to make police stations occasional courts of summary jurisdiction has been recently conferred on county magistrates. A police power of admitting arrested persons to bail in petty cases, with a corresponding duty to exercise the power, is vested in the police in authority at stations. This power has existed throughout the metropolitan police district from the first establishment of the police on its present footing, and also in the City of London and in many populous places under local Acts; and the principle has been recently extended to the country.

Qualifications for service.

The selection of persons for the force is a matter subject to general as well as special regulations, varying in each district according to circumstances of place and time. Testimonials as to character and antecedents should be and are in practice always required. For health a medical examination is enforced; as to general education, reading and writing are usually required; special education for police duties is necessarily unattainable before entry, but in the metropolitan police force of England approved candidates are admitted on probation, and drilled. When finally approved of, on admission to the force they make a declaration, as already stated, to duly serve.

Discipline.

Discipline is enforced by dismissal, reprimand, fines, removal to another division, or degradation in rank. Violation or neglect of duty may be punished by summary conviction.

Detectives.

For the detection of crime and offences it is obviously necessary that some members of the force should perform their duties out of uniform. Some are constantly employed as detectives, others doff their official dress on emergencies. In the English metropolis the detective officers form a distinct branch of the police service, called the criminal investigation department. One of the assistant commissioners of the metropolitan police attends specially to this department, to which a chief superintendent and a separate staff of inspectors and sergeants are attached, having an office in Scotland Yard, with officers of the department placed in the divisions of the district. The qualifications of the principal officers are special, and they are selected for their aptitude, knowledge of foreign languages, and a variety of circumstances rendering the application of the ordinary routine of training undesirable and impracticable. Constables and sergeants of the departments are selected from the general body of the force. Officers of the detective department of the metropolis in the performance of their various duties travel all over the globe, to foreign states as well as to the colonies. The number of detective officers in England and Wales for 1882-83 was 551.

Chief officers.

The chiefs of the metropolitan police force are the commissioner and three assistant commissioners, one acting in place of a director of criminal investigations, who has recently retired. A legal adviser to the commissioners is appointed by the secretary of state. Besides the divisional superintendents, there are now two district superintendents, who visit the whole of the divisions. All promotions in the service up to the rank of superintendent are made from the next rank below. When vacancies occur the rule is to recommend to the commissioner those best qualified in all respects, seniority of service being duly considered; but an educational examination by the civil service commissioners is requisite. A different standard and subject of examination is provided for each rank: (1) constables for sergeants; (2) sergeants for inspectors; (3) inspectors for superintendents.

Orders.

Orders having the approval of the secretary of state for the government of the police of the metropolis in a variety of matters are printed and issued daily throughout the district. The majority of these orders relate to incidents and contingencies of the passing hour, and affect particular divisions; others are of a permanent character, and require attention throughout the district. Such orders form the practice of the police in almost all matters of detail either not specifically regulated by Act of Parliament or requiring explanation and elucidation; and, if they are carefully considered and prepared, their issue must produce a uniform code of police procedure for the force.

Maintenance.

The cost of a police system is defrayed from a fund formed by local rates or by imperial funds, or both, and in part by the appropriation of fines and the fees payable by law in respect of the performance of individual duties, but not permitted to be retained by the performer. This fund is collected and expended through the medium of a receiver, treasurer, or other officer, and a staff of clerks, with the aid of the superintendents, inspectors, and police officers. The regulation and amount of the salaries (which are generally paid weekly or monthly according to the class), depend of course on local and other circumstances, but do not vary frequently. Where agriculture is the general occupation the pay of members of the force is low. Where mining and manufactures compete with agriculture it is higher; where they are the principal business they create a demand for labor which raises the salary of the constable as well as those of other workers. The pay of the constables of the metropolitan district varies from £62, 11s. 6d. [$304.11] to £83, 8s. 7d. [$405.46] per annum, that of the sergeants from £88, 12s. 11d. [$430.82] to £146 [$709.56], of the inspectors from £88, 12s. 11d. [$430.82] to £351, 19s. 4d. [$1,710.56]. The metropolitan police constable is subject to deductions for pension, and he contributes on the average about 2d. [4 cents] a week to gratuities for the widows or orphans of comrades who have recently died, and is under a rent of about 3s. 6d. [88 cents] if single and living out of the section house, and about 6s. 6d. [$1.58] a week if married. Analogous conditions exist in all the great city forces. The Liverpool constable begins with 26s. 8d. a week [$6.48]; 8d. [16 cents] a week is deducted at first, and 10d. [20 cents] after a short period, towards pension fund; an average of 4s. [97 cents] a week is spent on the lodgings of a single, and from 5s. 6d. [$1.33] to 7s. 6d. [$1.82] on those of a married man. Model scales of pay, which were suggested by the secretary of state in 1879, have been adopted by several county forces in Scotland, but not in burghs.

Rewards.

In addition to fixed salaries, the police system generally provides for rewards for extraordinary diligence and gratuities out of the police fund. Gifts or payments to individual officers by private persons ought to be controlled in a well-regulated system, where good conduct and vigilance ought to be closely watched to ensure promotion in due time. Specially meritorious acts, however, are sometimes admitted for pecuniary recognition by magistrates, or representative bodies. In England the police are not now permitted to participate in Government or other rewards for the discovery of crime. Provision is almost invariably made for pensions by a fund formed by a scale of deductions from pay, as already stated, and to some extent by fines. The general subject of superannuation is, however, too large to be entered upon here. For the ordinary services of the police within their local jurisdiction no charge should fall on particular persons who happen to derive special advantage from such police duty. It is a general benefit for which in one form or another the inhabitants are taxed.

Incidental expenses.

Other incidental expenditure in the performance of duties is met in various ways. The heavy cost connected with the conveyance of prisoners to and from prison on committal and remand is in England, except in Middlesex, borne by the state, being paid by the prison commissioners. The preliminary cost attending the arrest in the first instance is generally borne by the police fund. In some exceptional cases, where the police perform special duties beyond their district, the cost is thrown on individuals putting the law in motion. Thus the costs incurred under extradition treaties and under the Fugitive Offenders' Act in following criminals and bringing them back within the jurisdiction for trial where the offence was committed or arose are not expressly provided for by statute; but the regulations laid down by the secretary of state require all costs to be paid by applicants in the case of fugitive offenders.

Special powers.

The police have special powers in furtherance of their duties; even the exemption from toll (not now of general value) has that aspect. They are not only exempted but disqualified from various local offices as interfering with the time and attention required for the full performance of their duties. Rules of service generally forbid constables following any trade or occupation of profit even when not on actual duty, and in the metropolitan police district of London this disqualification extends in practice to their wives. The police are protected in the discharge of their duties in a variety of ways. Assaulting, resisting, or wilfully obstructing a peace officer in the due execution of his duty or any person acting in aid of such officer, and assaults with intent to resist or prevent lawful apprehension or detainer, are punishable summarily as well as upon indictment. Refusing to assist a constable in the execution of his duty in order to preserve the peace is an indictable misdemeanor at common law. The law specially provides for offences by the police in stealing or embezzling property entrusted to them in virtue of their employment (24 & 25 Vict. c. 96, §§ 69, 70).

Uniform.

Wearing a distinctive dress or uniform in the general performance of duty is a matter of the highest importance. It commands and has a very great effect in producing obedience and conformity to law and order, and in preventing violence, without the use of even a word or threat; and it has a scarcely less important effect in protecting the public from the illegal or irregular action of the police when on duty, when the dress involves, as it ordinarily does, the exhibition on its exterior of a letter and number.

Arms.

The extent to which the individual members of a police force are allowed or required to be armed when on duty for the enforcement of the law or for their own protection from violence is a matter of important discretion; for, although the principles of law, entailing or withholding the right of peace officers or private persons to employ weapons of offence, are comparatively well-defined, the emergency depends on a variety of circumstances on which it is extremely difficult for heads of forces to make regulations for the guidance of the men. In general the only weapon carried about the person of a police constable is the familiar wooden staff of office of the peace officer, and that not in the hands openly, but in a sheath at his side and only drawn when required.

Yearly cost.

The cost of the police in England and Wales for the year ending 29th September, 1883, including salaries and pay, allowances, clothing and accoutrements, horses, harness, forage, buildings, station-house charges, printing, stationery, and other miscellaneous charges was £3,367,678 [$16,366,915.08], a net increase of £107,598 [$522,926.28] as compared with the previous year. The cost of the separate forces for the year and the amounts contributed from the public revenue stand thus:

	Total Charge.	Contributed from Public Revenue.
Borough police	£857,863	£379,210
County	1,101,621	435,133
Metropolitan police (including naval dockyards and military stations)	1,317,303	508,183
City of London	90,891	......
Total	£3,367,678 [$16,366,915.08]	£1,322,526 [$6,427,476.36]

Deducting the City of London police, towards which no contribution is paid from the public revenue, the proportion of the amount so contributed was 39.5. But if the total charge for the metropolitan police is reduced by £131,560 [$639,381.60] received from public departments for special services rendered by the police, the proportion contributed from the public revenue, computed upon £1,185,743 [$5,762,710.98] was 42.8

per cent. All moneys received for the service of the metropolitan police between 1st April, 1883, and the 31st March, 1884, amounted to £1,469,930, 4s. 5d. [$7,143,860.87]. Of this total the sum of £639,751,-7s. 4d. [$5,109,191.64] was derived from the metropolitan police rate, and £510,933 [$2,483,134.38] as the contribution from moneys voted by parliament of 4d. [8 cents] per 1£ [$4.86] upon £30,663,903 [$149,-026,568.58], the assessed rental of property in the metropolitan police district. The pay, clothing, and equipments of the force from constables to superintendents was £1,024,587, 13s. 9d. [$4,979,496.12].

In concluding this general account of the existing police system, it is well to mention that the old system of parish constables no longer exists as a general institution. As an auxiliary force, although not forming part of the establishment of a police system, special constables form an important resource in the preservation of the peace (see CONSTABLE).

History of British police system.

History of the Introduction of the British Police System.—It is a self-evident proposition that the duties of watch and ward, whether under the Statute of Winchester or otherwise (see CONSTABLE), demanded greater attention in populous places than in scattered hamlets. Nevertheless the inefficiency of the arrangements was notorious from an early period, and is well illustrated by the "charge" of a Dogberry and the graver complaints of Lord Burleigh of the dulness of constables. In relation to London alone its state down to 1828 forms a subject not without general interest (see LONDON). Here it must suffice to say that committees of the House of Commons in 1772, 1793, 1812, 1817, 1818, and 1822 produced facts tending to the formation, but with hesitation, of a police establishment. To Dr. Colquhoun, a magistrate, the chief merit is due of having, before the close of the 18th century, in a treatise *On the Police of the Metropolis*, drawn attention to the subject. He pointed out that police in England may be considered as a new science, the properties of which consist, not in the judicial powers which lead to punishment, and which belong to the magistrates alone, but in the prevention and detection of crimes, and in those other functions which relate to internal regulations for the well-ordering and comfort of civil society. His work went through several editions in a very brief period. It was not, however, until 1828 that a committee of the House of Commons, appointed at the instance of Mr. (afterwards Sir Robert) Peel, the home secretary, to inquire into the cause of the increase in the number of commitments and convictions in London and Middlesex, and into the state of the police of the metropolis and of the districts adjoining, reported that a decisive change should be made, and an efficient system of police instituted for the adequate protection of property, and for the prevention and detection of crime in the metropolis. In the following year the famous Act for improving the police in and near the metropolis was passed (10 Geo. IV. c. 44).

The Act constituted a police district, excluding the City of London, with a radius of 12 miles. Two persons were constituted justices of the peace (afterwards called commissioners of police) to administer the Act under the immediate direction of a secretary of state and having a police office in Westminster. This office, established in a room with a table and two chairs, in an outlet from Whitehall, is the origin (as regards police associations) of the far-famed "Scotland Yard," with its now enlarged staff, but still inadequate structural arrangements. A sufficient number of "able men" (at first about 3000) constituted the force to whom were given, when sworn in, the common law powers, privileges, and duties of constables for preserving the peace and preventing robberies and other felonies, and apprehending offenders against the peace, with the duty to obey the lawful commands of the commissioners. The district was formed into divisions and sections, and ranks established on the same general system as at present exists. A fund was created principally by rates on the district for the maintenance of the force, with rewards for extraordinary diligence and compensation for injuries.

As might have been anticipated, the introduction of the new system of police attracted great public attention. At this distance of time, with the experience of an intervening half century, it is difficult to believe that the change by which the police system became in a few years as much a necessity of towns as their public lighting (and lighting and watching were of much the same age and character, and were frequently coupled in legislation) was regarded otherwise than with the approval of well-regulated minds. It substituted the vigorous action of a really responsible and well-regulated body, acting in an enlarged area, and independently of parochial authorities, for the partial and lax action of a variety of ill-governed and inadequate bodies. Legitimate but passing regrets might be natural as the introduction of vicarious action superseded the necessity for self help and responsibility. No poet could thereafter compose, as a sally of fancy, the adventures of a London citizen between Cheapside and Edmonton mounted on a runaway horse with associated gentlemen galloping after a presumed horse-stealer. To arrest the horse, whether a runaway or stolen, only a blue-coated policeman would thenceforward be seen on the track. The objections raised to the new police were of a more serious although scarcely of a more substantial kind. The assumption that a good police could only be attained at the expense of liberty, and that it necessarily involved some arbitrary principle opposed to the free constitution of the country, had been countenanced even by the report of the committee of 1822, in which it was remarked that it was difficult to reconcile an effective system of police with that perfect freedom of action and exemption from interference which are the great privileges and blessings of society in the country. With such sedate misgivings, it is not to be wondered at, when the system was actually introduced a few years later, that cries arose in the streets of "down with the new police," and that the constables were frequently followed by hooting crowds calling them obnoxious names. By associating them with the statesman who introduced the measure, and calling them "Peelers" and "Bobbies," names perpetuated to the present day and apparently likely to last, a compliment was really paid to the minister and to the force. But at that time Peel was attacked in parliament and suspicion thrown on the Act because the same minister had introduced Roman Catholic emancipation.

Within four years of the establishment of the police force the hostility seems to have culminated. It was evinced by the result of a collision between the police and a meeting of Chartists in Coldbath Fields in May, 1833, in which three police officers were stabbed and one killed with a dagger. At the inquest the coroner's jury returned a verdict of "justifiable homicide," in the teeth of the evidence. The crown thereupon adopted the strong but justifiable course of applying to the Court of King's Bench, and the inquisition was quashed. Committees were appointed by the House of Commons to inquire into the circumstances of the meeting, and also regarding an allegation of inhabitants of the Surrey side that policemen were employed as spies, and a third committee was appointed to inquire into the state of the police and crime in the district. The police system and the force as a whole came out with credit, notwithstanding individual instances of undue exercise of power calling for greater control.

There was no hesitation as to the duty of maintaining the principle of the new system, and the popular hostility gradually died away. After intermediate parliamentary reports and legislation by way of extension, an important Act was passed in 1839, reciting that the system of police established had been found very efficient and might be yet further improved (2 & 3 Vict. c. 47). The metropolitan police district was extended to 15 miles from Charing Cross. The whole of the River Thames (which had been in its course through London, so far as related to police matters, managed under distinct Acts) was brought within it, and the collateral but not exclusive powers of the metropolitan police were extended to the royal palaces and 10 miles around, and to the counties adjacent to the district. Various summary powers for dealing with street and other offences were conferred.

At the same time that the police were put on a more complete footing and the area enlarged, provision was made for the more effectual administration of justice by the magistrates of the metropolis (2 & 3 Vict. c. 71). The changes that occurred in magisterial functions are scarcely less remarkable than the transition from the parish constable to the organized police. The misdirected activity of the civil magistrate in the 17th century is illustrated by the familiar literature of Butler, Bunyan, and others. The zeal of that age was succeeded by apathetic reaction, and it became necessary in the metropolis to secure the services of paid justices. The malpractices of the so-called "trading justices" of the 18th century are described and exposed for all time by Fielding, who honorably performed the duties of justice of the peace for Middlesex and Westminster. At the beginning of the 19th century outside of the City of London (where magisterial duties were, as now, performed by the lord mayor and aldermen) there were various public offices besides the Bow Street and the Thames police offices, where magistrates attended. To the Bow Street office was subsequently attached the "horse patrol," and each of the police offices had a fixed number of constables attached to it, and the Thames police had an establishment of constables and surveyors. The horse patrol was in 1836, as previously intended, placed under the new police. It became desirable that the horse patrol and constables allotted to the several police offices not interfered with by the Act of 1828 should be incorporated with the metropolitan police force. This was effected, and thus magisterial functions were completely separated from the duties of the executive police; for, although the jurisdiction of the two justices, afterwards called commissioners, as magistrates extended to ordinary duties (except at courts of general or quarter sessions), from the first they did not take any part in the examination or committal for trial of persons charged with offences. No persons were brought before them. Their functions were in practice confined to the discipline of the force and the prevention and detection of offences, by having persons arrested or summoned to be dealt with by the ordinary magistrates whose courts were not interfered with.

Important alterations have been made since 1839 in the arrangements affecting the metropolitan police. In 1856 one commissioner and two assistant commissioners were substituted for two commissioners, and a third assistant commissioner has now (1884) been added. In 1866 jurisdiction was given to the metropolitan police in the royal naval dock yards and principal military stations of the war department in England and Wales, and within 15 miles, with the restriction that the powers and privileges of the constables of the metropolitan police when without the yards, naval and marine hospitals and infirmaries, and marine barracks or stations, and not on board or in any ship, vessel, or boat belonging to the queen or in her service, shall only be used in respect of the property of the crown or of persons subject to naval or marine or military discipline (23 & 24 Vict. c. 135).

Under this Act the metropolitan police exercise jurisdiction and perform duties extending from Chatham on the east and Dover and Portsmouth on the south to Devonport, Portsmouth, and Pembroke on the west, and of course including Aldershot. The expenses incurred are defrayed by parliament.

Connected with the last-mentioned Act, and in consequence of it, has been the exercise for eighteen years by the metropolitan police of the powers of the Contagious Diseases Act, 1866, and the medical examination of women under it,—a much debated and warmly contested power. The refusal in 1883 by the House of Commons to provide money for the expenses of the Act led to the discontinuance of action by the metropolitan police under it.

The Metropolitan Streets Act, 1867, for regulating the traffic in the metropolis, and for making provision for the greater security of persons passing through the streets and for other purposes, gives great discretionary power to the commissioner of police whether of the metropolis or of the City of London, in relation to prescribing special limits, with the approval of a secretary of state, within which regulations to prevent obstructions in the streets (without interfering with other powers) may be made and enforced. Apart from the special limits, general regulations are prescribed as to hackney carriages, stray dogs, and various other matters.

As already observed, the Acts noticed as to the metropolitan police district did not apply to the City of London, which was and is left as an island surrounded by the metropolis. The nightly watch and "bedels" within the City were regulated, and rates imposed for the purpose, in the reign of George II. In 1839, on the same day that the Act of Parliament passed with respect to the metropolitan police, a corresponding Act was passed for the City of London and a salaried commissioner of the police for the City and its liberties appointed by the common council. The power to make regulations relative to the general government of the police is vested in the commissioner, subject to the approbation of the mayor and aldermen and a secretary of state. In case of emergency the secretary of state may, at the request of the lord mayor, authorize the metropolitan police to act within the City of London under the command of their own officers, and on the other hand the lord mayor may, at the request of the secretary of state, in the like emergency, authorize the City police to act under their own officers within the metropolitan police district. The Act gives various special powers as to offences corresponding with the Metropolitan Police Act of 1839. It provides for a police rate, and the corporation is required to pay out of its revenues a fourth part of the expenses of the police force. No rated person is liable to any watch or ward by virtue of the Statute of Winchester (13 Edw. I.), and the ancient custom of electing ward constables is suspended.

In the article London (vol. xiv. p. 843) some statistics are given as to the police courts of the metropolis, and the state of crime and the proportion of police to the population under the last census.

In considering the introduction of the police system into the rest of England, it is to be borne in mind that in many towns and places an organized system of watching by paid officers, whether constables, watchmen, or police, was established by local acts of Parliament, at various dates, but especially in the early part of the present century.

An attempt at a paid county force was made in 1829 (in the same year with the Metropolitan Police Act), but not on corresponding lines, by a local Act to enable the magistrates of the county palatine of Chester to appoint special high constables and assistant petty constables (10 Geo. IV., c. 97). In 1830, and again three years later, provision was made to facilitate voluntary lighting and watching parishes throughout England and Wales. In 1835 the regulation of municipal corporations included power (since renewed) to appoint, by a watch committee, constables called "watchmen" paid by a watch rate.

Great facilities having been given by the legislature for the appointment of special constables (an auxiliary eleswhere noticed), provision was made in 1839 for the appointment of county paid constables where the ordinary officers for preserving the peace were insufficient for that purpose and for the protection of the inhabitants and for the security of property within the county. The number recommended (not exceeding one man for every thousand of the inhabitants, after deducting corporate boroughs already provided for, a restriction in after years removed from the statute book) and the rates of payment were required to be reported to the secretary of state, who made and laid before parliament rules for the government, pay, clothing, accoutrements, and necessaries of such constables; and thereupon the justices appointed, subject to the approval of the secretary of state, a chief constable, who had the appointment, control, and disposition (subject to the approval of the justices) of the other constables, and a deputy and superintendent to be at the head of the constables in each division of the county. On these constables were conferred all the powers and duties of constables by the common law or statute.

At first the salaries and allowances and expenses of the Act were paid out of the county rate (2 & 3 Vict. c. 93), but in the following year (1840) the Act was amended and extended, and a separate police rate levied in the county. Provision was at the same time made for a superannuation fund and for "station houses and strong rooms," and for consolidating the police of a borough with the county; and on the other hand, as the number of constables needed may be different in different parts of the same county, it might be divided into police districts, each district paying for its own constables. Power is given to the chief constable to appoint (with the approval of the justices) additional constables at the cost of individuals, but subject to the orders of the chief constable.

In 1842 an important statute was passed enacting that for the future no appointment of a petty constable, head-borough, borsholder, tithing man, or peace officer of the like description should be made for any parish at any court-leet, except for purposes unconnected with the preservation of the peace, and providing, as a means of increasing the security of persons and property, for the appointment by justices of the peace in divisional petty sessions of fit persons or their substitutes to act as constables in the several parishes of England, and giving vestries an optional power of providing paid constables. The justices in quarter sessions were empowered to provide lock-up houses for the confinement of persons taken into custody by any constable and not yet committed for trial, or in execution of any sentence, or instead to appropriate for that purpose existing lock-up houses, strong rooms, or cages belonging to any parish (5 & 6 Vict. c. 109). Constables appointed under this Act were made subject to the authority of the chief constable or superintendent, if any, appointed under the Act of 1839.

Under the Acts of 1839 and 1840 the establishment of a paid county police force was optional with the justices. After a further interval of fifteen years it was found expedient, for the more effectual prevention and detection of crime, suppression of vagrancy, and maintenance of good order, that further provision should be made for securing an efficient police force throughout England and Wales, and the previous optional power became compulsory (the Police Act, 1856). In every county in which a constabulary had not been already established under the previous Acts for the whole of the county, the justices in quarter sessions were required to proceed to establish a sufficient police force for the whole of the county and to consolidate divisions so as to form one general county police establishment,—subject, however, to the power by the queen in council to require the justices to form separate police districts, as provided for, in the earlier Acts. The privy council might arrange terms of consolidation of a borough police with the county.

In 1869 provision was made for the abolition of the old office of high constable (the High Constables Act, 1869); and the establishment of an efficient police having also rendered the general appointment of parish constables unnecessary, the appointment ceased, subject to the appointment by vestries of paid constables who are subject to the chief constable of the county (the Parish Constables Act, 1872). Thus under combined provisions the police system was established and has since continued throughout England.

Scotland.

In Scotland legislation for a system of police began early in the century by local Acts for Edinburgh and Glasgow, some containing provisions of great importance. The police of towns and populous places is now regulated chiefly by the General Police and Improvement (Scotland) Act, 1862, and the county police by an Act of 1857 (20 & 21 Vict. c. 72), under which counties are formed into police districts. Some details of the government, numbers and costs have been already given.

Ireland.

The police in Ireland comprises two forces—the Dublin metropolitan police and the royal Irish constabulary. Dublin was in 1808 formed into a district called "the police district of Dublin metropolis" (48 Geo. III. c. 140). After intermediate amendments in 1836, concurrently with the consolidation of police law for Ireland generally, the Dublin system was placed on the lines of Sir Robert Peel's Act of 1829 for the metropolis of London—the chief secretary of the lord lieutenant standing in the place of the secretary of state for the home department (6 & 7 Will. IV. c. 29); and six years later the systems were further assimilated (5 & 6 Vict. c. 22). Several alterations were made subsequently, and police courts regulated. The Dublin police is under the immediate direction of one commissioner and an assistant commissioner and the offices of receiver and secretary are consolidated. The royal Irish constabulary dates from 1836, when the laws relating to the constabulary force in Ireland were consolidated and a number of older Acts repealed (6 & 7 Will. IV. c. 13). This Act, although often amended, is the foundation of the existing police system in counties, towns and baronies throughout Ireland except in the Dublin metropolitan district. An inspector general, resident in Dublin and having an office there, and appointed by the lord lieutenant, has the general direction of the constabulary, and with the approbation of the lord lieutenant frames rules for their general government, classification, and distribution. In this way a uniform administration of police law prevails throughout Ireland without interfering with the Dublin metropolitan police. Under the inspector general there are a deputy inspector general and assistant inspectors general. The Irish constabulary is regarded as a semi-military force. Every man lives in barracks. It does not interfere with the Dublin metropolitan police, but a reserve force is established at a depôt in Dublin. The strength and pay of the force have been already noticed.

British colonies.

Police forces have been formed in all the British colonies, including the Dominion of Canada, mainly on the lines established in the mother country, having for their basis of action the common law existing there.

The early legislation for Sydney followed very closely the metropolitan police Acts, and some of the existing Acts of the Australian colonies exhibit great skill. Colonial forces generally are sworn to serve the queen, and an Act of the colonial legislature of New South Wales in 1853 made provision for the engagement in Great Britain of persons to serve in the police force of New South Wales. The general features of the Australian police comprise a chief commissioner or other head for each colony or district, appointed by the governor in council, with various grades of officers as at home, some appointed by the governor and the rest by the head of the police. The expense of the police establishments is borne by the colonial revenue (5 & 6 Vict. c. 76, § 46; 13 & 14 Vict. c. 59, § 23).

British India.

Nearly the whole of British India is divided into police districts, the general arrangements of the system of the regular police resembling in most respects those of the English police, but differing in details in the different presidencies. All are in uniform, trained to the use of firearms, and drilled, and may be called upon to perform military duties. The superior officers are nearly all Europeans, and many of them are military officers. The rest are natives, in Bombay chiefly Mohammedans. The organization of the police was not dealt with by the criminal code which came into force in 1883, but the code is full of provisions tending to make the force efficient. By that code as well as by the former code the police have a legal sanction for doing what by practice they do in England: they take evidence for their own information and guidance in the investigation of cases, and are clothed with the power to compel the attendance of witnesses and question them. The smallness of the number of the European magistrates and other circumstances make the police more important and relatively far more powerful in India than in England (Stephen). The difficulties in the way of ascertaining the truth, and investigating false statements and suppressed cases, are very great.

As regards the rural police of India every village headman, and the village watchman as well as the village police officer, are required by the code to communicate to the nearest magistrate or the officer in charge of the nearest police station, whichever is nearest, any information respecting offenders.

Reports indicating an increase in the number of dacoities and crimes of violence since 1880, especially in Rajputana, Central India and Hyderabad, are cited as proving the necessity for a system of detective police embracing the whole of India. A scheme for that purpose has been matured and will probably be carried out.

Taking Lower Bengal as an illustration of the existing system throughout India, the superior ranks of the police comprise an inspector general, deputies, district superintendents of different grades, assistant superintendents and probationers. The subordinate officers consist of inspectors of four grades, sub-inspectors (who are in charge of police stations), head constables and constables. The total budget grant for the year 1881–82 (the last examined) for the police department was 3,695,572 rupees [$1,796,047.99] on a sanctioned strength of 78 superior officers, 3081 subordinate officers, and 14,588 constables, excluding the municipal police but including the civil police and frontier police of the Chittagong hill tracts and the railway police. The strength of the municipal police was 371 officers and 5702 constables. The cost of the force employed on purely police work was 2,154,600 [$1,047,135.60] rupees—the cost per head of the total population being 6.2 pice [1.54 ct.]. The proportion of police to population was in Bengal proper 1 to 3933. The number of offences reported during the year was 104,153. The percentage of reported cases not inquired into is under four.

In India generally, including Assam and British Burmah, the total regular police of all kinds in 1881 was 147,200. The cost was £2,324,786 [$11,258,459.96], of which £2,075,525 [$10,087,051.50] was payable from imperial or provincial revenues, and the remainder from other sources. The rural police are not paid by the state, but by village cesses.

In Bengal and the Punjab there are 14 policemen to every 100 square miles, and in the Northwestern Provinces and Oudh 27. The ratio of these figures is explained partly by the greater density of population and partly by the frequency of crime.

Total force
of British
empire.

The police force of the British empire, metropolitan, municipal and rural together, is about 210,000. Of this total, 51,000 are in the United Kingdom and 147,000 in India, the remainder being in the colonies and dependencies. If to this total be added the number of village police in India who are legally recognized, whose number is not less than 350,000, the grand total of the police for the empire is 560,000. Thus we have for the whole empire an average of one policeman to every 571 of the people and to every 16 square miles (Sir Richard Temple).

United
States.

The United States of America have a system of police closely resembling that of England, and founded similarly on Acts of the legislature combined with the common law applicable to peace officers. Congress as well as the States separately may establish police regulations, and it is to be observed that the criminal law of England has been reproduced in various shapes in nearly all the States. The source of revenue for the maintenance of the police is taxation of real and personal property. Every State and every city in a State has its separate special administration. For the purposes of this article New York must suffice. The regulations of the police of Brooklyn, Philadelphia, and other cities present the same general features.

The police department of the city of New York consists of a "board of police" composed of four "commissioners" (appointed by the mayor with the consent of the board of aldermen) and the "police force" and officers appointed by the board. The board, consisting of the commissioners, is the head of the police department, and governs and controls its business; it is invested with and exercises all the powers conferred by law upon the police department, makes appointments, and by rules and regulations through a superintendent prescribes the general discipline of the department. The orders cannot, however, conflict with the constitution of the United States nor with the constitution or laws of the State of New York.

The police force of the city comprises officers ranking as follows:—superintendent of the whole force, four inspectors (the whole area of the city being divided into four inspection districts, subdivided into precincts, with an inspector to each), sergeants and roundsmen, who are visiting officers —the body of the force being termed "patrolmen," with "overmen" at stations and prisons.

The force (clothed in uniform) is divided into as many companies as there are precincts, and such other companies and "squads" as the board may order. The superintendent is the chief executive officer of the force, subject to the orders, rules, and regulations of the board, and it is his duty to enforce in the city all the laws of the State and ordinances of the city, and the rules and regulations of the police board. The superintendent promulgates written or printed orders to the officers and members of the police force not inconsistent with law or the rules and regulations of the board. It is the duty of the police force at all times of the day and night within the city and county of New York, and they are accordingly empowered, to especially preserve the public peace; prevent crime; detect and arrest offenders; suppress riots and insurrections; protect the rights of persons and of property; guard the public health; preserve order at every primary and public election; remove nuisances existing in public streets, roads, places, and highways; repress and restrain disorderly houses and houses of ill-fame; arrest all street beggars and mendicants; provide a proper police attendance at every fire in order that the firemen, fire-engines, and property exposed may be suitably assisted or protected; assist, advise, and protect immigrants, strangers, and travellers in public streets, or at steamboat and ship landings or railroad stations; enforce any law relating to the suppression and punishment of crime, or to the observance of Sunday, or regarding pawnbrokers, or mock auctions, or emigration, or elections, or gambling, or intemperance, or lotteries, or lottery policies, or vagrants, or disorderly persons, or the public health, or any ordinance or resolution of common councils, within the said district, applicable to police, health, or criminal procedure.

Special regulations are made on these and other kindred subjects, such as the regulation of traffic, preventing obstructions, the visitation of places of amusement, public houses and drinking places, observation of servants in charge of houses, and of suspicious persons, lost children, processions, balls and parties, elections, etc., and the attendance of an adequate number of police at every assembly of citizens.

The arrest of persons with or without process does not call for special notice as distinguished from the common law and statute law in England, and the practice as to the entry of charges and taking bail by the police is akin to the practice in the English metropolis, but the rules are somewhat stricter. A squad is organized for the sole purpose and duty of serving criminal process. Persons making complaint of a felony or misdemeanor may be required to make affirmation or oath which the police officers have power to administer. Charges against police, whether by members of the force or citizens, are made and dealt with under strict rules, and are tried upon written charges by one or more of the commissioners in power, a committee dismissing charges or directing their trial. Evidence is taken upon oath, and if the case is heard by less than three commissioners no judgment can be acted on until the witness is brought before and examined by all the commissioners. The board draws, by its president, on the treasurer of the city for the cost of arrest and conviction of criminals and others endangering the safety of the community and procuring information the use of which may prevent crime and enable the department to perform its important duties more successfully and with greater satisfaction to the public. The sum so drawn is charged as a "secret service fund." A place is provided in accordance with statute law for the detention of such witnesses as are unable to furnish security for their appearance in criminal proceedings.

The detective force, called the "detective squad," consists of a captain and other members assigned by the board to detective duty. This portion of the force has an office, as other portions of the police force, and is under the direct orders of the superintendent, to whom reports are made, and who in turn reports to the board. There is also a "special service squad" under the officer commanding the detective force.

There is a sanitary code, and a "sanitary police company" is set apart from the police force by the board of police, performing duties assigned by the board. The captain of the sanitary company assigns policemen to act as school officers. There are harbor police, a police steamboat and steam-boiler inspection squad to enforce the statute law on the subject, an "ordinance police squad" to enforce ordinances of the corporation, and a "property office."

Members of the force are subject to rules; at the discretion of the board, on written application, they are permitted to receive rewards or presents for services rendered by them in the discharge of duties which are both "meritorious and extraordinary," but for such only.

Admission to the force, examination, instruction, drill, and discipline are provided for by special regulations. The right of every member of the police force to entertain political or partisan opinions, and to express the same freely when such expression shall not concern the immediate discharge of his official duties, as well as the right of the elective franchise, is deemed sacred and inviolable; but no member of the force is permitted to be a delegate or representative to, or member of, or to take part in any political or partisan convention, whose purpose is the nomination of a candidate or candidates to any political office. Upon the days of election for public offices held under the laws of the State, he must do all within his power to preserve the peace, protect the integrity of the ballot box, enforce the rights of lawful voters, and prevent illegal and fraudulent voting.

The estimated salaries for the police of New York for 1884, comprising upwards of 2816 members of the force of all ranks, amounted to $3,328,333, besides the salaries of the clerical force. The appropriations for the maintenance of the city government (including the police) are made by the board of estimate and apportionment, composed of the mayor, comptroller, president of the board of aldermen, and president of the department of taxes and assessments. Some police statistics are given in the article New York (*q. v.*).

France.

Looked at from a general point of view, the police in France may be regarded as divided into two great branches—administrative police (*la police administrative*) and judicial police (*la police judiciaire*),—the former having for its object the maintenance of order, and the latter charged with tracing out offenders, collecting the proofs, and delivering the presumed offenders to the tribunals charged by law with their trial and punishment.

Police duties are exercised under the minister of the interior, in the departments and municipalities by the prefects and sub-prefects, appointed by the president of the republic, and mayors, having as auxiliaries the commissaries of police and other officers (appointed by the president but under the orders of the prefects). One of the chief prerogatives of the administrative police is to make rules to ensure public order. Of these rules some embrace general interests of the state, these being regulations of high or grand police; others have no other object than the ruling of the particular district and its inhabitants, and are simply termed police regulations. According as it deals with the general interests of the state or only with those of a municipality, the administrative police is said to be general or municipal; and each of these branches admits of other divisions according to the subject. The *police générale*, besides more obvious matters, includes all matters relating to public health, the regulation of prostitution, the inspection of food, the carrying on of trades and manufactures; and in relation to the welfare of the state it embraces public meetings, banquets, societies and clubs, cafés and public places, and the enforcement of laws relating to the publication and distribution of printed or written matter, the sale of journals, the surveillance of strangers or fugitives, the system of passports, the sale of gunpowder and firearms, designs against the state, and a variety of such matters. In this way the police who look after the safety of the state is closely allied with political matters (*la police politique*). Under a government really representing the popular will the duties of the *police politique* are trifling or at least innocuous, but under a despotic government they become of the highest importance. It is matter of history which cannot be treated of here that under Louis XIV. and in succeeding times the most unpopular and unjustifiable use was made of police as a secret instrument for the purposes of despotic government. Napoleon availed himself largely of police instruments, especially through his minister Fouché. On the restoration of constitutional government under Louis Philippe police action was less dangerous, but the danger revived under the second empire.

The ministry of police created by the act of the Directory in 1796 was in 1818 suppressed as an independent office, and in 1852 it was united with the ministry of the interior.

The detection and punishment of crime is theoretically as well as practically regarded by the French as essentially a matter of public concern, and to be provided for by public officials appointed for that purpose, and on the other hand in every French criminal proceeding, from the most trifling to the most important, every person injured by the offence may make himself *partie civile*. It follows that in many features the French police is organized in a different manner from the British, and has some very different duties (Stephen). An observation has been already cited, that neither in England nor in America is there a system of espionage by which private matters can be made the subject of police investigation or interference. On the other hand the English system is open to the observation that the police, in practice at least, are powerless to protect from annoyance in many matters essential to perfect rule. Short of absolute indecency or obscenity, printed matter of a scurrilous and offensive kind is openly sold in the streets without police interference; and, owing apparently to the much-abused maxim that an Englishman's house is his castle, the quiet and freedom from annoyance in the performance and fulfilling of the daily duties and engagements of life are not secured. The annoyance to which Carlyle was subject is only an illustration of the almost daily complaints that arise in the English metropolis. Although the noise of a bell may be the subject of indictment or injunction, the officers of police do not complain of or even remonstrate with an inconsiderate or selfish neighbor in such a matter, or even in still greater annoyances, such as those arising from animals kept in a state of confinement (not affecting public health), because the source of annoyance is within private territory, or because there is no summary mode of dealing with it. It is unreasonable that complainants should be told, as they are every day, and correctly, by magistrates, that the annoyances which render the enjoyment of life impracticable may be subject of indictment or injunction, but not of summary police intervention. The fear of drawing down ridicule akin to Verges's direction to the watch, "If you hear a child cry in the night, you must call to the nurse to bid her still it," probably stands unduly in the way of police interference with real nuisances.

It is not, however, in the minute details of regulation and inspection of the incidents of every-day life that the distinctions between the police systems of the two countries chiefly consist. Such distinctions have of late years greatly diminished; the intervention in all matters of health, for example, places the English system more akin to the French, and on the other hand all travellers of mature years can testify to the mitigation and even total cessation in France, and on the Continent generally, of the minute investigation of a stranger who is not a "suspect." "To the word espionage a stigma is attached," says Bentham. "Let us substitute the word inspection, which is unconnected with the same prejudices. If this inspection consists in the maintenance of an oppressive system of police, which subjects innocent actions to punishment, which condemns secretly and arbitrarily, it is natural that such a system and its agents should become odious. But if the inspection consists in the maintenance of a system of police for the preservation of the public tranquility and the execution of good laws, all its inspectors and all its guardians act a useful and salutary part; it is only the vicious who will have reason to complain, and it will be formidable to them alone." It is with reference to criminal matters and the *police judiciaire* that important distinctions exist between the French and English systems. In every *arrondissement* there is a *juge d'instruction* who makes the first formal inquiry in criminal cases; and in every tribunal of first instance, or *tribunal correctionnel*, there is a *procureur de la république* who with deputies forms the *ministère public* of that court. In the court of the *juges de paix* (who may be compared to police magistrates) the commissary of the police is the *ministère public*. The *juges de paix*, the *maire*, the commissaries of police, the *gendarmerie*, and in rural districts the *gardes champêtres* and the *gardes forestieres*, are officers of the judicial police; and by the *Code d'Instruction Criminelle* all these officers, even the *juges d'instruction* are under the orders of the *procureur-général*. The vocations of these officers as well as the courts are briefly explained in the article France (vol. ix. p. 452).

Sergents de ville, in Paris now called *gardiens de la paix* (the name having been changed thus in September, 1870), are the nearest equivalents of English police constables and are not officers of the *police judiciaire*. Their powers in preserving the public peace closely resemble the common law powers and duties and protection of the English constable. Their reports of cases have not the authority of a *procès verbal*.

In Paris, as elsewhere, the *préfet de police* is at the head of the force, with *commissaires de police*, appointed by the president of the republic on the nomination of the minister of the interior, but acting under the orders of the prefect, and having both administrative and judicial duties. The commissaries see that the laws relating to good order and public safety are observed, and that the police orders are executed, and take special action in serious matters. As officers of the judicial police they are the auxiliaries of the procureur of the republic in correctional and criminal police action, and in the ordinary police tribunal (*le tribunal de simple police*) they exercise the functions of magistrates.

The organization of the central administration (*administration centrale*) comprises three classes or functions which together constitute *la police*. First there is the office or *cabinet* of the prefect for the general police (*la police générale*), with three bureaus having for their special object the safety of the president of the republic, matters connected with the use of arms, various societies, the regulation and order of public ceremonies, theatres, amusements and entertainments, movements of troops, the military police (*la police militaire*), and various other matters; secondly, the judicial police (*la police judiciaire*) already spoken of, with five bureaus, in constant communication with the courts of judicature, and including the service of the prisons of the Seine, matters relating to aliens, and the protection of children; thirdly, the administrative police (*la police administrative*), with four bureaus, including everything relating to supplies, navigation, public carriages, animals, firemen, public health, and the enforcement of the law respecting the employment of young persons. Some minor matters are under the supervision of the prefect of the Seine. Concurrently with these divisions there is the municipal police, which comprises all the agents in enforcing police regulations in the streets or public thoroughfares, acting under the orders of a chief (*chef de la police municipale*) with a central bureau. The municipal police is divided into two principal branches—the service in uniform of the *gardiens de la paix*, and the service out of uniform of *inspecteurs de police*, the latter a comparatively small number.

For purposes of municipal police, Paris is divided into twenty arrondissements (corresponding in a great measure with the divisions of the metropolitan police of England), which the uniform police patrol.

The total police strength of the Paris arrondissements, according to the latest return, showed 5932 *gardiens de la paix*, each arrondissement officered by an *officier de paix* (an office peculiar to Paris), with 3 or 4 brigadiers and from 24 to 27 sous-brigadiers under his command. There are two divisional inspectors.

Besides these divisional *gardiens de la paix* police, there is a central administration consisting of 6 central brigades of 100 each, 4 of the brigades carrying out the orders of the prefecture at theatres, assemblies, races, and in the Bois de Boulogne, and elsewhere in the capital where their presence is required, while the 5th brigade regulates traffic generally, and the 6th prevents obstructions in the markets.

The *service de sûreté*, or detective department (out of uniform), with which is now amalgamated the *brigade des mœurs* (which deals with public morals, houses of ill fame, prostitutes, and so forth), comprises a commissary, principal inspectors, brigadiers, and 211 inspectors. There are a number of other branches of service including a fire brigade.

The proportion of police to inhabitants as last estimated is 1 in 352.

The pay of the *gardiens de la paix* is from 1400 [$254.80] to 1700 [$309.40] francs; brigadiers, 2000 [$364] francs; sous-brigadiers, 1800 [$327.60] francs; *officiers de paix*, 3000 [$546] to 6000 [$1092] francs. The estimate of expenditure of the whole Paris police for 1884 was 23,952,631 [$4,359,378.84] francs—of which the state contributed 7,693,825 [$1,400,-276.15] francs.

Whether the police of Paris are more effective than those of the English metropolis is doubted. Persons who are best entitled to express an opinion, having practical experience, think that, while a multitude of offices and officers for a multitude of subjects and stages of investigation—a system, in short, of bureaucracy—exists which creates an impression, the actual detection of grave offences is not commensurate with the display of attention.

Germany.

It is impossible in the narrow limits of this article to go through all the police forces of Europe. It must suffice to allude to a few principal states, noting the police forces of their capitals as illustrating the systems. Taking the Berlin force as illustrative of the police system in the German empire, police duties are as various as in France; the system includes a political police controlling all matters relating to the press, societies, clubs, and public and social amusements. Police duties are carried out under the direction of the royal police presidency, the executive police force comprising a police colonel, with, besides commissaries of criminal investigations, captains, lieutenants, acting lieutenants, sergeant-majors, and a large body of constables (*Schutzmänner*). The total in 1883-4 amounted to 3441 executive officers, including criminal investigation officers, the political police, and the department for the supervision of prostitution. Taking the population of Berlin from the statistical bureau of 27th July, 1884, at 1,242,820, this gives 361 to each officer. The pay of the police is principally provided from fiscal sources, and varies in an ascending scale from 1125 marks and lodging allowance for the lowest class of constable.

Austria.

Taking Vienna in the same way as illustrative of the Austrian police it is to be observed that there are three branches—(1) administration; (2) public safety and judicial police; and (3) the Government police. At the head of the police service in Vienna there is a president of police, and at the head of each of the three branches there is an *Oberpolizeirath* or chief commissary. The head of the Government branch sometimes fills the office of president. Each of the branches is subdivided into departments at the head of which are *Polizeiräthe*. Passing over the subdivisions of the administrative branch, the public safety and judicial branch includes the following departments: the office for public safety, the central inquiry office, and the record office or *Evidenzbureau*. The Government police branch comprises three departments: the Government police office, the press office, and the *Vereinsbureau* or office for the registration of societies.

The *Sicherheitswache* or executive police of Vienna consists of a central inspector and chief, district, divisional, and other inspectors, with about 2500 constables *Sicherheitswachmänner*. The detective department comprises a chief and other inspectors, and 130 agents. In July, 1884, the proportion of police constables to the inhabitants was 1 to 436. In the latest return, the entire police service comprises 2816 persons, at a cost of 2,355,710 [$1,144,875.06] florins—of which the state contributes 1,730,740 [$837,679.44] florins, and the communes the greater part of the remainder. The pay of the constable ascends from 360 [$174.96] florins with allowances of 90 [$43.74] florins.

It is obvious that there is a general resemblance between the organization and scope of the police forces of Germany and Austria and of France.

Belgium.

In Belgian municipalities the burgomasters are the heads of the force, which is under their control. The administrator of public safety is, however, specially instructed by the minister of justice to see that the laws and regulations affecting the police are properly carried out, and he can call on all public functionaries to act in furtherance of that object. The administrator of public safety is specially charged with the administration of the law in regard to aliens, and this law is applied, as in the case of Victor Hugo, to persons stirring up sedition. The duty of the *gendarmerie*, who constitute the horse and foot police, is generally to maintain internal order and peace. In Brussels as elsewhere the burgomaster is the head, but for executive purposes there is a chief commissary (subject, however, to the orders of the burgomaster), with assistant commissaries and commissaries of divisions and other officers, and central and other bureaus, with a body of agents (police constables) in each.

There are two main classes of police functions recognized by law, the administrative and the judicial police, the former engaged in the daily maintenance of peace and order and so preventing offences, the latter in the investigation of crime and tracing offenders; but the duties are necessarily performed to a great extent by the same agents. The two other functions of the judicial police are, however, limited to the same classes of officers, and they perform the same duties as in Paris,—the law in practice there being expressly adopted in Brussels.

In Brussels the police force numbers, according to the latest report, 485 of all ranks. For the population (162,489), this gives 1 to every 335 persons. Strictly speaking there is no detective branch so called, but the special and judicial officers are employed in detection as the necessity arises. The pay and establishment charges are defrayed by local taxation. The annual pay of a constable is 1500 francs.

While this article is going through the press the idea is put forward, in consequence of political disturbances, to place the police of the larger Belgian towns under the control of Government instead of that of the respective municipalities as at present, and establish a sort of prefecture in the police of Brussels. The attempt, if made, will probably meet with opposition from local authorities.

Switzerland.

In Switzerland, which is sometimes classed with Belgium as among the least policed states of Europe, the laws of the cantons vary. In some respects they are stricter than in Belgium or even in France. Thus a *permis de séjour* is sometimes required where none is in practice necessary in Paris or Brussels.

Italy.

In Italy there is in every province a prefect at the head of the police. See ITALY.

Netherlands.

The police in the Netherlands, as regards the sources from which its powers are derived, is divided into the state police and the communal police, the former forming part of the general executive government, and the latter, although regulated by the executive, enforcing general and local police legislation. Regulations for the state police are framed by the minister of justice. For the purposes of the state police the country is divided into five districts, with a director of police at the head of each district responsible for the control and government of the state police within it, and to see that the laws and ordinances for the safety and quietness of the state, the security of persons and property, and the equality of all before the law are carried out. The duty specially includes the supervision of strangers and their admission into and departure from the country, and extends even to the enforcement of shooting and fishing licenses. In each district there is an officer of justice who directs the prosecution of criminal offences.

At the head of the communal police stand the burgomasters, and under them police commissaries entrusted with the observance of police regulations, whose appointment and removal rest with the crown, but they are paid by the commune. The whole of the communal police are bound to assist the state police; and, on the other hand, the latter assist the police, especially in the country districts. The duties of the officer of justice may be carried out by the commissary of police, who for the time being is an assistant officer of justice. In large communes the police force is divided into several grades. Besides commissaries, of whom one is chief, there are a chief inspector, classes of inspectors, and brigadiers; but the arrangements differ in almost every municipality.

The total strength of the police is 6000; at The Hague there is supposed to be one constable to 1000 inhabitants. Only in Amsterdam, Rotterdam, and The Hague are there special departments of detective police. Police salaries vary in different communes. The highest are at The Hague, and range from 600 [$243, value of Dutch florins] florins for a third-class constable to 1800 [$729 value of Dutch florins] florins for a chief inspector. The cost of the state police and the expenses incurred in prosecutions for crime are defrayed by the state. The expenses of the communal police are paid out of local rates on houses and land.

Russia. An official Russian document specially obtained for this article affords the following scanty particulars regarding the police in European Russia.

At the head of a police district there is a police master, who has subordinate officers on his staff. A number of constables are appointed, depending on the population. Large towns are subdivided into districts with inspectors and assistants, smaller towns with an assistant inspector. In villages police duties are executed by the inhabitants elected for that purpose, constituting "hundreds" or "tenths" according to the number of inhabitants. There is a control over the villages by the police of the district, and the governor general has a controlling power over all, including the police master. Besides the ordinary police there are police brigades in large towns with duties of a special kind, as attending parades and fêtes. Each member of the brigade has five hundred inhabitants to look after or control. In the capitals there is a secret police having a staff in St. Petersburg of a chief and his assistant, four clerks, and twenty inspectors, and in Moscow of a chief, two clerks, and twelve inspectors.

The principal active duties of the Russian police comprise the enforcement of police laws and the suppression of nuisances, disturbances, and crime. The details of these duties are laid down in a special Act, which is subdivided into different statutes, taken from the criminal code. The provincial towns are governed by a special law, passed in 1876, as supplementary to the already existing law. The towns provide the funds for the maintenance of the police. Laws of 1853 regulated the lodgings and necessaries for the whole police staff according to their rank; but a change has been introduced since 1873, and many officers receive payment in the place of lodgings. Police pay varies from 200 [$154] roubles upwards.

In closing this article, it is well to observe that the distinction between the exercise of judicial power and police functions should be always borne in mind. "The functions of justice and those of the police must be apt in many points to run into one another, especially as the business would be very badly managed if the same persons whose more particular duty it is to act as officers of the police were not upon occasion to act in the capacity of officers of justice. The idea, however, of the two functions may still be kept distinct" (Bentham). The employment of police powers in the ante-judiciary part of criminal process, which previously to the establishment of a police force in England was thought to require an apology as founded on convenience and utility rather than on principle, has become a necessity.

The necessity for a police force as part of any system of orderly government is exemplified by its recent introduction into Egypt. Amid differences of opinion on every subject, and even on the administration of the force and its duties, the abstract propriety of a police force is apparently beyond dispute.

In every country the difficult question, apart from any as to the extent of interference with the freedom of individual action, arises in actual police administration—*Quis custodiet ipsos custodes?*

By whatever name the head of a police force is known, whether as commissioner, chief constable, superintendent, or otherwise, the efficient performance of his duty involves inquiry and judgment upon that inquiry. The character and efficiency of his force must largely depend upon the insight as well as vigor brought to bear upon the individual members of that force.

In relation to the public generally a perfect police code must be full of restraints, with coextensive powers of inquiry, even in matters that do not involve punishment. The extent to which these restraints and powers are applied greatly depends on time and place. Precautions which are necessary, Bentham observes, at certain periods of danger and trouble, ought not to be continued in a period of quietness, and care should be taken not to shock the national spirit. One nation would not endure what is borne by another. (J. E. D.)

POLIGNAC, an ancient French family which had its seat in the Cevennes near Puy-en-Velay (Haute-Loire). Cardinal **Melchoir de Polignac** (1661–1742) was a younger son of Armand XVI., marquis de Polignac, and at an early age achieved distinction as a diplomatist. In 1695 he was sent as ambassador to Poland, where he contrived to bring about the election of the prince of Conti as successor to John Sobieski (1697). The subsequent failure of this intrigue led to his temporary disgrace; but in 1702 he was restored to favor, and in 1712 he was sent as the plenipotentiary of Louis XIV. to the congress of Utrecht. During the regency he became involved in the Cellamare plot, and was relegated to Flanders for three years. From 1721 to 1732 he acted for France at the Vatican. In 1726 he received the archbishopric of Auch, and he died at Paris in 1742. He left unfinished a metrical refutation of Lucretius which was published after his death by the Abbé de Rothelin (*Anti-Lucretius*, 1745), and had considerable vogue in its day. Count **Jules de Polignac** (ob. 1817), grand-nephew of the preceding, was created duke by Louis XVI. in 1780, and in 1782 was made postmaster-general. His position and influence at court were largely due to his wife, the bosom friend of Marie Antoinette; the duke and duchess alike shared the unpopularity of the court, and were among the first who were compelled to "emigrate" in 1789. The duchess died shortly after the queen, but her husband, who had received an estate from Catherine II. in the Ukraine, survived till 1817. Of their three sons the second, Prince **Jules de Polignac** (1780–1847), held various offices after the restoration of the Bourbons, received from the pope his title of "Prince" in 1820, and in 1823 was made ambassador to the court of St. James's. In August 8, 1829, he was called by Charles X. to the ministry of foreign affairs, and in the following November he became president of the council. On the revolution of July, 1830, he fled for his life, but after wandering for some time among the wilds of Normandy was arrested at Granville. His trial before the chamber of peers resulted in his condemnation to perpetual imprisonment (at Ham), but he benefited by the amnesty of 1836, when the sentence was commuted to one of exile. During his captivity he wrote *Considérations politiques* (1832).

He afterwards spent some years in England, but finally was permitted to re-enter France on condition that he did not take up his abode in Paris. He died at St. Germain on March 29, 1847.

POLILLO. See PHILIPPINE ISLANDS.

POLITIAN (1454–1494). Angelo Ambrogini, known in literary annals as ANGELO POLIZIANO or POLITIANUS from his birth-place, was born at Montepulciano in Tuscany in the year 1454. His father, Benedetto, a jurist of good family and distinguished ability, was murdered by political antagonists for adopting the cause of Piero de' Medici in Montepulciano; and this circumstance gave his eldest son, Angelo, a claim on the family of Medici. At the age of ten the boy came to prosecute his studies at Florence, where he learned Latin under Christoforo Landino, and Greek under Argyropulos and Andronicos Kallistos. From Marsilio Ficino he imbibed the rudiments of philosophy. The precocity of his genius for scholarship and poetry was early manifested. At thirteen years of age he began to circulate Latin letters; at seventeen he sent forth essays in Greek versification; at eighteen he published an edition of Catullus. In 1470 he won for himself the title of *Homericus juvenis* by translating four books of the *Iliad* into Latin hexameters. Lorenzo de' Medici, who was then the autocrat of Florence and the chief patron of learning in Italy, took Poliziano into his household, made him the tutor of his children, and secured him a distinguished post in the university of Florence. Before he reached the age of thirty, Poliziano expounded the humanities with almost unexampled lustre even for that epoch of brilliant professors. Among his pupils could be numbered the chief students of Europe, the men who were destined to carry to their homes the *spolia opima* of Italian culture. Not to mention Italians, it will suffice to record the names of the German Reuchlin, the English Grocyn and Linacre, and the Portuguese Tessiras. Poliziano had few advantages of person to recommend him. He was ungainly in form, with eyes that squinted, and a nose of disproportionate length. Yet his voice was rich and capable of fine modulation; his eloquence, ease of utterance, and copious stream of erudition were incomparable. It was the method of professors at that period to read the Greek and Latin authors with their class, dictating philological and critical notes, amending corrupt passages in the received texts, offering elucidations of the matter and pouring forth stores of acquired knowledge regarding the laws, manners, religious and philosophical opinions of the ancients. Poliziano covered nearly the whole ground of classical literature during the years of his professorship, and published the notes of his courses upon Ovid, Suetonius, Statius, the younger Pliny, Quintilian, and the writers of Augustan histories. He also undertook a recension of the text of the *Pandects* of Justinian, which formed the subject of one of his courses; and this recension, though it does not rank high in the scale of juristic erudition, gave an impulse to the scholarly criticism of the Roman code. At the same time he was busy as a translator from the Greek. His versions of Epictetus, Herodian, Hippocrates, Galen, Plutarch's *Eroticus*, and Plato's *Charmides* delighted contemporaries by a certain limpid fluency of Latin style and grace of manner which distinguished him also as an original writer. Of these learned labors the most universally acceptable to the public of that time were a series of discursive essays on philology and criticism, first published in 1489 under the title of *Miscellanea*. They had an immediate, a lasting, and a wide renown, encouraging the scholars of the next century and a half to throw their occasional discoveries in the field of scholarship into a form at once so attractive and so instructive. Poliziano was not, however, contented with these simply professorial and scholastic compositions. Nature had endowed him with literary and poetic gifts of the highest order. These he devoted to the composition of Latin and Greek verses, which count among the best of those produced by men of modern times in rivalry with ancient authors. The *Manto*, in which he pronounced a panegyric of Virgil; the *Ambra*, which contains a beautiful idyllic sketch of Tuscan landscape, and a studied eulogy of Homer; the *Rusticus*, which celebrated the pleasures of country life in no frigid or scholastic spirit; and the *Nutricia*, which was intended to serve as a general introduction to the study of ancient and modern poetry,—these are the masterpieces of Poliziano in Latin verse, displaying an authenticity of inspiration, a sincerity of feeling, and a command of metrical resources which mark them out as original productions of poetic genius rather than as merely professorial lucubrations. Exception may be taken to their style, when compared with the best work of the Augustan or even of the Silver age. But what renders them always noteworthy to the student of modern humanistic literature is that they are in no sense imitative or conventional, but that they convey the genuine thoughts and emotions of a born poet in Latin diction and in metre moulded to suit the characteristics of the singer's temperament.

Poliziano was great as a scholar, as a professor, as a critic, and as a Latin poet at an age when the classics were still studied with the passion of assimilative curiosity, and not with the scientific industry of a later period. He was the representative hero of that age of scholarship in which students drew their ideal of life from antiquity and fondly dreamed that they might so restore the past as to compete with the classics in production and bequeath a golden age of resuscitated paganism to the modern world. Yet he was even greater as an Italian poet. Between Boccaccio and Ariosto, no single poet in the mother tongue of Italy deserves so high a place as Poliziano. What he might have achieved in this department of literature had he lived at a period less preoccupied with humanistic studies, and had he found a congenial sphere for his activity, can only be guessed. As it is, we must reckon him as decidedly the foremost and indubitably the most highly gifted among the Italian poets who obeyed Lorenzo de' Medici's demand for a resuscitation of the vulgar literature. Lorenzo led the way himself, and Poliziano was more a follower in his path than an initiator. Yet what Poliziano produced, impelled by a courtly wish to satisfy his patron's whim, proves his own immeasurable superiority as an artist. His principal Italian works are the stanzas called *La Giostra*, written upon Giuliano de' Medici's victory in a tournament; the *Orfeo*, a lyrical drama performed at Mantua with musical accompaniment; and a collection of fugitive pieces, reproducing various forms of Tuscan popular poetry. *La Giostra* had no plan, and remained imperfect; but it demonstrated the capacities of the octave stanza for rich, harmonious, and sonorous metrical effect. The *Orfeo* is a slight piece of work, thrown off at a heat, yet abounding in unpremeditated lyrical beauties, and containing in itself the germ both of the pastoral play and of the opera. The Tuscan songs are distinguished by a "roseate fluency," an exquisite charm of half romantic half humorous abandonment to fancy, which mark them out as improvisations of genius. It may be added that in all these departments of Italian composition Poliziano showed how the taste and learning of a classical scholar could be engrafted on the stock of the vernacular, and how the highest perfection of artistic form might be attained in Italian without a sacrifice of native spontaneity and natural flow of language.

It is difficult to combine in one view the several aspects presented to us by this many-sided man of literary genius. At a period when humanism took the lead in forming Italian character and giving tone to European culture, he climbed with facility to the height of achievement in all the branches of scholarship which were then most seriously prized—in varied knowledge of ancient authors, in critical capacity, in rhetorical and poetical exuberance. This was enough at that epoch to direct the attention of all the learned men of Europe on Poliziano. At the same time, almost against his own inclination, certainly with very little enthusiasm on his part, he lent himself so successfully to Lorenzo de' Medici's scheme for resuscitating the decayed literature of Tuscany that his slightest Italian effusions exercised a potent influence on the immediate future. He appears before us as the dictator of Italian culture in a double capacity—as the man who most perfectly expressed the Italian conception of humanism, and brought erudition into accord with the pursuit of noble and harmonious form, and also as the man whose vernacular compositions were more significant than any others of the great revolution in favor of Italian poetry which culminated in Ariosto. Beyond the sphere of pure scholarship and pure literature Poliziano did not venture. He was present, indeed, at the attack made by the Pazzi conspirators on the persons of Lorenzo and Giuliano de' Medici, and wrote an interesting account of its partial success. He also contributed a curious document on the death of Lorenzo de' Medici to the students of Florentine history. But he was not, like many other humanists of his age, concerned in public affairs of state or diplomacy, and he held no office except that of professor at Florence. His private life was also uneventful. He passed it as a house-friend and dependant of the Medici, as the idol of the learned world, and as a simple man of letters for whom (with truly Tuscan devotion to the Saturnian country) rural pleasures were always acceptable. He was never married; and his morals incurred suspicion, to which his own Greek verses lend a certain amount of plausible coloring. In character Poliziano was decidedly inferior to the intellectual and literary eminence which he displayed. He died half broken hearted by the loss of his friend and patron Lorenzo de' Medici, in 1494, at the age of forty, just before the wave of foreign invasion which was gathering in France swept over Italy.

For the life and works of Politian, consult F. O. Mencken (Leipsic, 1736). a vast repertory of accumulated erudition; Jac. Mähly, *Angelus Politianus* (Leipsic, 1864); Carducci's edition of the Italian poems (Florence, Barbera, 1863); Del Lungo's edition of the Italian prose works and Latin and Greek poems (Florence, Barbera, 1867); the *Opera Omnia* (Basel, 1554); Greswell's English *Life of Politian;* Roscoe's *Lorenzo de' Medici;* Von Reumont's *Life of Lorenzo de' Medici;* Symonds's *Renaissance in Italy*, and translations from Poliziano's Italian poems in his *Sketches and Studies in Italy*, which include the *Orfeo*. (J. A. S.)

POLITICAL ECONOMY.

THE present condition of the study of political economy seems to prescribe, as most suitable for these pages, a treatment of the subject different from that adopted in relation to other departments of knowledge. There prevails wide-spread dissatisfaction with the existing state of economic science, and much difference of opinion both as to its method and as to its doctrines. There is, in fact, reason to believe that it has now entered on a transition stage, and is destined ere long to undergo a considerable transformation. Hence it has appeared to be unseasonable, and therefore inexpedient, to attempt in this place a new dogmatic treatise on political economy. What is known as the "orthodox" or "classical" system, though in our time very generally called in question, is to be found set out in numerous text-books accessible to every one. Again, some of the most important special branches of economics are so fully explained and discussed in other parts of the present work (see BANKING, EXCHANGE, FINANCE, MONEY, etc.) as to dispense with any further treatment of them here. It has been thought that the mode of handling the subject most appropriate to the circumstances of the case, and likely to be most profitable, would be that of tracing historically from a general point of view the course of speculation regarding economic phenomena, and contemplating the successive forms of opinion concerning them as products of the periods at which they were respectively evolved.

Such a study is in harmony with the best intellectual tendencies of our age, which is, more than anything else, characterized by the universal supremacy of the historical spirit. To such a degree has this spirit permeated all our modes of thinking that with respect to every branch of knowledge, no less than with respect to every institution and every form of human activity, we almost instinctively ask, not merely what is its existing condition, but what were its earliest discoverable germs, and what has been the course of its development? The assertion of J. B. Say that the history of political economy is of little value, being for the most part a record of absurd and justly exploded opinions, belongs to a system of ideas already obsolete, and requires at the present time no formal refutation. It deserves notice only as reminding us that we must discriminate between history and antiquarianism: what from the first had no significance it is mere pedantry to study now. We need concern ourselves only with those modes of thinking which have prevailed largely and seriously influenced practice in the past, or in which we can discover the roots of the present and the future.

When we thus place ourselves at the point of view of history, it becomes unnecessary to discuss the definition of political economy, or to enlarge on its method, at the outset. It will suffice to conceive it as the theory of social wealth, or to accept provisionally Say's definition which makes it the science of the production, distribution, and consumption of wealth. Any supplementary ideas which require to be taken into account will be suggested in the progress of our survey, and the determination of the proper method of economic research will be treated as one of the principal results of the historical evolution of the science.

The history of political economy must of course be distinguished from the economic history of mankind, or of any separate portion of our race. The study of the succession of economic facts themselves is one thing; the study of the succession of theoretic ideas concerning the facts is another. And it is with the latter alone that we are here directly concerned. But these two branches of research, though distinct, yet stand in the closest relation to each other. The rise and the form of economic doctrines have been largely conditioned by the practical situation, needs, and tendencies of the corresponding epochs. With each important social change new economic questions have presented themselves; and the theories prevailing in each period have owed much of their influence to the fact that they seemed to offer solutions of the urgent problems of the age. Again, every thinker, however in some respects he may stand above or before his contemporaries, is yet a child of his time, and cannot be isolated from the social medium in which he lives and moves. He will necessarily be affected by the circumstances which surround him, and in particular by the practical exigencies of which his fellows feel the strain. This connection of theory with practice has its advantages and its dangers. It tends to give a real and positive character to theoretic inquiry; but it may also be expected to produce exaggerations in doctrine, to lend undue prominence to particular sides of the truth, and to make transitory situations or temporary expedients be regarded as universally normal conditions.

There are other relations which we must not overlook in tracing the progress of economic opinion. The several branches of the science of society are so closely connected that the history of no one of them can with perfect rationality be treated apart, though such a treatment is recommended—indeed necessitated—by practical utility. The movement of economic thought is constantly and powerfully affected by the prevalent mode of thinking, and even the habitual tone of sentiment, on social subjects generally. All the intellectual manifestations of a period in relation to human questions have a kindred character, and bear a certain stamp of homogeneity, which is vaguely present to our minds when we speak of the spirit of the age. Social speculation again, and economic research as one branch of it, is both through its philosophic method and through its doctrine under the influence of those simpler sciences which in the order of development precede the social, especially of the science of organic nature.

It is of the highest importance to bear in mind these several relations of economic research both to external circumstance and to other spheres of contemporary thought, because by keeping them in view we shall be led to form less absolute and therefore juster estimates of the successive phases of opinion. Instead of merely praising or blaming these according to the degrees of their accordance with a predetermined standard of doctrine, we shall view them as elements in an ordered series, to be studied mainly with respect to their filiation, their opportuneness, and their influences. We shall not regard each new step in this theoretic development as implying an unconditional negation of earlier views, which often had a relative justification, resting, as they did, on a real, though narrower, basis of experience, or assuming the existence of a different social order. Nor shall we consider all the theoretic positions now occupied as definitive; for the practical system of life which they tacitly assume is itself susceptible of change, and destined, without doubt, more or less to undergo it. Within the limits of a sketch like the present these considerations cannot be fully worked out; but an effort will be made to keep them in view, and to mark the relations here indicated, wherever their influence is specially important or interesting.

The particular situation and tendencies of the several thinkers whose names are associated with economic doctrines have, of course, modified in a greater or less degree the spirit or form of those doctrines. Their relation to special predecessors, their native temperament, their early training, their religious prepossessions and political partialities, have all had their effects. To these we shall in some remarkable instances direct attention; but, in the main, they are, for our present purpose, secondary and subordinate. The *ensemble* must preponderate over the individual; and the constructors of theories must be regarded as organs of a common intellectual and social movement.

The history of economic inquiry is most naturally divided into the three great periods of (1) the ancient, (2) the mediæval, and (3) the modern worlds. In the two former, this branch of study could exist only in a rudimentary state. It is evident that for any considerable development of social theory two conditions must be fulfilled. First, the phenomena must have exhibited themselves on a sufficiently extended scale to supply adequate matter for observation, and afford a satisfactory basis for scientific generalizations; and, secondly, whilst the spectacle is thus provided, the spectator must have been trained for his task, and armed with the appropriate aids and instruments of research, that is to say, there must have been such a previous cultivation of the less complex sciences as will have both furnished the necessary data of doctrine and prepared the proper methods of investigation. Sociology requires to use for its purposes theorems which belong to the domains of physics and biology, and which it must borrow from their professors; and, on the logical side, the methods which it has to employ—deductive, observational, comparative—must have been previously shaped in the cultivation of mathematics and the study of the inorganic world or of organisms less complex than the social. Hence it is plain that, though some laws or tendencies of society must have been forced on men's attention in every age by practical exigencies which could not be postponed, and though the questions thus raised must have received some empirical solution, a really scientific sociology must be the product of a very advanced stage of intellectual development. And this is true of the economic, as of other branches of social theory. We shall therefore content ourselves with a general outline of the character of economic thought in antiquity and the Middle Ages, and of the conditions which determined that character.

ANCIENT TIMES.

The Oriental Theocracies.—The earliest surviving expressions of thought on economic subjects have come down to us from the Oriental theocracies. The general spirit of the corresponding type of social life consisted in taking imitation for the fundamental principle of education, and consolidating nascent civilization by heredity of the different functions and professions, or even by a system of castes, hierarchically subordinated to each other according to the nature of their respective offices, under the common supreme direction of the sacerdotal caste. This last was charged with the traditional stock of conceptions, and their application for purposes of discipline. It sought to realize a complete regulation of human life in all its departments on the basis of this transmitted body of practical ideas. Conservation is the principal task of this social order, and its most remarkable quality is stability, which tends to degenerate into stagnation. But there can be no doubt that the useful arts were long, though slowly, progressive under this regime, from which they were inherited by the later civilizations—the system of classes or castes maintaining the degree of division of labor which had been reached in those early periods. The eminent members of the corporations which presided over the theocracies without doubt gave much earnest thought to the conduct of industry, which, unlike war, did not imperil their political pre-eminence by developing a rival class. But conceiving life as a whole, and making its regulation their primary aim, they naturally considered most the social reactions which industry is fitted to exercise. The moral side of economics is the one they habitually contemplate, or (what is not the same) the economic side of morals. They abound in those warnings against greed and the haste to be rich which religion and philosophy have in all ages seen to be necessary. They insist on honesty in mutual dealings, on just weights and measures, on the faithful observance of contracts. They admonish against the pride and arrogance apt to be generated by riches, against undue prodigality and self-indulgence, and enforce the duties of justice and beneficence towards servants and inferiors. Whilst, in accordance with the theological spirit, the personal acquisition of wealth is in general thesis represented as determined by divine wills, its dependence on individual diligence and thrift is emphatically taught. There is indeed in the fully developed theocratic systems a tendency to carry precept, which there differs little from command, to an excessive degree of minuteness—to prescribe in detail the time, the mode, and the accompaniments of almost every act of every member of the community. This system of exaggerated surveillance is connected with the union, or rather confusion, of the spiritual and temporal powers, whence it results that many parts of the government of society are conducted by direct injunction or restraint, which at a later stage are intrusted to general intellectual and moral influences.

Greek and Roman Antiquity.—The practical economic enterprises of Greek and Roman antiquity could not, even independently of any special adverse influences, have competed in magnitude of scale or variety of resource with those of modern times. The unadvanced condition of physical science prevented a large application of the less obvious natural powers to production, or the extensive use of machinery, which has acquired such an immense development as a factor in modern industry. The imperfection of geographical knowledge and of the means of communication and transport were impediments to the growth of foreign commerce. These obstacles arose necessarily out of the mere immaturity of the industrial life of the periods in question. But more deeply rooted impediments to a vigorous and expansive economic practical system existed in the characteristic principles of the civilization of antiquity. Some writers have attempted to set aside the distinction between the ancient and modern worlds as imaginary or unimportant, and, whilst admitting the broad separation between ourselves and the theocratic peoples of the East, to represent the Greeks and Romans as standing on a substantially similar ground of thought, feeling, and action with the Western populations of our own time. But this is a serious error, arising from the same too exclusive preoccupation with the cultivated classes and with the mere speculative intellect which has often led to an undue disparagement of the Middle Ages. There is this essential difference between the spirit and life of ancient and of modern communities, that the former were organized for war, the latter during their whole history have increasingly tended to be organized for industry, as their practical end and aim. The profound influence of these different conditions on every form of human activity must never be overlooked or forgotten. With the military constitution of ancient societies the institution of slavery was essentially connected. Far from being an excrescence on the contemporary system of life, as it was in the modern West Indies or the United States of America, it was so entirely in harmony with that life that the most eminent thinkers regarded it as no less indispensable than inevitable. It does, indeed, seem to have been a temporary necessity, and on the whole, regard being had to what might have taken its place, a relative good. But it was attended with manifold evils. It led to the prevalence amongst the citizen class of a contempt for industrial occupations; every form of production, with a partial exception in favor of agriculture, was branded as unworthy of a free man—the only noble forms of activity being those directly connected with public life, whether military or administrative. Labor was degraded by the relegation of most departments of it to the servile class, above whom the free artisans were but little elevated in general esteem. The agents of production, being for the most part destitute of intellectual cultivation and excluded from any share in civic ideas, interests, or efforts, were unfitted in character as well as by position for the habits of skilful combination and vigorous initiation which the progress of industry demands. To this must be added that the comparative insecurity of life and property arising out of military habits, and the consequent risks which attended accumulation, were grave obstructions to the formation of large capitals, and to the establishment of an effective system of credit. These causes conspired with the undeveloped state of knowledge and of social relations in giving to the economic life of the ancients the limitation and monotony which contrast so strongly with the inexhaustible resource, the ceaseless expansion, and the thousandfold variety of the same activities in the modern world. It is, of course, absurd to expect incompatible qualities in any social system; each system must be estimated according to the work it has to do. Now the historical vocation of the ancient civilization was to be accomplished, not through industry, but through war, which was in the end to create a condition of things admitting of its own elimination and of the foundation of a regime based on pacific activity.

The Greeks.—This office was, however, reserved for Rome, as the final result of her system of conquest; the military activity of Greece, though continuous, was incoherent and sterile, except in the defence against Persia, and did not issue in the accomplishment of any such social mission. It was, doubtless, the inadequacy of the warrior life, under these conditions, to absorb the faculties of the race, that threw the energies of its most eminent members into the channel of intellectual activity, and produced a singularly rapid evolution of the æsthetic, philosophic, and scientific germs transmitted by the theocratic societies.

In the *Works and Days* of Hesiod, we find an order of thinking in the economic sphere very similar to that of the theocracies. With a recognition of the divine disposing power, and traditional rules of sacerdotal origin, is combined practical sagacity embodied in precept or proverbial saying. But the development of abstract thought, beginning from the time of Thales, soon gives to Greek culture its characteristic form, and marks a new epoch in the intellectual history of mankind.

The movement was now begun, destined to mould the whole future of humanity, which, gradually sapping the old hereditary structure of theological convictions, tended to the substitution of rational theories in every department of speculation. The eminent Greek thinkers, while taking a deep interest in the rise of positive science, and most of them studying the only science—that of geometry—then assuming its definitive character, were led by the social exigencies which always powerfully affect great minds to study with special care the nature of man and the conditions of his existence in society. These studies were indeed essentially premature; a long development of the inorganic and vital sciences was necessary before sociology or morals could attain their normal constitution. But by their prosecution amongst the Greeks a noble intellectual activity was kept alive, and many of those partial lights obtained for which mankind cannot afford to wait. Economic inquiries, along with others, tended towards rationality; Plutus was dethroned and terrestrial substituted for supernatural agencies. But such inquiries, resting on no sufficiently large basis of practical life, could not attain any considerable results. The military constitution of society, and the existence of slavery, which was related to it, leading, as has been shown, to a low estimate of productive industry, turned away the habitual attention of thinkers from that domain. On the other hand, the absorption of citizens in the life of the state, and their preoccupation with party struggles, brought questions relating to politics, properly so called, into special prominence. The principal writers on social subjects are therefore almost exclusively occupied with the examination and comparison of political constitutions, and with the search after the education best adapted to train the citizen for public functions. And we find, accordingly, in them no systematic or adequate handling of economic questions—only some happy ideas and striking partial anticipations of later research.

In their thinking on such questions, as on all sociological subjects, the following general features are observable.

1. The individual is conceived as subordinated to the state, through which alone his nature can be developed and completed, and to the maintenance and service of which all his efforts must be directed. The great aim of all political thought is the formation of

good citizens; every social question is studied primarily from the ethical and educational point of view. The citizen is not regarded as a producer, but only as a possessor, of material wealth; and this wealth is not esteemed for its own sake or for the enjoyments it procures, but for the higher moral and public aims to which it may be made subservient.

2. The state, therefore, claims and exercises a controlling and regulating authority over every sphere of social life, including the economic, in order to bring individual action into harmony with the good of the whole.

3. With these fundamental notions is combined a tendency to attribute to institutions and to legislation an unlimited efficacy, as if society had no spontaneous tendencies, but would obey any external impulse, if impressed upon it with sufficient force and continuity.

Every eminent social speculator had his ideal state, which approximated to or diverged from the actual or possible, according to the degree in which a sense of reality and a positive habit of thinking characterized the author.

The most celebrated of these ideal systems is that of Plato. In it the Greek idea of the subordination of the individual to the state appears in its most extreme form. In that class of the citizens of his republic who represent the highest type of life, community of property and of wives is established, as the most effective means of suppressing the sense of private interest, and consecrating the individual entirely to the public service. It cannot perhaps be truly said that his scheme was incapable of realization in an ancient community favorably situated for the purpose. But it would soon be broken to pieces by the forces which would be developed in an industrial society. It has, however, been the fruitful parent of modern Utopias, specially attractive as it is to minds in which the literary instinct is stronger than the scientific judgment, in consequence of the freshness and brilliancy of Plato's exposition and the unrivalled charm of his style. Mixed with what we should call the chimerical ideas in his work, there are many striking and elevated moral conceptions, and, what is more to our present purpose, some just economic analyses. In particular, he gives a correct account of the division and combination of employments, as they naturally arise in society. The foundation of the social organization he traces, perhaps, too exclusively to economic grounds, not giving sufficient weight to the disinterested social impulses in men which tend to draw and bind them together. But he explains clearly how the different wants and capacities of individuals demand and give rise to mutual services, and how, by the restriction of each to the sort of occupation to which, by his position, abilities, and training, he is best adapted, everything needful for the whole is more easily and better produced or effected. In the spirit of all the ancient legislators he desires a self-sufficing state, protected from unnecessary contacts with foreign populations, which might tend to break down its internal organization or to deteriorate the national character. Hence he discountenances foreign trade, and with this view removes his ideal city to some distance from the sea. The limits of its territory are rigidly fixed and the population is restricted by the prohibition of early marriages, by the exposure of infants, and by the maintenance of a determinate number of individual lots of land in the hands of the citizens who cultivate the soil. These precautions are inspired more by political and moral motives than by the Malthusian fear of failure of subsistence. Plato aims, as far as possible, at equality of property amongst the families of the community which are engaged in the immediate prosecution of industry. This last class, as distinguished from the governing and military classes, he holds, according to the spirit of his age, in but little esteem; he regards their habitual occupations as tending to the degradation of the mind and the enfeeblement of the body, and rendering those who follow them unfit for the higher duties of men and citizens. The lowest forms of labor he would commit to foreigners and slaves. Again in the spirit of ancient theory, he wishes (*Legg.*, v. 12) to banish the precious metals, as far as practicable, from use in internal commerce, and forbids the lending of money on interest, leaving indeed to the free will of the debtor even the repayment of the capital of the loan. All economic dealings he subjects to active control on the part of the Government, not merely to prevent violence and fraud, but to check the growth of luxurious habits, and secure to the population of the state a due supply of the necessaries and comforts of life.

Contrasted with the exaggerated idealism of Plato is the somewhat limited but eminently practical genius of Xenophon. In him the man of action predominates, but he has also a large element of the speculative tendency and talent of the Greek. His treatise entitled *Œconomicus* is well worth reading for the interesting and animated picture it presents of some aspects of contemporary life, and is justly praised by Sismondi for the spirit of mild philanthropy and tender piety which breathes through it. But it scarcely passes beyond the bounds of domestic economy, though within that limit its author exhibits much sound sense and sagacity. His precepts for the judicious conduct of private property do not concern us here, nor his wise suggestions for the government of the family and its dependants. Yet it is in this narrower sphere and in general in the concrete domain that his chief excellence lies; to economics in their wider aspects he does not contribute much. He shares the ordinary preference of his fellow countrymen for agriculture over other employments, and is, indeed, enthusiastic in his praises of it as developing patriotic and religious feeling and a respect for property, as the best preparation for military life, and as leaving sufficient time and thought disposable to admit of considerable intellectual and political activity. Yet his practical sense leads him to attribute greater importance than most other Greek writers to manufactures, and still more to trade, to enter more largely on questions relating to their conditions and development, and to bespeak for them the countenance and protection of the state. Though his views on the nature of money are vague and in some respects erroneous, he sees that its export in exchange for commodities will not impoverish the community. He also insists on the necessity, with a view to a flourishing commerce with other countries, of peace, of a courteous and respectful treatment of foreign traders, and of a prompt and equitable decision of their legal suits. The institution of slavery he of course recognizes and does not disapprove; he even recommends, for the increase of the Attic revenues, the hiring out of slaves by the state for labor in the mines, after branding them to prevent their escape, the number of slaves being constantly increased by fresh purchases out of the gains of the enterprise.

Almost the whole system of Greek ideas up to the time of Aristotle is represented in his encyclopædic construction. Mathematical and astronomical science was largely developed at a later stage, but in the field of social studies no higher point was ever attained by the Greeks than is reached in the writings of this great thinker. Both his gifts and his situation eminently favored him in the treatment of these subjects. He combined in rare measure a capacity for keen observation with generalizing power, and sobriety of judgment with ardor for the public good. All that was original or significant in the political life of Hellas had run its course before his time or under his own eyes, and he had thus a large basis of varied experience on which to ground his conclusions. Standing outside the actual movement of contemporary public life, he occupied the position of thoughtful spectator and impartial judge. He could not indeed, for reasons already stated, any more than other Greek speculators, attain a fully normal attitude in these researches. Nor could he pass beyond the sphere of what is now called statical sociology; the idea of laws of the historical development of social phenomena he scarcely apprehended, except in some small degree in relation to the succession of political forms. But there is to be found in his writings a remarkable body of sound and valuable thoughts on the constitution and working of the social organism. The special notices of economic subjects are neither so numerous nor so detailed as we should desire. Like all the Greek thinkers, he recognizes but one doctrine of the state, under which ethics, politics proper, and economics take their place as departments bearing to each other a very close relation, and having indeed their lines of demarcation from each other not very distinctly marked. When wealth comes under consideration, it is studied not as an end in itself, but with a view to the higher elements and ultimate aims of the collective life.

The origin of society he traces, not to economic necessities, but to natural social impulses in the human constitution. The nature of the social union, when thus established, being determined by the partly spontaneous partly systematic combination of diverse activities, he respects the independence of the latter whilst seeking to effect their convergence. He therefore opposes himself to the suppression of personal freedom and initiative, and the excessive subordination of the individual to the state, and rejects the community of property and wives proposed by Plato for his governing class. The principle of private property he regards as deeply rooted in man, and the evils which are alleged to result from the corresponding social ordinance he thinks ought really to be attributed either to the imperfections of our nature or to the vices of other public institutions. Community of goods must, in his view, tend to neglect of the common interest and to the disturbance of social harmony.

Of the several classes which provide for the different wants of the society, those who are occupied directly with its material needs—the immediate cultivators of the soil, the mechanics and artificers—are excluded from any share in the government of the state, as being without the necessary leisure and cultivation, and apt to be debased by the nature of their occupations. In a celebrated passage he propounds a theory of slavery, in which it is based on the universality of the relation between command and obedience, and on the natural division by which the ruling is marked off from the subject race. He regards the slave as having no independent will, but as an "animated tool" in the hands of his master; and in his subjection to such control, if only it be intelligent, Aristotle holds that the true well-being of the inferior as well as of the superior is to be found. This view, so shocking to our modern sentiment, is of course not personal to Aristotle; it is simply the theoretic presentation of the facts of Greek life, in which the maintenance of a body of citizens pursuing the higher culture and devoted to the tasks of war and government was founded on the systematic degradation of a wronged and despised class, excluded from all the higher offices of human beings and sacrificed to the maintenance of a special type of society.

The methods of economic acquisition are divided by Aristotle into two, one of which has for its aim the appropriation of natural products and their application to the material uses of the household; under this head come hunting, fishing, cattle-rearing, and agriculture. With this "natural economy," as it may be called, is, in some sense, contrasted the other method to which Aristotle gives the name of "chrematistic," in which an active exchange of products goes on, and money comes into operation as its medium and regulator. A certain measure of this "money economy," as it may be termed in opposition to the preceding and simpler form of industrial life, is accepted by Aristotle as a necessary extension of the latter, arising out of increased activity of intercourse, and satisfying real wants. But its development on the great scale, founded on the thirst for enjoyment and the unlimited desire of gain, he condemns as unworthy and corrupting. Though his views on this subject appear to be principally based on moral grounds, there are some indications of his having entertained the erroneous opinion held by the physiocrats of the 18th century, that agriculture alone (with the other branches of natural economy) is truly productive, whilst the other kinds of industry, which either modify the products of nature or distribute them by way of exchange, however convenient and useful they may be, make no addition to the wealth of the community.

He rightly regards money as altogether different from wealth, illustrating the difference by the story of Midas. And he seems to have seen that money, though its use rests on a social convention, must be composed of a material possessing an independent value of its own. That his views on capital were indistinct appears from his famous argument against interest on loans, which is based on the idea that money is barren and cannot produce money.

Like the other Greek social philosophers, Aristotle recommends to the care of Governments the preservation of a due proportion between the extent of the civic territory and its population, and relies on pre-nuptial continence, late marriages, and the prevention or destruction of births for the due limitation of the number of citizens, the insufficiency of the latter being dangerous to the independence and its superabundance to the tranquillity and good order of the state.

The Romans.—Notwithstanding the eminently practical, realistic, and utilitarian character of the Romans, there was no energetic exercise of their powers in the economic field; they developed no large and many-sided system of production and exchange. Their historic mission was military and political, and the national energies were mainly devoted to the public service at home and in the field. To agriculture, indeed, much attention was given from the earliest times, and on it was founded the existence of the hardy population which won the first steps in the march to universal dominion. But in the course of their history the cultivation of the soil by a native yeomanry gave place to the introduction on a great scale of slave laborers acquired by their foreign conquests; and for the small properties of the earlier period were substituted the vast estates—the *latifundia*—which, in the judgment of Pliny, were the ruin of Italy. The industrial arts and commerce (the latter, at least when not conducted on a great scale) they regarded as ignoble pursuits, unworthy of free citizens; and this feeling of contempt was not merely a prejudice of narrow or uninstructed minds, but was shared by Cicero (*De Off.* i. 42) and others among the most liberal spirits of the nation. As might be expected from the want of speculative originality among the Romans, there is little evidence of serious theoretic inquiry on economic subjects. Their ideas on these as on other social questions were for the most part borrowed from the Greek thinkers. Such traces of economic thought as do occur are to be found in (1) the philosophers, (2) the writers *de re rustica*, and (3) the jurists. It must, however, be admitted that many of the passages in these authors referred to by those who assert the claim of the Romans to a more prominent place in the history of the science often contain only obvious truths or vague generalities.

In the philosophers, whom Cicero, Seneca, and the elder Pliny sufficiently represent (the last indeed being rather a learned encyclopædist or polyhistor than a philosopher), we find a general consciousness of the decay of industry, the relaxation of morals, and the growing spirit of self-indulgence amongst their contemporaries, who are represented as deeply tainted with the imported vices of the conquered nations. This sentiment, both in these writers and in the poetry and miscellaneous literature of their times, is acompanied by a half-factitious enthusiasm for agriculture and an exaggerated estimate of country life and of early Roman habits, which are principally, no doubt, to be regarded as a form of protest against the evils of the present, and, from this point of view, remind us of the declamations of Rousseau in a not dissimilar age. But there is little of large or just thinking on the economic evils of the time and their proper remedies. Pliny, still further in the spirit of Rousseau, is of opinion that the introduction of gold as a medium of exchange was a thing to be deplored, and that the age of barter was preferable to that of money. He expresses views on the necessity of preventing the efflux of money similar to those of the modern mercantile school—views which Cicero also, though not so clearly, appears to have entertained. Cato, Varro, and Columella concern themselves more with the technical precepts of husbandry than with the general conditions of industrial success and social well-being. But the two last named have the great merit of having seen and proclaimed the superior value of free to slave labor, and Columella is convinced that to the use of the latter the decline of the agricultural economy of the Romans was in a great measure to be attributed. These three writers agree in the belief that it was chiefly by the revival and reform of agriculture that the threatening inroads of moral corruption could be stayed, the old Roman virtues fostered, and the foundations of the commonwealth strengthened. Their attitude is thus similar to that of the French physiocrats invoking the improvement and zealous pursuit of agriculture alike against the material evils and the social degeneracy of their time. The question of the comparative merits of the large and small systems of cultivation appears to have been much discussed in the old Roman, as in the modern European world; Columella is a decided advocate of the *petite culture*. The jurists were led by the coincidence which sometimes takes place between their point of view and that of economic science to make certain classifications and establish some more or less refined distinctions which the modern economists have either adopted from them or used independently. They appear also (though this has been disputed, Neri and Carli maintaining the affirmative, Pagnini the negative) to have had correct notions of the nature of money as having necessarily a value of its own, determined by economic conditions, and therefore incapable of being impressed upon it by convention or arbitrarily altered by public authority. But in general we find in these writers, as might be expected, not so much the results of independent thought as documents illustrating the facts of Roman economic life, and the historical policy of the nation with respect to economic subjects. From the latter point of view they are of much interest; and by the information they supply as to the course of legislation relating to property generally, to sumptuary control, to the restrictions imposed on spendthrifts, to slavery, to the encouragement of population, and the like, they give us much clearer insight than we should otherwise possess into influences long potent in the history of Rome and of the

Western world at large. But, as it is with the more limited field of systematic thought on political economy that we are here occupied, we cannot enter into these subjects. One matter, however, ought to be adverted to, because it was not only repeatedly dealt with by legislation, but is treated more or less fully by all Roman writers of note, namely, the interest on money loans. The rate was fixed by the laws of the Twelve Tables; but lending on interest was afterwards (B.C. 341) entirely prohibited by the Genucian Law. In the legislation of Justinian, rates were sanctioned varying from four to eight per cent. according to the nature of the case, the latter being fixed as the ordinary mercantile rate, whilst compound interest was forbidden. The Roman theorists almost without exception disapprove of lending on interest altogether. Cato, as Cicero tells us, thought it as bad as murder ("Quid fenerari? Quid hominem occidere?" *De Off.* ii. 25); and Cicero, Seneca, Pliny, Columella all join in condemning it. It is not difficult to see how in early states of society the trade of money-lending becomes, and not unjustly, the object of popular odium; but that these writers, at a period when commercial enterprise had made such considerable progress, should continue to reprobate it argues very imperfect or confused ideas on the nature and functions of capital. It is probable that practice took little heed either of these speculative ideas or of legislation on the subject, which experience shows can always be easily evaded. The traffic in money seems to have gone on all through Roman history, and the rate to have fluctuated according to the condition of the market.

Looking back on the history of ancient economic speculation, we see that, as might be anticipated *a priori*, the results attained in that field by the Greek and Roman writers were very scanty. As Dühring has well remarked, the questions with which the science has to do were regarded by the ancient thinkers rather from their political than their properly economic side. This we have already pointed out with respect to their treatment of the subject of population, and the same may be seen in the case of the doctrine of the division of labor, with which Plato and Aristotle are in some degree occupied. They regard that principle as a basis of social classification, or use it in showing that society is founded on a spontaneous co-operation of diverse activities. From the strictly economic point of view, there are three important propositions which can be enunciated respecting that division: (1) that its extension within any branch of production makes the products cheaper; (2) that it is limited by the extent of the market; and (3) that it can be carried farther in manufactures than in agriculture. But we shall look in vain for these propositions in the ancient writers; the first alone might be *inferred* from their discussions of the subject. It has been the tendency especially of German scholars to magnify unduly the extent and value of the contributions of antiquity to economic knowledge. The Greek and Roman authors ought certainly not to be omitted in any account of the evolution of this branch of study. But it must be kept steadily in view that we find in them only first hints or rudiments of general economic truths, and that the science is essentially a modern one. We shall indeed see hereafter that it could not have attained its definitive constitution before our own time.

MIDDLE AGES.

The Middle Ages (400–1300 A.D.) form a period of great significance in the economic, as in the general, history of Europe. They represent a vast transition, in which the germs of a new world were deposited, but in which little was fully elaborated. There is scarcely anything in the later movement of European society which we do not find there, though as yet, for the most part, crude and undeveloped. The mediæval period was the object of contemptuous depreciation on the part of the liberal schools of the last century, principally because it contributed so little to literature. But there are things more important to mankind than literature; and the great men of the Middle Ages had enough to do in other fields to occupy their utmost energies. The development of the Catholic institutions and the gradual establishment and maintenance of a settled order after the dissolution of the Western empire absorbed the powers of the thinkers and practical men of several centuries. The first mediæval phase, from the commencement of the 5th century to the end of the 7th, was occupied with the painful and stormy struggle towards the foundation of the new ecclesiastical and civil system; three more centuries were filled with the work of its consolidation and defence against the assaults of nomad populations; only in the final phase, during the 11th, 12th, and 13th centuries, when the unity of the West was founded by the collective action against impending Moslem invasion, did it enjoy a sufficiently secure and stable existence to exhibit its essential character, and produce its noblest personal types. The elaboration of feudalism was, indeed, in progress during the whole period, showing itself in the decomposition of power and the hierarchical subordination of its several grades, the movement being only temporarily suspended during the second phase by the necessary defensive concentration under Charlemagne. But not before the first century of the last phase was the feudal system fully constituted. In like manner, only in the final phase could the effort of Catholicism after a universal discipline be carried out on the great scale—an effort forever admirable, though necessarily on the whole unsuccessful.

No large or varied economic activity was possible under the ascendency of feudalism. That organization, as has been abundantly shown by philosophical historians, was indispensable for the preservation of order and for public defence, and contributed important elements to general civilization. But, whilst recognizing it as opportune and relatively beneficent, we must not expect from it advantages inconsistent with its essential nature and historical office. The class which predominated in it was not sympathetic with industry, and held the handicrafts in contempt, except those subservient to war or rural sports. The whole practical life of the society was founded on territorial property; the wealth of the lord consisted in the produce of his lands and the dues paid to him in kind; this wealth was spent in supporting a body of retainers whose services were repaid by their maintenance. There could be little room for manufactures, and less for commerce; and agriculture was carried on with a view to the wants of the family, or at most of the immediate neighborhood, not to those of a wider market. The economy of the period was therefore simple, and, in the absence of special motors from without, unprogressive.

In the latter portion of the Middle Ages several circumstances came into action which greatly modified these conditions. The crusades undoubtedly produced a powerful economic effect by transferring in many cases the possessions of the feudal chiefs to the industrious classes, whilst by bringing different nations and races into contact, by enlarging the horizon and widening the conceptions of the populations, as well as by affording a special stimulus to navigation, they tended to give a new activity to international trade. The independence of the towns and the rising importance of the burgher class supplied a counterpoise to the power of the land aristocracy; and the strength of these new social elements was increased by the corporate constitution given to the urban industries, the police of the towns being also founded on the trade guilds, as that of the country districts was on the feudal relations. The increasing demand of the towns for the products of agriculture gave to the prosecution of that art a more extended and speculative character; and this again led to improved methods of transport and communication. But the range of commercial enterprise continued everywhere narrow, except in some favored centres, such as the Italian republics, in which, however, the growth of the normal habits of industrial life was impeded or perverted by military ambition, which was not, in the case of those communities, checked as it was elsewhere by the pressure of an aristocratic class.

Every great change of opinion on the destinies of man and the guiding principles of conduct must react on the sphere of material interests; and the Catholic religion had a powerful influence on the economic life of the Middle Ages. Christianity inculcates, perhaps, no more effectively than the older religions the special economic virtues of industry, thrift, fidelity to engagements, obedience to lawful authority; but it brought out more forcibly and presented more persistently the higher aims of life, and so produced a more elevated way of viewing the different social relations. It purified domestic life, a reform which has the most important economic results. It taught the doctrine of fundamental human equality, heightened the dignity of labor, and preached with quite a new emphasis the obligations of love, compassion, and forgiveness, and the claims of the poor. The constant presentation to the general mind and conscience of these ideas, the dogmatic bases of which were scarcely as yet assailed by skepticism, must have had a powerful effect in moralizing life. But to the influence of Christianity as a moral doctrine was added that of the church as an organization, charged with the application of that doctrine to men's daily transactions. Besides the teachings of the sacred books, there was a mass of ecclesiastical legislation providing specific prescriptions for the conduct of the faithful. And this legislation dealt with the economic as with other provinces of social activity. In the *Corpus Juris Canonici*, which condenses the result of centuries of study and effort, along with much else is set out what we may call the Catholic economic theory, if we understand by theory, not a reasoned explanation of phenomena, but a body of ideas leading to prescriptions for the guidance of conduct. Life is here looked at from the point of view of spiritual interests; the aim is to establish and maintain amongst men a true kingdom of God.

The canonists are friendly to the notion of a community of goods from the side of sentiment ("Dulcissima rerum possessio communis est"), though they regard the distinction of *meum* and *tuum* as an institution necessitated by the fallen state of man. In cases of need the public authority is justified in re-establishing *pro hac vice* the primitive community. The care of the poor is not a matter of free choice; the relief of their necessities is *debitum legale*. *Avaritia* is idolatry; *cupiditas*, even when it does not grasp at what is another's, is the root of all evil, and ought to be not merely regulated but eradicated. Agriculture and handiwork are viewed as legitimate modes of earning food and clothing; but trade is regarded with disfavor, because it was held almost certainly to lead to fraud: of agriculture it was said, "Deo non displicet"; but of the merchant, "Deo placere non potest." The seller was bound to fix the price of his wares, not according to the market rate, as determined by supply and demand, but according to their intrinsic value (*justum pretium*). He must not conceal the faults of his merchandise, nor take advantage of the need or ignorance of the buyer to obtain from him more than the fair price. Interest on money is forbidden; the prohibition of usury is, indeed, as Roscher says, the centre of the whole canonistic system of economy, as well as the foundation of a great part of the ecclesiastical jurisdiction. The question whether a transaction was or was not usurious turning mainly on the intentions of the parties; the innocence or blameworthiness of dealings in which money was lent became rightfully a subject of determination for the church, either by her casuists or in her courts.

The foregoing principles point towards a noble ideal, but by their ascetic exaggeration they worked in some directions as an impediment to industrial progress. Thus, whilst, with the increase of production, a greater division of labor and a larger employment of borrowed capital naturally followed, the laws on usury tended to hinder this expansion. Hence they were undermined by various exceptions, or evaded by fictitious transactions. These laws were in fact dictated by, and adapted to, early conditions—to a state of society in which money loans were commonly sought either with a view to wasteful pleasures or for the relief of such urgent distress as ought rather to have been the object of Christian beneficence. But they were quite unsuited to a period in which capital was borrowed for ends useful to the public, for the extension of enterprise and the employment of labor. The absolute theological spirit in this, as in other instances, could not admit the modification in rules of conduct demanded by a new social situation; and vulgar good sense better understood what were the fundamental conditions of industrial life.

When the intellectual activity previously repressed by the more urgent claims of social preoccupations tended to revive towards the close of the mediæval period, the want of a rational appreciation of the whole of human affairs was felt, and was temporarily met by the adoption of the results of the best Greek speculation. Hence we find in the writings of St. Thomas Aquinas the political and economic doctrines of Aristotle reproduced with a partial infusion of Christian elements. His adherence to his master's point of view is strikingly shown by the fact that he accepts (at least if he is the author of the *De Regimine Principum*) his theory of slavery, though by the action of the forces of his own time the last relics of that institution were being eliminated from European society.

This great change—the enfranchisement of the working classes—was the most important practical outcome of the Middle Ages. The first step in this movement was the transformation of slavery, properly so called, into serfdom. The latter is, by its nature, a transitory condition. The serf was bound to the soil, had fixed domestic relations, and participated in the religious life of the society; and the tendency of all his circumstances, as well as of the opinions and sentiments of the time, was in the direction of liberation. This issue was, indeed, not so speedily reached by the rural as by the urban workman. Already in the second phase serfdom is abolished in the cities and towns, whilst agricultural serfdom does not disappear before the third. The latter revolution is attributed by Adam Smith to the operation of selfish interests, that of the proprietor on the one hand, who discovered the superior productiveness of cultivation by free tenants, and that of the sovereign on the other, who, jealous of the great lords, encouraged the encroachments of the villeins on their authority. But that the church deserves a share of the merit seems beyond doubt—moral impulses, as often happens, conspiring with political and economic motives. The serfs were treated best on the ecclesiastical estates, and the members of the priesthood, both by their doctrine and by their situation since the Northern conquests, were constituted patrons and guardians of the oppressed or subject classes.

Out of the liberation of the serfs rose the first lineaments of the hierarchical constitution of modern industry in the separation between the entrepreneurs and the workers. The personal enfranchisement of the latter, stimulating activity and developing initiative, led to accumulations, which were further promoted by the establishment of order and good government by the civic corporations which grew out of the enfranchisement. Thus an active capitalist class came into existence. It appeared first in commerce, the inhabitants of the trading cities importing expensive luxuries from foreign countries, or the improved manufactures of richer communities, for which the great proprietors gladly exchanged the raw produce of their lands. In performing the office of carriers, too, between different countries, these cities had an increasing field for commercial enterprise. At a later period, as Adam Smith has shown, commerce promoted the growth of manufactures, which were either produced for foreign sale, or made from foreign materials, or imitated from the work of foreign artificers. But the first important development of handicrafts in modern Europe belongs to the 14th and 15th centuries, and the rise of manufacturing entrepreneurs is not conspicuous within the Middle Ages properly so called. Agriculture, of course, lags behind; though the feudal lords tend to transform themselves into directors of agricultural enterprise, their habits and prejudices retard such a movement, and the advance of rural industry proceeds slowly. It does, however, proceed, partly by the stimulation arising from the desire to procure the finer objects of manufacture imported from abroad or produced by increased skill at home, partly by the expenditure on the land of capital amassed in the prosecution of urban industries.

Some of the trade corporations in the cities appear to have been of great antiquity; but it was in the 13th century that they rose to importance by being legally recognized and regulated. These corporations have been much too absolutely condemned by most of the economists, who insist on applying to the Middle Ages the ideas of the 18th and 19th centuries. They were, it is true, unfitted for modern times, and it was necessary that they should disappear; their existence indeed was quite unduly prolonged. But they were at first in several respects highly beneficial. They were a valuable rallying point for the new industrial forces, which were strengthened by the rise of the *esprit de corps* which they fostered. They improved technical skill by the precautions which were taken for the solidity and finished execution of the wares produced in each locality, and it was with a view to the advancement of the industrial arts that St. Louis undertook the better organization of the trades of Paris. The corporations also encouraged good moral habits through the sort of spontaneous surveillance which they exercised, and they tended to develop the social sentiment within the limits of each profession, in times when a larger public spirit could scarcely yet be looked for.

MODERN TIMES.

The close of the Middle Ages, as Comte has shown, must be placed at the end, not of the 15th, but of the 13th century. The modern period, which then began, is filled by a development exhibiting three successive phases, and issuing in the state of things which characterizes our own epoch. During the 14th and 15th centuries the Catholico-feudal system was breaking down by the mutual conflicts of its own official members, whilst the constituent elements of a new order were rising beneath it. On the practical side the antagonists matched against each other were the crown and the feudal chiefs; and these rival powers sought to strengthen themselves by forming alliances with the towns and the industrial forces they represented. The movements of this phase can scarcely be said to find an echo in any contemporary economic literature. In the second phase of the modern period, which opens with the beginning of the 16th century, the spontaneous collapse of the mediæval structure is followed by a series of systematic assaults which still further disorganize it. During this phase the central temporal power, which has made a great advance in stability and resources, lays hold of the rising elements of manufactures and commerce, and seeks, whilst satisfying the popular enthusiasm for their promotion, to use them for political ends, and make them subserve its own strength and splendor by furnishing the treasure necessary for military success. With this practical effort and the social tendencies on which it rests the mercantile school of political economy, which then obtains a spontaneous ascendency, is in close relation. Whilst partially succeeding in the policy we have indicated, the European Governments yet on the whole necessarily fail, their origin and nature disqualifying them for the task of guiding the industrial movement; and the discredit of the spiritual power, with which most of them are confederate, further weakens and undermines them. In the last phase, which coincides approximately with the 18th century, the tendency to a completely new system, both temporal and spiritual, becomes decisively pronounced, first in the philosophy and general literature of the period, and then in the great French explosion. The universal critical doctrine, which had been announced by the Protestantism of the previous phase, and systematized in England towards the close of that phase, is propagated and popularized, especially by French writers. The spirit of individualism inherent in the doctrine was eminently adapted to the wants of the time, and the general favor with which the dogmas of the social contract and *laissez faire* were received indicated a just sentiment of the conditions proper to the contemporary situation of European societies. So long as a new coherent system of thought and life could not be introduced, what was to be desired was a large and active development of personal energy under no further control of the old social powers than would suffice to prevent anarchy. Governments were therefore rightly called on to abandon any effective direction of the social movement, and, as far as possible, to restrict their intervention to the maintenance of material order. This policy was, from its nature, of temporary application only; but the negative school, according to its ordinary spirit, erected what was merely a transitory and exceptional necessity into a permanent and normal law. The unanimous European movement towards the liberation of effort, which sometimes rose to the height of a public passion, had various sides, corresponding to the different aspects of thought and life; and of the economic side the French physiocrats were the first theoretic representatives on the large scale, though the office they undertook was, both in its destructive and organic provinces, more thoroughly and effectively done by Adam Smith, who must be regarded as continuing and completing their work.

It must be admitted that with the whole modern movement serious moral evils were almost necessarily connected. The general discipline which the Middle Ages had sought to institute and had partially succeeded in establishing, though on precarious bases, having broken down, the sentiment of duty was weakened along with the spirit of *ensemble* which is its natural ally, and individualism in doctrine tended to encourage egoism in action. In the economic field this result is specially conspicuous. National selfishness and private cupidity increasingly dominate; and the higher and lower industrial classes tend to separation and even to mutual hostility. The new elements —science and industry—which were gradually acquiring ascendency bore indeed in their bosom an ultimate discipline more efficacious and stable than that which had been dissolved; but the final synthesis was long too remote, and too indeterminate in its nature, to be seen through the dispersive and seemingly incoherent growth of those elements. Now, however, that synthesis is becoming appreciable; and it is the effort towards it, and towards the practical system to be founded on it, that gives its peculiar character to the period in which we live. And to this spontaneous nisus of society corresponds, as we shall see, a new form of economic doctrine, in which it tends to be absorbed into general sociology and subordinated to morals.

It will be the object of the following pages to verify and illustrate in detail the scheme here broadly indicated, and to point out the manner in which the respective features of the several successive modern phases find their counterpart and reflection in the historical development of economic speculation.

FIRST MODERN PHASE.

The first phase was marked, on the one hand, by the spontaneous decomposition of the mediæval system, and, on the other, by the rise of several important elements of the new order. The spiritual power became less apt as well as less able to fulfil its moral office, and the social movement was more and more left to the irregular impulses of individual energy, often enlisted in the service of ambition and cupidity. Strong Governments were formed, which served to maintain material order amidst the growing intellectual and moral disorder. The universal admission of the commons as an element in the political system showed the growing strength of the industrial forces, as did also in another way the insurrections of the working classes. The decisive prevalence of peaceful activity was indicated by the rise of the institution of paid armies—at first temporary, afterwards permanent—which prevented the interruption or distraction of labor by devoting a determinate minority of the population to martial operations and exercises. Manufactures became increasingly important; and in this branch of industry the distinction between the entrepreneur and the workers was first firmly established, whilst fixed relations between these were made possible by the restriction of military training and service to a special profession. Navigation was facilitated by the use of the mariner's compass. The art of printing showed how the intellectual movement and the industrial development were destined to be brought into relation with each other and to work towards common ends. Public credit rose in Florence, Venice, and Genoa long before Holland and England attained any great financial importance. Just at the close of the phase, the discovery of America and of the new route to the East, whilst revolutionizing the course of trade, prepared the way for the establishment of colonies, which contributed powerfully to the growing preponderance of industrial life, and pointed to its ultimate universality. It is doubtless due to the equivocal nature of the stage, standing between the mediæval and the fully characterized modern period, that on the theoretic side we find nothing corresponding to this marvellous practical ferment and expansion. The general political doctrine of Aquinas was retained, with merely subordinate modifications. The only special economic question which seems to have received particular attention was that of the nature and functions of money, the importance of which began to be felt as payments in service or in kind were discontinued, and regular systems of taxation began to be introduced.

Roscher, and after him Wolowski, have called attention to Nicole Oresme, who died bishop of Lisieux in 1382. Roscher pronounces him a great economist. His *Tractatus de Origine, Natura, Jure, et Mutationibus Monetarum* (reprinted by Wolowski, 1864) contains a theory of money which is almost entirely correct according to the views of the 19th century, and is stated with such brevity, clearness, and simplicity of language as, more than anything else, show the work to be from the hand of a master.

SECOND MODERN PHASE: MERCANTILE SYSTEM.

Throughout the first modern phase the rise of the new social forces had been essentially spontaneous; in the second they became the object of systematic encouragement on the part of Governments, which, now that the financial methods of the Middle Ages no longer sufficed, could not further their military and political ends by any other means than increased taxation, implying augmented wealth of the community. Industry thus became a permanent interest of European Governments, and even tended to become the principal object of their policy. In natural harmony with this state of facts, the mercantile system arose and grew, attaining its highest development about the middle of the 17th century.

The mercantile doctrine, stated in its most extreme form, makes wealth and money identical, and regards it therefore as the great object of a community so to conduct its dealings with other nations as to attract to itself the largest possible share of the precious metals. Each country must seek to export the utmost possible quantity of its own manufactures, and to import as little as possible of those of other countries, receiving the difference of the two values in gold and silver. This difference is called the balance of trade, and the balance is favorable when more money is received than is paid. Governments must resort to all available expedients—prohibition of, or high duties on, the importation of foreign wares, bounties on the export of home manufactures, restrictions on the export of the precious metals—for the purpose of securing such a balance.

But this statement of the doctrine, though current in the text books, does not represent correctly the views of all who must be classed as belonging to the mercantile school. Many of the members of that school were much too clear-sighted to entertain the belief, which the modern student feels difficulty in supposing any class of thinkers to have professed, that wealth consists exclusively of gold and silver. The mercantilists may be best described, as Roscher has remarked, not by any definite economic theorem which they held in common, but by a set of theoretic tendencies, commonly found in combination, though severally prevailing in different degrees in different minds. These tendencies may be enumerated as follows: (1) towards overestimating the importance of possessing a large amount of the precious metals; (2) towards an undue exaltation (*a*) of foreign trade over domestic, and (*b*) of the industry which works up materials over that which provides them; (3) towards attaching too high a value to a dense population as an element of national strength; and (4) towards invoking the action of the state in furthering artificially the attainment of the several ends thus proposed as desirable.

If we consider the contemporary position of affairs in western Europe, we shall have no difficulty in understanding how these tendencies would inevitably arise. The discoveries in the New World had led to a large development of the European currencies. The old feudal economy, founded principally on dealings in kind, had given way before the new "money economy," and the dimensions of the latter were everywhere expanding. Circulation was becoming more rapid, distant communications more frequent, city life and movable property more important. The mercantilists were impressed by the fact that money is wealth *sui generis*, that it is at all times in universal demand, and that it puts into the hands of its possessor the power of acquiring all other commodities. The period, again, was marked by the formation of great states, with powerful governments at their head. These governments required men and money for the maintenance of permanent armies, which, especially for the religious and Italian wars, were kept up on a great scale. Court expenses, too, were more lavish than ever before, and a larger number of civil officials was employed. The royal domains and dues were insufficient to meet these requirements, and taxation grew with the demands of the monarchies. Statesmen saw that for their own political ends industry must flourish. But manufactures make possible a denser population and a higher total value of exports than agriculture; they open a less limited and more promptly extensible field to enterprise. Hence they became the object of special Governmental favor and patronage, whilst agriculture fell comparatively into the background. The growth of manufactures reacted on commerce, to which a new and mighty arena had been opened by the establishment of colonies. These were viewed simply as estates to be worked for the advantage of the mother countries, and the aim of statesmen was to make the colonial trade a new source of public revenue. Each nation, as a whole, working for its own power, and the greater ones for predominance, they entered into a competitive struggle in the economic no less than in the political field, success in the former being indeed, by the rulers, regarded as instrumental to pre-eminence in the latter. A national economic interest came to exist, of which the Government made itself the representative head. States became a sort of artificial hothouses for the rearing of urban industries. Production was subjected to systematic regulation, with the object of securing the goodness and cheapness of the exported articles, and so maintaining the place of the nation in foreign markets. The industrial control was exercised, in part directly by the state, but largely also through privileged corporations and trading companies. High duties on imports were resorted to, at first perhaps mainly for revenue, but afterwards in the interest of national production. Commercial treaties were a principal object of diplomacy, the end in view being to exclude the competition of other nations in foreign markets, whilst in the home market as little room as possible was given for the introduction of anything but raw materials from abroad. The colonies were prohibited from trading with other European nations than the parent country, to which they supplied either the precious metals or raw produce purchased with home manufactures. It is evident that what is known as the mercantile doctrine was essentially the theoretic counterpart of the practical activities of the time, and that nations and Governments were led to it, not by any form of scientific thought, but by the force of outward circumstance, and the observation of facts which lay on the surface.

And yet, if we regard the question from the highest point of view of philosophic history, we must pronounce the universal enthusiasm of this second modern phase for manufactures and commerce to have been essentially just, as leading the nations into the main avenues of general social development. If the thought of the period, instead of being impelled by contemporary circumstances, could have been guided by sociological prevision, it must have entered with zeal upon the same path which it empirically selected. The organization of agricultural industry could not at that period make any marked progress, for the direction of its operations was still in the hands of the feudal class, which could not in general really learn the habits of industrial life, or place itself in sufficient harmony with the workers on its domains. The industry of the towns had to precede that of the country, and the latter had to be developed mainly through the indirect action of the former. And it is plain that it was in the life of the manufacturing proletariat, whose labors are necessarily the most continuous and the most social, that a systematic discipline could at a later period be first applied, to be afterwards extended to the rural populations.

That the efforts of Governments for the furtherance of manufactures and commerce were really effective towards that end is admitted by Adam Smith, and cannot reasonably be doubted, though free trade doctrinaires have often denied it. Technical skill must have been promoted by their encouragements; whilst new forms of national production were fostered by attracting workmen from other countries, and by lightening the burden of taxation on struggling industries. Communication and transport by land and sea were more rapidly improved with a view to facilitate traffic; and, not the least important effect, the social dignity of the industrial professions was enhanced relatively to that of the classes before exclusively dominant.

It has often been asked to whom the foundation of the mercantile system, in the region whether of thought or of practice, is to be attributed. But the question admits of no absolute answer. That mode of conceiving economic facts arises spontaneously in unscientific minds, and ideas suggested by it are to be found in the Greek and Latin writers. The policy which it dictates was, as we have shown, inspired by the situation of the European nations at the opening of the modern period. Such a policy had been already in some degree practiced in the 14th and 15th centuries, thus preceding any formal exposition or defence of its speculative basis. At the commencement of the 16th century it began to exercise a widely extended influence. Charles V. adopted it, and his example contributed much to its predominance. Henry VIII. and Elizabeth conformed their measures to it. The leading states soon entered on a universal competition, in which each power brought into play all its political and financial resources for the purpose of securing to itself manufacturing and commercial preponderance. Through almost the whole of the 17th century the prize, so far as commerce was concerned, remained in the possession of Holland, Italy having lost her former ascendency by the opening of the new maritime routes, and Spain and Germany being depressed by protracted wars and internal dissensions. The admiring envy of Holland felt by English politicians and economists appears in such writers as Raleigh, Mun, Child, and Temple; and how strongly the same spectacle acted on French policy is shown by a well-known letter of Colbert to M. de Pomponne, ambassador to the Dutch States. Cromwell, by his Navigation Act, which destroyed the carrying trade of Holland and founded the English empire of the sea, and Colbert, by his whole economic policy, domestic and international, were the chief practical representatives of the mercantile system. From the latter great statesman the Italian publicist Mengotti gave to that system the name of *Colbertismo;* but it would be an error to consider the French minister as having absolutely accepted its dogmas. He regarded his measures as temporary only, and spoke of protective duties as crutches by the help of which manufacturers might learn to walk and then throw them away. The policy of exclusions had been previously pursued by Sully, partly with a view to the accumulation of a royal treasure, but chiefly from his special enthusiasm for agriculture, and his dislike of the introduction of foreign luxuries as detrimental to the national character. Colbert's tariff of 1664 not merely simplified but considerably reduced the existing duties; the tariff of 1667 indeed increased them, but that was really a political measure directed against the Dutch. It seems certain that France owed in a large measure to his policy the vast development of trade and manufactures which so much impressed the imagination of contemporary Europe, and of which we hear so much from English writers of the time of Petty. But this policy had also undeniably its dark side. Industry was forced by such systematic regulation to follow invariable courses, instead of adapting itself to changing tastes and popular demand. Nor was it free to simplify the processes of production, or to introduce increased division of labor and improved appliances. Spontaneity, initiation, and invention were repressed or discouraged, and thus ulterior sacrificed in a great measure to immediate results. The more enlightened statesmen, and Colbert in particular, endeavored, it is true, to minimize these disadvantages by procuring, often at great expense, and communicating to the trades through inspectors nominated by the Government, information respecting improved processes employed elsewhere in the several arts; but this, though in some degree a real, was certainly on the whole, and in the long run, an insufficient compensation.

We must not expect from the writers of this stage any exposition of political economy as a whole; the publications which appeared were for the most part evoked by special exigencies and related to particular questions, usually of a practical kind, which arose out of the great movements of the time. They were in fact of the nature of counsels to the Governments of states, pointing out how best they might develop the productive powers at their disposal and increase the resources of their respective countries. They are conceived (as List claims for them) strictly in the spirit of *national* economy, and cosmopolitanism is essentially foreign to them. On these monographs the mercantile theory sometimes had little influence, the problems discussed not involving its tenets. But it must in most cases be taken to be the scheme of fundamental doctrine (so far as it was ever entitled to such a description) which in the last resort underlies the writer's conclusions.

Scaruffi.

The rise of prices following on the discovery of the American mines was one of the subjects which first attracted the attention of theorists. This rise brought about a great and gradually increasing disturbance of existing economic relations, and so produced much perplexity and anxiety, which were all the more felt because the cause of the change was not understood. To this was added the loss and inconvenience arising from the debasement of the currency often resorted to by sovereigns as well as by republican states. Italy suffered most from this latter abuse, which was multiplied by her political divisions. It was this evil which called forth the work of Count Gasparo Scaruffi (*Discorso sopra le monete e della vera proporzione fra l'oro e l'argento*, 1582). In this he put forward the bold idea of a universal money, everywhere identical in size, shape, composition, and designation. The project was, of course, premature, and was not adopted even by the Italian princes to whom the author specially appealed, but the reform is one which, doubtless, the future will see realized. Gian Donato Turbolo, master of the Neapolitan mint, in his *Discorsi e Relazioni*, 1629, protested against any tampering with the currency. Another treatise relating to the subject of money was that of the Florentine Bernardo Davanzati, otherwise known as the able translator of Tacitus, *Lezioni delle Monete*, 1588. It is a slight and somewhat superficial production, only remarkable as written with conciseness and elegance of style.

Bodin.

A French writer who dealt with the question of money, but from a different point of view, was Jean Bodin. In his *Réponse aux paradoxes de M. Malestroit touchant l'enchérissement de toutes les choses et des monnaies*, 1568, and in his *Discours sur le rehaussement et diminution des monnaies*, 1578, he showed a more rational appreciation than many of his contemporaries of the causes of the revolution in prices and the relation of the variations in money to the market values of wares in general as well as to the wages of labor. He saw that the amount of money in circulation did not constitute the wealth of the community, and that the prohibition of the export of the precious metals was useless, because rendered inoperative by the necessities of trade. Bodin is no inconsiderable figure in the literary history of the epoch, and did not confine his attention to economic problems; in his *Six livres de la République*, about 1576, he studies the general conditions of the prosperity and stability of states. In harmony with the conditions of his age, he approves of absolute Governments as the most competent to ensure the security and well-being of their subjects. He enters into an elaborate defence of individual property against Plato and More, rather perhaps because the scheme of his work required the treatment of that theme than because it was practically urgent in his day, when the excesses of the Anabaptists had produced a strong feeling against communistic doctrines. He is under the general influence of the mercantilist views, and approves of energetic governmental interference in industrial matters, of high taxes on foreign manufactures and low duties on raw materials and articles of food, and attaches great importance to a dense population. But he is not a blind follower of the system; he wishes for unlimited freedom of trade in many cases, and he is in advance of his more eminent contemporary Montaigne in perceiving that the gain of one nation is not necessarily the loss of another. To the public finances, which he calls the sinews of the state, he devotes much attention and insists on the duties of the Government in respect to the right adjustment of taxation. In general he deserves the praise of steadily keeping in view the higher aims and interests of society in connection with the regulation and development of its material life.

Stafford.

Correct views as to the cause of the general rise of prices are also put forward by the English writer, W. S. (William Stafford), in his *Briefe Conceipte of English Policy*, published in 1581 and dedicated to Queen Elizabeth. It is in the form of a dialogue, and is written with liveliness and spirit. The author seems to have been acquainted with the writings of Bodin. He has just ideas as to the nature of money and fully understands the evils arising from a debased coinage. He describes in detail the way in which the several interests in the country had been affected by such debasement in previous reigns, as well as by the change in the value of the precious metals. The great popular grievance of his day, the conversion of arable land into pasture, he attributes chiefly to the restrictions on the export of corn, which he desires to see abolished. But in regard to manufactures he is at the same point of view with the later mercantilists, and proposes the exclusion of all foreign wares which might as well be provided at home, and the prohibition of the export of raw materials intended to be worked up abroad.

Albertine pamphlets.

Out of the question of money, too, arose the first remarkable German production on political economy which had an original national character and addressed the public in the native tongue. Duke George of the Ernestine Saxon line was inclined (1530) to introduce a debasement of the currency. A pamphlet, *Gemeine Stymmen von der Müntze*, was published in opposition to this proceeding, under the auspices of the Albertine branch, whose policy was sounder in the economic sphere no less than in that of ecclesiastical affairs. A reply appeared justifying the Ernestine project. This was followed by a rejoinder from the Albertine side. The Ernestine pamphlet is described by Roscher as ill-written, obscure, inflated, and, as might be expected from the thesis it maintained, sophistical. But it is interesting as containing a statement of the fundamental principles of the mercantile system more than one hundred years before the publication of Mun's book and forty-six before that of Bodin's *Six livres de la République*. The Albertine tracts, according to Roscher, exhibit such sound views of the conditions and evidences of national wealth, of the nature of money and trade, and of the rights and duties of governments in relation to economic action, that he regards the unknown author as entitled to a place beside Raleigh and the other English "colonial theorists" of the end of the 16th and beginning of the 17th century.

Copernicus.

In connection with the same subject of money we meet the great name of Copernicus. His treatise *De monetæ cudendæ ratione*, 1526 (first printed in 1816), was written by order of King Sigismund I., and is an exposition of the principles on which it was proposed to reform the currency of the Prussian provinces of Poland. It advocates unity of the monetary system throughout the entire state, with strict integrity in the quality of the coin, and the charge of a seigniorage sufficient to cover the expenses of mintage.

Serra.

Antonio Serra is regarded by some as the creator of modern political economy. He was a native of Cosenza in Calabria. His *Breve Trattato delle cause che possono fare abbondare li regni d'oro e d'argento dove non sono miniere*, 1613, was written during his imprisonment, which is believed to have been due to his having taken part in the conspiracy of Campanella for the liberation of Naples from the Spanish yoke and the establishment of a republican government. This work, long overlooked, was brought into notice in the following century by Galiani and others. Its title alone would sufficiently indicate that the author had adopted the principles of the mercantile system, and in fact in this treatise the essential doctrines of that system are expounded in a tolerably formal and consecutive manner. He strongly insists on the superiority of manufactures over agriculture as a source of national wealth, and uses in support of this view the prosperity of Genoa, Florence, and Venice, as contrasted with the depressed condition of Naples. With larger insight than many of the mercantilists exhibit, he points out the importance, towards the acquisition of wealth, not alone of favorable external conditions, but of energetic character and industrious habits in a population, as well as of a stable government and a good administration of the laws.

Watteville.

The first systematic treatise on our science which proceeded from a French author was the *Traité de l'Économie Politique*, published by Montchrétien de Watteville in 1615. The use of the title, says Roscher, now for the first time given to the science, was in itself an important service, since even Bacon understood by "Economia" only the theory of domestic management. The general tendencies and aims of the period are seen in the fact that this treatise, notwithstanding the comprehensive name it bears, does not deal with agriculture at all, but only with the mechanical arts, navigation, commerce, and public finance. The author is filled with the then dominant enthusiasm for foreign trade and colonies. He advocates the control by princes of the industry of their subjects, and condemns the too great freedom, which, in his opinion to their own detriment, the Governments of Spain, Portugal, and Holland had given to trade. His book may be regarded as a formal exposition of the principles of the mercantile system for the use of Frenchmen.

Mun.

A similar office was performed in England by Thomas Mun. In his two works, *A Discourse of Trade from England unto the East Indies*, 2d ed., 1621, and especially in *England's Treasure by Foreign Trade*, 1664 (posthumous), we have for the first time a clear and systematic statement of the theory of the balance of trade, as well as of the means by which, according to the author's view, a favorable balance could be secured for England. The great object of the economic policy of a state, according to him, should be so to manage its export of manufactures, its direct and carrying trade, and its customs duties as to attract to itself money from abroad. He was, however, opposed to the prohibition of the export of the precious metals in exchange for foreign wares, but on the ground, fully according with his general principles, that those wares might afterwards be re-exported and might then bring back more treasure than had been originally expended in their purchase; the first export of money might be, as he said, the seed-time, of which the ultimate receipt of a larger amount would be the harvest. He saw, too, that it is inexpedient to have too much money circulating in a country, as this enhances the prices of commodities, and so makes them less salable to foreigners, but he is favorable to the formation and maintenance of a state treasure.[1]

Child.

One of the most remarkable of the modern mercantilists was Sir Josiah Child (*Brief Observations concerning Trade and the Interest of Money*, 1668, and *A New Discourse of Trade*, 1668 and 1690). He was one of those who held up Holland as a model for the imitation of his fellow-countrymen. He is strongly impressed with the importance for national wealth and well-being of a low rate of interest, which he says is to commerce and agriculture what the soul is to the body, and which he held to be the "*causa causans* of all the other causes of the riches of the Dutch people." Instead of regarding such low rate as dependent on determinate conditions which should be allowed to evolve themselves spontaneously, he thinks it should be created and maintained by public authority. Child, whilst adhering to the doctrine of the balance of trade, observes that a people cannot always sell to foreigners without ever buying from them, and denies that the export of the precious metals is necessarily detrimental. He has the ordinary mercantilist partiality for a numerous population. He advocates the reservation by the mother country of the sole right of trade with her colonies, and, under certain limitations, the formation of privileged trading companies. As to the Navigation Act, he takes up a position not unlike that afterwards occupied by Adam Smith, regarding that measure much more favorably from the political than from the economic point of view. It will be seen that he is somewhat eclectic in his opinions; but he cannot properly be regarded, though some have attributed to him that character, as a precursor of the free-trade school of the 18th century.

Sir W. Temple.

Davenant.

Two other eclectics may be here mentioned, in whom just views are mingled with mercantilist prejudices—Sir William Temple and Charles Davenant. The former in his *Observations upon the United Provinces of the Netherlands*, 1672, and his *Essay on the Trade of Ireland*, 1673, has many excellent remarks on fundamental economic principles, as on the functions of labor and of saving in the production of national wealth; but he is infected with the errors of the theory of the balance of trade. He follows the lead of Raleigh and Child in urging his fellow-countrymen to imitate the example of the Dutch in their economic policy—advice which in his case was founded on his observations during a lengthened residence in Holland as ambassador to the States. Davenant, in his *Essay on the East-India Trade*, 1696-97, *Essay on the Probable Ways of making the People Gainers in the Balance of Trade*, 1699, etc., also takes up an eclectic position, combining some correct views on wealth and money with mercantilist notions on trade, and recommending Governmental restrictions on colonial commerce as strongly as he advocates freedom of exchange at home.

Whilst the mercantile system represented the prevalent form of economic thought in the 17th century, and was alone dominant in the region of practical statesmanship, there was growing up, side by side with it, a body of opinion, different and indeed hostile in character, which was destined ultimately to drive it from the field. The new ideas were first developed in England, though it was in France that in the following century they took hold of the public mind, and became a power in politics. That they should first show themselves here, and afterwards be extended, applied, and propagated throughout Europe by French writers, belongs to the order of things according to which the general negative doctrine in morals and politics, undoubtedly of English origin, found its chief home in France, and was thence diffused in widening circles through the civilized world. In England this movement of economic thought took the shape mainly of individual criticism of the prevalent doctrines, founded on a truer analysis of facts and conceptions; in France it was penetrated with a powerful social sentiment, furnished the creed of a party, and inspired a protest against institutions and an urgent demand for practical reform.

Regarded from the theoretic side, the characteristic features of the new direction were the following. The view of at least the extreme mercantilists that national wealth depends on the accumulation of the precious metals is proved to be false, and the gifts of nature and the labor of man are shown to be its real sources. The exaggerated estimate of the importance of foreign commerce is reduced, and attention is once more turned to agriculture and the conditions of its successful prosecution. On the side of practical policy, a so-called favorable balance of trade is seen not to be the true object of a nation's or a statesman's efforts, but the procuring for the whole population in the fullest measure the enjoyment of the necessaries and conveniences of life. And—what more than anything else contrasts the new system with the old—the elaborate apparatus of prohibitions, protective duties, bounties, monopolies, and privileged corporations, which the European Governments had created in the supposed interests of manufactures and trade, is denounced or deprecated as more an impediment than a furtherance, and the freedom of industry is insisted on as the one thing needful. This circle of ideas, of course, emerges only gradually, and its earliest representatives in economic literature in general apprehend it imperfectly and advocate it with reserve; but it rises steadily in importance, being more and more favored by the highest minds, and finding an increasing body of supporters amongst the intelligent public.

Hobbes.

Some occasional traits of an economic scheme in harmony with these new tendencies are to be found in the *De Cive* and *Leviathan* of Hobbes. But the efficacy of that great thinker lay rather in the general philosophic field; and by systematizing, for the first time, the whole negative doctrine, he gave a powerful impulse towards the demolition of the existing social order, which was destined, as we shall see, to have momentous consequences in the economic no less than in the strictly political department of things.

Sir William Petty.

A writer of no such extended range, but of much sagacity and good sense, was SIR WILLIAM PETTY (*q.v.*), author of a number of pieces containing germs of a sound economic doctrine. A leading thought in his writings is that "labor is the father and active principle of wealth, lands are the mother." He divides a population into two classes, the productive and the unproductive, according as they are or are not occupied in producing useful material things. The value of any commodity depends, he says, anticipating Ricardo, on the amount of labor necessary for its production. He is desirous of obtaining a universal measure of value, and chooses as his unit the average food of the cheapest kind required for a man's daily sustenance. He understands the nature of the rent of land as the excess of price over the cost of production. He disapproves of the attempt to fix by authority a maximum rate of interest, and is generally opposed to Governmental interference with the course of industry. He sees that a country requires for its exchanges a definite quantity of money and may have too much of it, and condemns the prohibition of its exportation. He holds that one only of the precious metals must be the foundation of the currency, the other circulating as an ordinary article of merchandise. Petty's name is specially associated with the progress of statistics, with which he was much occupied, and which he called by the name of political arithmetic. Relying on the results of such inquiries, he set himself strongly against the opinion which had been advanced by the author of *Britannia Languens* (1680), Fortrey, Roger Coke, and other writers, that the prosperity of England was on the decline.

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[1] Writers of less importance who followed the same direction were Sir Thomas Culpepper (*A Tract against the High Rate of Usury*, 1623, and *Useful Remark on High Interest*, 1641); Sir Dudley Digges (*Defence of Trade*, 1615); G. Malynes (*Consuetudo vel Lex Mercatoria*, 1622); E. Misselden (*Circle of Commerce*, 1623); Samuel Fortrey (*England's Interest and Improvement*, 1663 and 1673); and John Pollexfen (*England and India inconsistent in their Manufactures*, 1697).

Sir Dudley North.

The most thorough-going and emphatic assertion of the free-trade doctrine against the system of prohibitions which had gained strength by the Revolution was contained in Sir Dudley North's *Discourses upon Trade*, 1691. He shows that wealth may exist independently of gold or silver, its source being human industry, applied either to the cultivation of the soil or to manufactures. The precious metals, however, are one element of national wealth, and perform highly important offices. Money may exist in excess, as well as in defect, in a country; and the quantity of it required for the purposes of trade will vary with circumstances; its ebb and flow will regulate themselves spontaneously. It is a mistake to suppose that stagnation of trade arises from want of money; it must arise either from a glut of the home market, or from a disturbance of foreign commerce, or from diminished consumption caused by poverty. The export of money in the course of traffic, instead of diminishing, increases the national wealth, trade being only an exchange of superfluities. Nations are related to the world just in the same way as cities to the state or as families to the city. North emphasizes more than his predecessors the value of the home trade. With respect to the interest of capital, he maintains that it depends, like the price of any commodity, on the proportion of demand and supply, and that a low rate is a result of the relative increase of capital, and cannot be brought about by arbitrary regulations, as had been proposed by Child and others. In arguing the question of free trade, he urges that individuals often take their private interest as the measure of good and evil, and would for its sake debar others from their equal right of buying and selling, but that every advantage given to one interest or branch of trade over another is injurious to the public. No trade is unprofitable to the public; if it were, it would be given up; when trades thrive, so does the public, of which they form a part. Prices must determine themselves, and cannot be fixed by law; and all forcible interference with them does harm instead of good. No people can become rich by state regulations,—only by peace, industry, freedom, and unimpeded economic activity. It will be seen how closely North's view of things approaches to that embodied some eighty years later in Adam Smith's great work.

Locke.

Locke is represented by Roscher as, along with Petty and North, making up the "triumvirate" of eminent British economists of this period who laid the foundations of a new and more rational doctrine than that of the mercantilists. But this view of his claims seems capable of being accepted only with considerable deductions. His specially economic writings are *Considerations of the lowering of Interest and raising the value of Money*, 1691, and *Further Considerations*, 1695. Though Leibnitz declared with respect to these treatises that nothing more solid or intelligent could be said on their subject, it is difficult absolutely to adopt that verdict. Locke's spirit of sober observation and patient analysis led him indeed to some just conclusions; and he is entitled to the credit of having energetically resisted the debasement of the currency, which was then recommended by some who were held to be eminent practical authorities. But he falls into errors which show that he had not by any means completely emancipated himself from the ideas of the mercantile system. He attaches far too much importance to money as such. He says expressly that riches consist in a plenty of gold and silver, that is, as he explains, in having more in proportion of these metals than the rest of the world or than our neighbors. "In a country not furnished with mines, there are but two ways of growing rich, either conquest or commerce." Hence he accepts the doctrine of the balance of trade. He shows that the rate of interest can no more be fixed by law than the rent of houses or the hire of ships, and opposes Child's demand for legislative interference with it. But he erroneously attributed the fall of the rate which had taken place generally in Europe to the increase of the quantity of gold and silver by the discovery of the American mines. He sets too absolute a value on a numerous population, in this point agreeing with Petty. On wages he observes that the rate must be such as to cover the indispensable wants of the laborer; when the price of subsistence rises, wages must rise in a like ratio, or the working population must come on the poor-rates. The fall of the rent of land he regards as a sure sign of the decline of national wealth. "Taxes, however contrived, and out of whose hands soever immediately taken, do, in a country where their great fund is in land, for the most part terminate upon land." In this last proposition we see a foreshadowing of the *impôt unique* of the physiocrats. Whatever may have been Locke's direct economic services, his principal importance, like that of Hobbes, lies in his general philosophic and political principles, which powerfully affected French and indeed European thought, exciting a spirit of opposition to arbitrary power, and laying the foundation of the doctrine developed in the *Contrat Social*.[1]

THIRD MODERN PHASE: SYSTEM OF NATURAL LIBERTY.

Both in England and France the ruling powers had already begun to be alarmed by the subversive tendencies which appeared inherent in the modern movement, and took up in consequence an attitude of resistance. Reaction became triumphant in France during the latter half of the reign of Louis XIV. under the disastrous influence of Madame de Maintenon. In England, after the transaction of 1688, by which the government was consolidated on the double basis of aristocratic power and official orthodoxy, the state policy became not so much retrograde as stationary, industrial conquest being put forward to satisfy the middle class and wean it from the pursuit of a social renovation. In both countries there was for some time a noticeable check in the intellectual development, and Roscher and others have observed that, in economic studies particularly, the first three decades of the 18th century were a period of general stagnation, eclecticism for the most part taking the place of originality. The movement was, however, soon to be resumed, but with an altered and more formidable character. The negative doctrine, which had risen and taken a definite form in England, was diffused and popularized in France, where it became evident, even before the decisive explosion, that the only possible issue lay in a radical social transformation. The partial schools of Voltaire and Rousseau in different ways led up to a violent crisis, whilst taking little thought of the conditions of a system which could replace the old; but the more complete and organic school, of which Diderot is the best representative, looked through freedom to reorganization. Its constructive aim is shown by the design of the *Encyclopédie*,—a project, however, which could have only a temporary success, because no real synthesis was forthcoming, and this joint production of minds often divergent could possess no more than an external unity. It was with this great school that the physiocrats were specially connected; and, in common with its other members, whilst pushing towards an entire change of the existing system, they yet would gladly have avoided political demolition through the exercise of a royal dictatorship, or contemplated it only as the necessary condition of a new and better order of things. But, though marked off by such tendencies from the purely revolutionary sects, their method and fundamental ideas were negative, resting, as they did, essentially on the basis of the *jus naturæ*. We shall follow in detail these French developments in their special relation to economic science, and afterwards notice the corresponding movements in other European countries which showed themselves before the appearance of Adam Smith, or were at least unaffected by his influence.

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[1] Minor English writers who followed the new economic direction were Lewis Roberts, *Treasure of Traffick*, 1641; Rice Vaughan, *Discourse of Coin and Coinage*, 1675; Nicholas Barbon, *Discourse concerning Coining the new money lighter*, 1696, in which some of Locke's errors were pointed out; and the author of an anonymous book entitled *Considerations on the East India Trade*, 1701. Practical questions much debated at this period were those connected with banking, on which a lengthened controversy took place, S. Lamb, W. Potter, F. Cradocke, M. Lewis, M. Godfrey, R. Murray, H. Chamberlen, and W. Paterson, founder of the Bank of England (1694), producing many pamphlets on the subject; and the management of the poor, which was treated by Locke, Sir Matthew Hale, R. Haines, T. Firmin, and others.

1. *Before Adam Smith.*

France.—The more liberal, as well as more rational, principles put forward by the English thinkers of the new type began, early in the 18th century, to find an echo in France, where the clearer and more vigorous intellects were prepared for their reception by a sense of the great evils which exaggerated mercantilism, serving as instrument of political ambition, had produced in that country. The impoverished condition of the agricultural population, the oppressive weight and unequal imposition of taxation, and the unsound state of the public finances had produced a general feeling of disquiet, and led several distinguished writers to protest strongly against the policy of Colbert and to demand a complete reform.

Boisguillebert.

The most important amongst them was Pierre Boisguillebert, whose whole life was devoted to these controversies. In his statistical writings (*Détail de la France sous le règne présent*, 1697; *Factum de la France*, 1707) he brings out in gloomy colors the dark side of the age of Louis XIV., and in his theoretic works (*Traité de la nature et du commerce des grains; Dissertations sur la nature des richesses de l'argent et des tributs;* and *Essai sur la rareté de l'argent*) he appears as an earnest, even passionate antagonist of the mercantile school. He insists again and again on the fact that national wealth does not consist in gold and silver, but in useful things, foremost among which are the products of agriculture. He even goes so far as to speak of "argent criminel," which from being the slave of trade, as it ought to be, had become its tyrant. He sets the "genuinely French Sully" far above the "Italianizing Colbert," and condemns all arbitrary regulations affecting either foreign or internal commerce, especially as regards the corn trade. National wealth does not depend on Governments, whose interference does more harm than good; the natural laws of the economic order of things cannot be violated or neglected with impunity; the interests of the several classes of society in a system of freedom are identical, and those of individuals coincide with that of the state. A similar solidarity exists between different nations; in their economic dealings they are related to the world as individual towns to a nation, and not merely plenty, but peace and harmony, will result from their unfettered intercourse. Men he divides into two classes—those who do nothing and enjoy everything, and those who labor from morning to night often without earning a bare subsistence; the latter he would favor in every way. Here we catch the breath of popular sympathy which fills the social atmosphere of the 18th century. He dwells with special emphasis on the claims of agriculture, which had in France fallen into unmerited neglect, and with a view to its improvement calls for a reform in taxation. He would replace indirect taxes by taxes on income, and would restore the payment of taxes in kind, with the object of securing equality of burden and eliminating every element of the arbitrary. He has some interesting views of a general character; thus he approximates to a correct conception of agricultural rent; and he points to the order in which human wants follow each other,—those of necessity, convenience, comfort, superfluity, and ostentation succeeding in the order named, and ceasing in the inverse order to be felt as wealth decreases. The depreciating tone in which Voltaire speaks of Boisguillebert (*Siècle de Louis XIV.*, chap. 30) is certainly not justified; he had a great economic talent, and his writings contain important germs of truth. But he appears to have exerted little influence, theoretical or practical, in his own time.

Vauban.

The same general line of thought was followed by the illustrious Vauban in his economic tracts, especially that bearing the title of *Projet d'une dixme Royale*, 1707. He is deeply impressed with the deplorable condition of the working classes of France in his day. He urges that the aim of the Government should be the welfare of all orders of the community; that all are entitled to like favor and furtherance; that the often despised and wronged lower class is the basis of the social organization; that labor is the foundation of all wealth, and agriculture the most important species of labor; that the most essential condition of successful industry is freedom; and that all unnecessary or excessive restrictions on manufactures and commerce should be swept away. He protests in particular against the inequalities of taxation, and the exemptions and privileges enjoyed by the higher ranks. With the exception of some duties on consumption he would abolish all the existing taxes, and substitute for them a single tax on income and land, impartially applied to all classes, which he describes under the name of "Dixme Royale," that is to say, a tenth in kind of all agricultural produce, and a tenth of money income chargeable on manufacturers and traders.

Fénelon.

The liberal and humane spirit of Fénelon led him to aspire after freedom of commerce with foreign nations, and to preach the doctrine that the true superiority of one state over another lies in the number indeed, but also in the morality, intelligence, and industrious habits of its population. The *Télémaque*, in which these views were presented in an attractive form, was welcomed and read amongst all ranks and classes, and was thus an effective organ for the propagation of opinion.

Montesquieu.

After these writers there is a marked blank in the field of French economic thought, broken only by the *Réflexions Politiques sur les Finances et le Commerce* (1738) of Dutot, a pupil of Law, and the semi-mercantilist *Essais Politiques sur le Commerce* (1731) of Mélon, till we come to the great name of Montesquieu. The *Esprit des Lois*, so far as it deals with economic subjects, is written upon the whole from a point of view adverse to the mercantile system, especially in his treatment of money, though in his observations on colonies and elsewhere he falls in with the ideas of that system. His immortal service, however, was not rendered by any special research, but by his enforcement of the doctrine of natural laws regulating social no less than physical phenomena. There is no other thinker of importance on economic subjects in France till the appearance of the physiocrats, which marks an epoch in the history of the science.

Physiocrats.

The heads of the physiocratic school were François Quesnay (1694–1774) and Jean Claude Marie Vincent, sieur de Gournay (1712–1759). The principles of the school had been put forward in 1755 by Cantillon, a French merchant of Irish extraction (*Essai sur la nature du Commerce en général*), whose biography Jevons has elucidated, and whom he regards as the true founder of political economy; but it was in the hands of Quesnay and Gournay that they acquired a systematic form, and became the creed of a united group of thinkers and practical men, bent on carrying them into action. The members of the group called themselves "les économistes," but it is more convenient, because unambiguous, to designate them by the name "physiocrates," invented by Dupont de Nemours, who was one of their number. In this name, intended to express the fundamental idea of the school, much more is implied than the subjection of the phenomena of the social, and in particular the economic, world to fixed relations of coexistence and succession. This is the positive doctrine which lies at the bottom of all true science. But the law of nature referred to in the title of the sect was something quite different. The theological dogma which represented all the movements of the universe as directed by divine wisdom and benevolence to the production of the greatest possible sum of happiness had been transformed in the hands of the metaphysicians into the conception of a *jus naturæ*, a harmonious and beneficial code established by the favorite entity of these thinkers, Nature, antecedent to human institutions, and furnishing the model to which they should be made to conform. This idea, which Buckle apparently supposes to have been an invention of Hutcheson's, had come down through Roman juridical theory from the speculations of Greece. It was taken in hand by the modern negative school from Hobbes to Rousseau, and used as a powerful weapon of assault upon the existing order of society, with which the "natural" order was perpetually contrasted as offering the perfect type from which fact had deplorably diverged. The theory received different applications according to the diversity of minds or circumstances. By some it was directed against the artificial manners of the times, by others against contemporary political institutions; it was specially employed by the physiocrats in criticising the economic practice of European Governments.

The general political doctrine is as follows. Society is composed of a number of individuals all having the same natural rights. If all do not possess (as some members of the negative school maintained) equal capacities, each can at least best understand his own interest, and is led by nature to follow it. The social union is really a contract between these individuals, the object of which is the limitation of the natural freedom of each, just so far as it is inconsistent with the rights of the others. Government, though necessary, is a necessary evil; and the governing power appointed by consent should be limited to the amount of interference absolutely required to secure the fulfilment of the contract. In the economic sphere, this implies the right of the individual to such natural enjoyments as he can acquire by his labor. That labor, therefore should be undisturbed and unfettered; and its fruits should be guaranteed to the possessor; in other words, property should be sacred. Each citizen must be allowed to make the most of his labor; and therefore freedom of exchange should be ensured, and competition in the market should be unrestricted, no monopolies or privileges being permitted to exist.

The physiocrats then proceed with the economic analysis as follows. Only those labors are truly "productive" which add to the quantity of raw materials available for the purposes of man; and the real annual addition to the wealth of the community consists of the excess of the mass of agricultural products (including, of course, metals) over their cost of production. On the amount of this "produit net" depends the well-being of the community, and the possibility of its advance in civilization. The manufacturer merely gives a new form to the materials extracted from the earth; the higher value of the object, after it has passed through his hands, only represents the quantity of provisions and other materials used and consumed in its elaboration. Commerce does nothing more than transfer the wealth already existing from one hand to another; what the trading classes gain thereby is acquired at the cost of the nation, and it is desirable that its amount should be as small as possible. The occupations of the manufacturer and merchant, as well as the liberal professions, and every kind of personal service, are "useful" indeed, but they are "sterile," drawing their income, not from any fund which they themselves create, but from the superfluous earnings of the agriculturist. Perfect freedom of trade not only rests, as we have already seen, on the foundation of natural right, but is also recommended by the consideration that it makes the "produit net," on which all wealth and general progress depend, as large as possible. "Laissez faire, laissez passer" should therefore be the motto of Governments. The revenue of the state, which must be derived altogether from this net product, ought to be raised in the most direct and simplest way,—namely, by a single impost of the nature of a land tax.

The special doctrine relating to the exclusive productiveness of agriculture arose out of a confusion between "value" on the one hand and "matter and energy" on the other. Smith and others have shown that the attempt to fix the character of "sterility" on manufactures and commerce was founded in error. And the proposal of a single *impôt territorial* falls to the ground with the doctrine on which it was based. But such influence as the school exerted depended little, if at all, on these peculiar tenets, which indeed some of its members did not hold. The effective result of its teaching was mainly destructive. It continued in a more systematic form the efforts in favor of the freedom of industry already begun in England and France. The essential historical office of the physiocrats was to discredit radically the methods followed by the European Governments in their dealings with industry. For such criticism as theirs there was, indeed, ample room: the policy of Colbert, which could be only temporarily useful, had been abusively extended and intensified; Governmental action had intruded itself into the minutest details of business, and every process of manufacture and transaction of trade was hampered by legislative restrictions. It was to be expected that the reformers should, in the spirit of the negative philosophy, exaggerate the vices of established systems; and there can be no doubt that they condemned too absolutely the economic action of the state, both in principle and in its historic manifestations, and pushed the "laissez faire" doctrine beyond its just limits. But this was a necessary incident of their connection with the revolutionary movement, of which they really formed one wing. In the course of that movement, the primitive social contract, the sovereignty of the people, and other dogmas now seen to be untenable were habitually invoked in the region of politics proper, and had a transitory utility as ready and effective instruments of warfare. And so also in the economic sphere the doctrines of natural rights of buying and selling, of the sufficiency of enlightened selfishness as a guide in mutual dealings, of the certainty that each member of the society will understand and follow his true interests, and of the coincidence of those interests with the public welfare, though they will not bear a dispassionate examination, were temporarily useful as convenient and serviceable weapons for the overthrow of the established order. The tendency of the school was undoubtedly to consecrate the spirit of individualism, and the state of non-government. But this tendency, which may with justice be severely condemned in economists of the present time, was then excusable because inevitable. And whilst it now impedes the work of reconstruction which is for us the order of the day, it then aided the process of social demolition, which was the necessary, though deplorable, condition of a new organization.

These conclusions as to the revolutionary tendencies of the school are not at all affected by the fact that the form of government preferred by Quesnay and some of his chief followers was what they called a legal despotism, which should embrace within itself both the legislative and the executive function. The reason for this preference was that an enlightened central power could more promptly and efficaciously introduce the policy they advocated than an assembly representing divergent opinions, and fettered by constitutional checks and limitations. Turgot, as we know, used the absolute power of the crown to carry into effect some of his measures for the liberation of industry, though he ultimately failed because unsustained by the requisite force of character in Louis XVI. But what the physiocratic idea with respect to the normal method of government was appears from Quesnay's advice to the dauphin, that when he became king he should "do nothing, but let the laws rule," the laws having been of course first brought into conformity with the *jus naturæ*. The partiality of the school for agriculture was in harmony with the sentiment in favor of "nature" and primitive simplicity which then showed itself in so many forms in France, especially in combination with the revolutionary spirit, and of which Rousseau was the most eloquent exponent. It was also associated in these writers with a just indignation at the wretched state in which the rural laborers of France had been left by the scandalous neglect of the superior orders of society—a state of which the terrible picture drawn by La Bruyère is an indestructible record. The members of the physiocratic group were undoubtedly men of thorough uprightness, and inspired with a sincere desire for the public good, especially for the material and moral elevation of the working classes. Quesnay was physician to Louis XV., and resided in the palace at Versailles; but in the midst of that corrupt court he maintained his integrity, and spoke with manly frankness what he believed to be the truth. And never did any statesman devote himself with greater singleness of purpose or more earnest endeavor to the service of his country than Turgot, who was the principal practical representative of the school.

Quesnay.

The publications in which Quesnay expounded his system were the following—two articles, on "Fermiers" and on "Grains," in the *Encyclopédie* of Diderot and D'Alembert (1756, 1757); a discourse on the law of nature in the *Physiocratie* of Dupont de Nemours (1768); *Maximes générales de gouvernement économiqe d'un royaume agricole* (1758), and the simultaneously published *Tableau Économique avec son explication, ou Extrait des Économies Royales de Sully* (with the celebrated motto "pauvres paysans, pauvre royaume; pauvre royaume, pauvre roi"); *Dialogue sur le commerce et les travaux des artisans;* and other minor pieces. The *Tableau Économique*, though on account of its dryness and abstract form it met with little general favor, may be considered the principal manifesto of the school. It was regarded by the followers of Quesnay as entitled to a place amongst the foremost products of human wisdom, and is named by the elder Mirabeau, in a passage quoted by Adam Smith, as one of the three great inventions which have contributed most to the stability of political societies, the other two being those of writing and of money. Its object was to exhibit by means of certain formulas the way in which the products of agriculture, which is the only source of wealth, would in a state of perfect liberty be distributed among the several classes of the community (namely, the productive classes of the proprietors and cultivators of land, and the unproductive class composed of manufacturers and merchants), and to represent by other formulas the modes of distribution which take place under systems of Governmental restraint and regulation, with the evil results arising to the whole society from different degrees of such violations of the natural order. It follows from Quesnay's theoretic views that the one thing deserving the solicitude of the practical economist and the statesman is the increase of the net product; and he infers also what Smith afterwards affirmed on not quite the same ground, that the interest of the landowner is "strictly and indissolubly connected with the general interest of the society."

Gournay.

Jean V. Gournay, as we have seen, was regarded as one of the founders of the school, and appears to have exercised some influence even upon the formation of Quesnay's own opinions. With the exception of a translation of Sir Josiah Child, Gournay wrote nothing but memoirs addressed to ministers, which have not seen the light; but we have a full statement of his views in the *Éloge* dedicated to his memory by his illustrious friend Turgot. Whilst Quesnay had spent his youth amidst rural scenes, and had been early familiar with the labors of the field, Gournay had been bred as a merchant, and had passed from the counting-house to the office of intendant of commerce. They thus approached the study of political economy from different sides, and this diversity of their antecedents may in part explain the amount of divergence which existed between their views. Gournay softened the rigor of Quesnay's system, and brought it nearer to the truth, by rejecting what Smith calls its "capital error"—the doctrine, namely, of the unproductiveness of manufactures and commerce. He directed his efforts to the assertion and vindication of the principle of industrial liberty, and it was by him that this principle was formulated in the phrase, since so often heard for good and for evil, "Laissez faire, laissez passer."

V. Mirabeau.

One of the earliest and most complete adherents of the physiocratic school, as well as an ardent and unwearied propagator of its doctrines, was Victor Mirabeau, whose sincere and independent, though somewhat perverse and whimsical, character is familiar to English readers through Carlyle's essay on his more celebrated son. He had expressed some physiocratic views earlier than Quesnay, but owned the latter for his spiritual father, and adopted most of his opinions, the principal difference being that he was favorable to the *petite* as opposed to the *grande culture* which latter was preferred by his chief as giving, not indeed the largest gross, but the largest net product. Mirabeau's principal writings were *Ami des Hommes, ou traité sur la population* (1756, 1760), *Theorie de l'impôt* (1760), *Les Économiques* (1769), and *Philosophie rurale, ou Économie générale et politique de l' Agriculture* (1763).

Dupont de Nemours.

The last of these was the earliest complete exposition of the physiocratic system. Another earnest and persevering apostle of the system was Dupont de Nemours (1739-1817), known by his treatises *De l'exportation et de l'importation des grains* (1764), *De l'origine et des progrès d'une science nouvelle* (1767), *Du commerce de la Compagnie des Indes* (1767), and especially by his more comprehensive work *Physiocratie, ou Constitution naturelle du gouvernement le plus avantageux au genre humain* (1768). the title of this work gave, as has been already mentioned, a name to the school.

Larivière.

Another formal exposition of the system, to which Adam Smith refers as "the most distinct and best connected account" of it was produced by Mercier-Larivière, under the title *L'Ordre naturel et essentiel des sociétés politiques* (1767), a title which is interesting as embodying the idea of the *jus naturæ*. Both he and Dupont de Nemours professed to study human communities, not only in relation to their economic, but also to their political and general social aspects; but, notwithstanding these larger pretensions, their views were commonly restricted in the main to the economic sphere; at least material considerations decidedly preponderated in their inquiries, as was naively indicated by Larivière when he said, "Property, security, liberty—these comprise the whole social order; the right of property is a tree of which all the institutions of society are branches."

Turgot.

The most eminent member of the group was without doubt Anne Robert Jacques Turgot (1727-1781). This is not the place to speak of his noble practical activity, first as intendant of Limoges, and afterwards for a brief period as finance minister, or of the circumstances which led to his removal from office, and the consequent failure of his efforts for the salvation of France. His economic views are explained in the introductions to his edicts and ordinances, in letters and occasional papers, but especially in his *Réflexions sur la formation et la distribution des richesses* (1766). This is a condensed but eminently clear and attractive exposition of the fundamental principles of political economy, as they were conceived by the physiocrats. It embodies, indeed, the erroneous no less than the sound doctrines of that school; but several subjects, especially the various forms of land-economy, the different employments of capital, and the legitimacy of interest, are handled in a generally just as well as striking manner; and the mode of presentation of the ideas, and the luminous arrangement of the whole, are Turgot's own. The treatise, which contains a surprising amount of matter in proportion to its length, must always retain a place among the classics of the science.

The physiocratic school never obtained much direct popular influence, even in its native country, though it strongly attracted many of the more gifted and earnest minds. Its members, writing on dry subjects in an austere and often heavy style, did not find acceptance with a public which demanded before all things charm of manner in those who addressed it. When Morellet, one of their number, entered the lists with Galiani, it was seen how *esprit* and eloquence could triumph over science, solid indeed, but clumsy in its movements. The physiocratic tenets, which were in fact partially erroneous, were regarded by many as chimerical, and were ridiculed in the contemporary literature, as, for example, the *impôt unique* by Voltaire in his *L'homme aux quarante écus*, which was directed in particular against Mercier-Larivière. It was justly objected to the group that they were too absolute in their view of things; they supposed, as Smith remarks in speaking of Quesnay, that the body politic could thrive only under one precise régime,—that, namely, which they recommended,—and thought their doctrines universally and immediately applicable in practice. They did not, as theorists, sufficiently take into account national diversities, or different stages in social development; nor did they, as politicians, adequately estimate the impediments which ignorance, prejudice, and interested opposition present to enlightened statesmanship. It is possible that Turgot himself, as Grimm suggests, owed his failure in part to the too unbending rigor of his policy and the absence of any attempt at conciliation. Be this as it may, his defeat helped to impair the credit of his principles, which were represented as having been tried and found wanting.

The physiocratic system, after guiding in some degree the policy of the Constituent Assembly, and awakening a few echoes here and there in foreign countries, soon ceased to exist as a living power; but the good elements it comprised were not lost to mankind, being incorporated into the sounder and more complete construction of Adam Smith.

Italy.—In Italy, as in the other European nations, there was little activity in the economic field during the first half of the 18th century.

Bandini.

It was then, however, that a really remarkable man appeared, the archdeacon Salustio Antonio Bandini (1677-1760), author of the *Discorso sulla Maremma Sienese*, written in 1737, but not published till 1775. The object of the work was to raise the

Maremma from the wretched condition into which it had fallen through the decay of agriculture. This decay he showed to be, at least in part, the result of the wretched fiscal system which was in force; and his book led to important reforms in Tuscany, where his name is held in high honor. Not only by Pecchio and other Italian writers, but by Roscher also, he is alleged to have anticipated some leading doctrines of the physiocrats, but this claim is disputed. There was a remarkable renascence of economic studies in Italy during the latter half of the century, partly due to French influence, and partly, it would appear, to improved government in the northern states.

The movement at first followed the lines of the mercantile school. Thus, in Antonio Broggia's *Trattati dei tributi e delle monete e del governo politico della società* (1743), and Girolamo Belloni's *Dissertazione sopra il commercio* (1750), which seems to have had a success and reputation much above its merits, mercantilist tendencies decidedly preponderate. **Genovesi.** But the most distinguished writer who represented that economic doctrine in Italy in the last century was Antonio Genovesi, a Neapolitan (1712-1769). He felt deeply the depressed intellectual and moral state of his fellow-countrymen, and aspired after a revival of philosophy and reform of education as the first condition of progress and well-being. With the object of protecting him from the theological persecutions which threatened him on account of his advanced opinions, Bartolomeo Intieri, of whom we shall hear again in relation to Galiani, founded in 1755, expressly for Genovesi, a chair of commerce and mechanics, one of the conditions of foundation being that it should never be filled by a monk. This was the first professorship of economics established in Europe; the second was founded at Stockholm in 1758, and the third in Lombardy ten years later, for Beccaria. The fruit of the labors of Genovesi in this chair was his *Lezioni di commercio, ossia di economia civile* (1769), which contained the first systematic treatment of the whole subject which had appeared in Italy. As the model for Italian imitation he held up England, a country for which, says Pecchio, he had a predilection almost amounting to fanaticism. He does not rise above the false economic system which England then pursued; but he rejects some of the grosser errors of the school to which he belonged; he advocates the freedom of the corn trade, and deprecates regulation of the interest on loans. In the spirit of his age, he denounces the relics of mediæval institutions, such as entails and tenures in mortmain, as impediments to the national prosperity. **Galiani.** Ferdinando Galiani was another distinguished disciple of the mercantile school. Before he had completed his twenty-first year he published a work on money (*Della moneta libri cinque*, 1750), the principles of which are supposed to have been dictated by two experienced practical men, the marquis Rinuccini and Bartolomeo Intieri, whose name we have already met. But his reputation was made by a book written in French and published in Paris, where he was secretary of embassy, in 1770, namely, his *Dialogues sur le commerce des blés*. This work, by its light and pleasing style, and the vivacious wit with which it abounded, delighted Voltaire, who spoke of it as a book in the production of which Plato and Molière might have been combined! The author, says Pecchio, treated his arid subject as Fontenelle did the vortices of Descartes, or Algarotti the Newtonian system of the world. The question at issue was that of the freedom of the corn trade, then much agitated, and, in particular, the policy of the royal edict of 1764, which permitted the exportation of grain so long as the price had not arrived at a certain height. The general principle he maintains is that the best system in regard to this trade is to have no system,—countries differently circumstanced requiring, according to him, different modes of treatment. This seems a lame and impotent conclusion from the side of science; yet doubtless the physiocrats, with whom his controversy lay, prescribed on this, as on other subjects, rules too rigid for the safe guidance of statesmen, and Galiani may have rendered a real service by protesting against their absolute solutions of practical problems. He fell, however, into some of the most serious errors of the mercantilists,—holding, as indeed did also Voltaire and even Verri, that one country cannot gain without another losing, and in his earlier treatise going so far as to defend the action of Governments in debasing the currency.

Beccaria. Amongst the Italian economists who were most under the influence of the modern spirit, and in closest harmony with the general movement which was impelling the Western nations towards a new social order, Cesare Beccaria (1738-1794) holds a foremost place. He is best known by his celebrated treatise *Dei delitti e delle pene*, by which Voltaire said he had made himself a benefactor of all Europe, and which, we are told, has been translated into twenty-two languages. The empress Catherine having invited him to fix his residence at St. Petersburg, the Austrian Government of Lombardy, in order to keep him at home, established expressly for him a chair of political economy; and in his *Elementi di economia pubblica* (1769-1771; not published, however, till 1804) are embodied his teachings as professor. The work is unfinished: he had divided the whole subject under the heads of agriculture, manufactures, commerce, taxation, government; but he has treated adequately only the first two heads, and the last two not at all, having been called to take part in the councils of the state. He was in some degree under the influence of physiocratic ideas, and holds that agriculture is the only strictly productive form of industry, whilst manufacturers and artisans are a sterile class. He was strongly opposed to monopolies and privileges, and to corporations in arts and trades; in general he warmly advocated internal industrial freedom, though in regard to foreign commerce a protectionist. In the special case of the corn trade he was not, any more than Galiani, a partisan of absolute liberty. His exposition of economic principles is concise and sententious, and he often states correctly the most important considerations relating to his subject without adding the developments which would be desirable to assist comprehension and strengthen conviction. Thus on "production capital" (*capitali fondatori*), as distinct from "revenue capital," in its application to agriculture, he presents in a condensed form essentially the same explanations as Turgot about the same time gave; and on the division of labor and the circumstances which cause different rates of wages in different employments, he in substance comes near to Smith, but without the fulness of illustration which is so attractive a feature of the *Wealth of Nations*. **Verri.** Pietro Verri (1728-1797), an intimate and life-long friend of Beccaria, was for twenty-five years one of the principal directors of the administration of Lombardy, in which capacity he originated many economic and other reforms. In his *Riflessioni sulle leggi vincolanti, principalmente nel commercio d' grani* (written in 1769, printed in 1796), he considers the question of the regulation of the corn trade both historically and in the light of theoretic principles, and arrives at the conclusion that liberty is the best remedy against famine and against excessive fluctuations of price. He is generally opposed to Governmental interference with internal commerce, as well as to trade corporations, and the attempts to limit prices or fix the rate of interest, but is in favor of the protection of national industry by a judiciously framed tariff. These views are explained in his *Meditazioni sull' economia politica* (1771), an elementary treatise on the science, which was received with favor, and translated into several foreign languages. A primary principle with him is what he calls the augmentation of reproduction—that is, in Smith's language, of "the annual produce of the land and labor" of a nation; and by its tendency to promote or to restrict this augmentation he tests every enactment and institution. Accordingly, unlike Beccaria, he prefers the *petite* to the *grande culture*, as giving a larger total produce. In dealing with taxation, he rejects the physiocratic proposal of a single *impôt territorial*. **Carli.** Giovanni R. Carli (1720-1795), also an official promoter of the reforms in the government of Austrian Lombardy, beside learned and sound treatises on money, was author of *Ragionamenti sopra i bilanci economici delle nazioni*, in which he shows the falsity of the notion that a state gains or loses in foreign commerce according to the so-called balance of trade. In his letter to Pompeo Neri *Sull libero commercio de' grani* (1771), he takes up a position similar to that of Galiani, regarding the question of the freedom of the corn trade as not so much a scientific as an administrative one, to be dealt with differently under different local or other conditions. Rejecting the physiocratic doctrine of the exclusive productiveness of agriculture, he illustrates in an interesting way the necessity of various economic classes in a society, and the reflex agency of manufactures in stimulating the cultivation of the soil. **Vasco.** Giambattista Vasco (1733-1796), wrote discourses on several questions proposed by academies and sovereigns. In these he condemns trade corporations and the attempts by Governments to fix the price of bread and to limit the interest on loans. In advocating the system of a peasant proprietary, he suggests that the law should determine the minimum and maximum portions of land which a citizen should be permitted to possess. He also, with a view to prevent the undue accumulation of property, proposes the abolition of the right of bequest, and the equal division of the inheritance amongst the children of the deceased. **Filangieri.** Gaetano Filangieri (1752–1788), one of the Italian writers of the last century whose names are most widely known throughout Europe, devoted to economic questions the second book of his *Scienza della legislazione* (5 vols., 1780–1785). Filled with reforming ardor and a passionate patriotism, he employed his vehement eloquence in denouncing all the abuses of his time. Apparently without any knowledge of Adam Smith, he insists on unlimited freedom of trade, calls for the abolition of the mediæval institutions which impeded production and national well-being, and condemns the colonial system then followed by England, Spain and Holland. He prophesies, as Raynal and Genovesi had done before him, that all America would one day be independent, a prediction which probably helped to elicit Benjamin Franklin's tribute of admiration for his work. Rather a propagator than a discoverer, he sometimes adopted from others erroneous opinions, as, for example, when he approves the *impôt unique* of the physiocrats. On the whole, however, he represents the most advanced political and social tendencies of his age; whilst strongly contrasted with Beccaria in temperament and style, he was a worthy laborer in the same cause of national and universal progress. **Ricci.** Ludovico Ricci (1742–1799) was author of an able report *Sulla riforma degli istituti pii della città di Modena* (1787). He treated the subject of poor relief and charitable institutions in so general a way that the work possesses a universal and permanent interest. He dwells on the evils of indiscriminate relief as tending to increase the misery it seeks to remove, and as lowering the moral character of a population. He exposes especially the abuses connected with lying-in and foundling hospitals. There is much in him which is akin to the views of Malthus; like him he is opposed to any state provision for the destitute, who ought, he thinks, to be left to voluntary private beneficence. **Paoletti.** Ferdinando Paoletti (1717–1801) was an excellent and public-spirited priest, who did much for the diffusion of intelligence amongst the agricultural population of Tuscany, and for the lightening of the taxes which pressed upon them. He corresponded with Mirabeau ("Friend of Men"), and appears to have accepted the physiocratic doctrines, at least in their general substance. He was author of *Pensieri sopra l'agricoltura* (1769), and of *I veri mezzi di render felice le società* (1772); in the latter he advocates the freedom of the corn trade. **Mengotti.** The tract *Il Colbertismo* (1791) by Count Francesco Mengotti is a vigorous protest against the extreme policy of prohibition and protection, which may still be read with interest. Mengotti also wrote (1791) a treatise *Del commercio de' Romani*, directed mainly against the exaggerations of Huet in his *Histoire du commerce et de la navigation des anciens* (1716), and useful as marking the broad difference between the ancient and modern civilizations.

Ortes. Here lastly may be mentioned another Italian thinker who, eminently original and even eccentric, cannot easily be classed among his contemporaries, though some Continental writers of our own century have exhibited similar modes of thought. This was Giammaria Ortes (1713–1790). He is opposed to the liberalist tendencies of his time, but does not espouse the doctrines of the mercantile system, rejecting the theory of the balance of trade and demanding commercial freedom. It is in the Middle Ages that he finds his social and economic type. He advocates the maintenance of church property, is averse to the ascendency of the money power, and has the mediæval dislike for interest on loans. He entertains the singular idea that the wealth of communities is always and everywhere in a fixed ratio to their population, the latter being determined by the former. Poverty, therefore, necessarily waits on wealth, and the rich, in becoming so, only gain what the poor lose. Those who are interested in the improvement of the condition of the people labor in vain, so long as they direct their efforts to the increase of the sum of the national wealth, which it is beyond their power to alter, instead of to the distribution of that wealth, which it is possible to modify. The true remedy for poverty lies in mitigating the gain-pursuing propensities in the rich and in men of business. Ortes studied in a separate work the subject of population; he formulates its increase as "geometrical," but recognizes that, as a limit is set to such increase amongst the lower animals by mutual destruction, so is it in the human species by "reason"—the "prudential restraint" of which Malthus afterwards made so much. He regards the institution of celibacy as no less necessary and advantageous than that of marriage. He enunciates what has since been known as the "law of diminishing returns to agricultural industry." He was careless as to the diffusion of his writings; and hence they remained almost unknown till they were included in the Custodi collection of Italian economists, when they attracted much attention by the combined sagacity and waywardness which marked their author's intellectual character.

Spain.—The same breath of a new era which was in the air elsewhere in Europe made itself felt also in Spain.

Ustariz. In the earlier part of the 18th century Geronimo Ustariz had written his *Teorica y Practica del Comercio y Marina* (1724; published, 1740; Eng. transl. by John Kippax, 1751; French by Forbonnais, 1753), in which he carries mercantile principles to their utmost extreme.

Campomanes. The reforming spirit of the latter half of the century was best represented in that country by Pedro Rodriguez, Count of Campomanes (1723–1802). He pursued with ardor the same studies and in some degree the same policy as his illustrious contemporary Turgot, without, however, having arrived at so advanced a point of view. He was author of *Respuesta fiscal sobre abolir la tasa y establecer el comercio de granos* (1764), *Discurso sobre el fomento de industria popolar* (1774), and *Discurso sobre la educacion de los artesanos y su fomento* (1775). By means of these writings, justly eulogized by Robertson, as well as by his personal efforts as minister, he sought to establish the freedom of the corn trade, to remove the hindrances to industry arising from mediæval survivals, to give a large development to manufactures, and to liberate agriculture from the odious burdens to which it was subject. He saw that, notwithstanding the enlightened administration of Charles III., Spain still suffered from the evil results of the blind confidence reposed by her people in her gold mines, and enforced the lesson that the real sources of the wealth and power of his country must be sought, not in America, but in her own industry.

In both Italy and Spain, as is well observed by Comte, the impulse towards social change took principally the direction of economic reform, because the pressure exercised by Governments prevented so large a measure of free speculation in the fields of philosophy and general politics as was possible in France. In Italy, it may be added, the traditions of the great industrial past of the northern cities of that country also tended to fix attention chiefly on the economic side of public policy and legislation.

Germany.—We have seen that in Italy and England political economy had its beginnings in the study of practical questions relating chiefly to money or to foreign commerce. In Germany it arose (as Roscher has shown) out of the so-called cameralistic sciences. From the end of the Middle Ages there existed in most German countries a council, known as the Kammer (Lat. *camera*), which was occupied with the management of the public domain and the guardianship of regal rights. The emperor Maximilian found this institution existing in Burgundy, and established, in imitation of it, aulic councils at Innsbruck and Vienna in 1498 and 1501. Not only finance and taxation, but questions also of economic police, came to be intrusted to these bodies. A special preparation became necessary for their members, and chairs of cameralistic science were founded in universities for the teaching of the appropriate body of doctrine. One side of the instruction thus given borrowed its materials from the sciences of external nature, dealing, as it did, with forestry, mining, general technology, and the like; the other related to the conditions of national prosperity as depending on human relations and institutions; and out of the latter German political economy was at first developed.

In no country had mercantilist views a stronger hold than in Germany, though in none, in the period we are now considering, did the system of the balance of trade receive a less extensive practical application. All the leading German economists of the 17th century—Bornitz, Besold, Klock, Becher, Horneck, Seckendorf, and Schröder—stand on the common basis of the mercantile doctrine. And the same may be said of the writers of the first half of the 18th

Justi. Zincke.

century in general, and notably of Justi (d. 1771), who was the author of the first systematic German treatise on political economy, a work which, from its currency as a text book, had much effect on the formation of opinion. Only in Zincke (1692-1769) do we find occasional expressions of a circle of ideas at variance with the dominant system, and pointing in the direction of industrial freedom. But these writers, except from a national point of view, are unimportant, not having exercised any influence on the general movement of European thought.

Karl Friedrich of Baden. Schmalz.

The principles of the physiocratic system met with a certain amount of favor in Germany. Karl Friedrich, margrave of Baden, wrote for the use of his sons an *Abrégé des principes d Économie Politique*, 1772, which is in harmony with the doctrines of that system. It possesses, however, little scientific value. Schlettwein (1731-1802) and Mauvillon (1743-1794) were followers of the same school. Theodor Schmalz (1764-1831), who is commonly named as "the last of the physiocrats," may be here mentioned, though somewhat out of the historic order. He compares Colbertism with the Ptolemaic system, physiocratism with the Copernican. Adam Smith he represents as the Tycho Brahe of political economy,—a man of eminent powers, who could not resist the force of truth in the physiocrats, but partly could not divest himself of rooted prejudices, and partly was ambitious of the fame of a discoverer and a reconciler of divergent systems. Though Smith was now "the fashion," Schmalz could not doubt that Quesnay's doctrine was alone true, and would ere long be triumphant everywhere.

Sonnenfels.

Just before the appearance of Smith, as in England Steuart, and in Italy Genovesi, so in Austria Sonnenfels (1733-1817), the first distinguished economist of that country, sought to present the mercantile system in a modified and more enlightened form; and his work (*Grundsätze der Polizei, Handlung, und Finanz*, 1765; 8th ed., 1822) exercised even during a considerable part of the present century much influence on opinion and on policy in Austria.

Möser.

But the greatest German economist of the 18th century was, in Roscher's opinion, Justus Möser (1720-1794), the author of *Patriotische Phantasieen* 1774), a series of fragments, which, Goethe nevertheless declares, form, "ein wahrhaftes Ganzes." The poet was much influenced by Möser in his youth, and has eulogized in the *Dichtung und Wahrheit* his spirit, intellect, and character, and his thorough insight into all that goes on in the social world. Whilst others occupied themselves with larger and more prominent public affairs and transactions, Möser observed and reproduced the common daily life of his nation, and the thousand "little things" which compose the texture of popular existence. He has been compared to Franklin for the homeliness, verve, and freshness of his writings. In opinions he is akin to the Italian Ortes. He is opposed to the whole spirit of the "Aufklärung," and to the liberal and rationalistic direction of which Smith's work became afterwards the expression. He is not merely conservative but reactionary, manifesting a preference for mediæval institutions such as the trade guilds, and, like Carlyle in our own time, seeing advantages even in serfdom, when compared with the sort of freedom enjoyed by the modern drudge. He has a marked antipathy for the growth of the money power and of manufactures on the large scale, and for the highly developed division of labor. He is opposed to absolute private property in land, and would gladly see revived such a system of restrictions as in the interest of the state, the commune, and the family were imposed on mediæval ownership. In his wayward and caustic style, he often criticizes effectively the doctrinaire narrowness of his contemporaries, throws out many striking ideas, and in particular sheds real light on the economic phenomena and general social conditions of the Middle Ages.

2. *Adam Smith, with his Immediate Predecessors and his Followers.*

Hume.

England.—The stagnation in economic inquiry which showed itself in England in the early part of the 18th century was not broken by any notable manifestation before 1735, when Bishop Berkeley put forward in his *Querist*, with much force and point, views opposed to those of the mercantile school on the nature of national wealth and the functions of money, though not without an admixture of grave error. But soon a more decisive advance was made. Whilst in France the physiocrats were working after their own fashion towards the construction of a definitive system of political economy, a Scottish thinker of the first order was elucidating, in a series of short but pregnant essays, some of the fundamental conceptions of the science. What had been written on these questions in the English language before his time had remained almost altogether within the limits of the directly practical sphere. With Locke, indeed, the general system of the modern critical philosophy had come into relation with economic inquiry, but only in a partial and indeterminate way. But in Hume the most advanced form of this philosophy was represented, and his appearance in the field of economics decisively marks the tendency of the latter order of speculation to place itself in connection with the largest and deepest thought on human nature and general human history. Most of the essays here referred to first appeared in 1752, in a volume entitled *Political Discourses*, and the number was completed in the collection of *Essays and Treatises on Several Subjects*, published in the following year. The most important of them are those on Commerce, on Money, on Interest, and on the Balance of Trade. Yet these should not be separated from the rest, for, notwithstanding the unconnected form of these little treatises, there runs through them a profound unity of thought, so that they indeed compose in a certain sense an economic system. They exhibit in full measure Hume's wonderful acuteness and subtlety, which indeed sometimes dispose him to paradox, in combination with the breadth, the absence of prejudice, and the social sympathies which so eminently distinguish him; and they offer, besides, the charm of his easy and natural style and his rare power of lucid exposition.

In the essay on money he refutes the mercantilist error, which tended to confound it with wealth. "Men and commodities," he says, "are the real strength of any community." "In the national stock of labor consists all real power and riches." Money is only the oil which makes the movements of the mechanism of commerce more smooth and easy. He shows that, from the domestic as distinguished from the international point of view, the absolute quantity of money, supposed as of fixed amount, in a country is of no consequence, whilst an excessive quantity, larger, that is, than is required for the interchange of commodities, may be injurious as raising prices and driving foreigners from the home markets. He goes so far, in one or two places, as to assert that the value of money is chiefly fictitious or conventional, a position which cannot be defended; but it must not be pressed against him, as he builds nothing on it. He has some very ingenious observations (since, however, questioned by J. S. Mill) on the effects of the increase of money in a country in stimulating industry during the interval which takes place before the additional amount is sufficiently diffused to alter the whole scale of prices. He shows that the fear of the money of an industrious community being lost to it by passing into foreign countries is groundless, and that, under a system of freedom, the distribution of the precious metals which is adapted to the requirements of trade will spontaneously establish itself. "In short, a Government has great reason to preserve with care its people and its manufactures; its money it may safely trust to the course of human affairs without fear or jealousy."

A very important service was rendered by his treatment of the rate of interest. He exposes the erroneous idea often entertained that it depends on the quantity of money in a country, and shows that the reduction of it must in general be the result of "the increase of industry and frugality, of arts and commerce," so that it may serve as a barometer, its lowness being an almost infallible sign of the flourishing condition of a people. It may be observed in passing that in the essay devoted to this subject he brings out a principle of human nature which economists too often overlook, "the constant and insatiable desire of the mind for exercise and employment," and the consequent action of *ennui* in prompting to exertion.

With respect to commerce, he points to its natural foundation in what has since been called "the territorial division of labor," and proves that the prosperity of one nation, instead of being a hindrance, is a help to that of its neighbors. "Not only as a man, but as a British subject," he says, "I pray for the flourishing commerce of Germany, Spain, Italy, and even France itself." He condemns the "numberless bars, obstructions, and imposts which all nations of Europe, and none more than England, have put upon trade." Yet on the question of protection to national industry he is not quite at the free-trade point of view, for he approves of a tax on German linen as encouraging home manufactures, and of a tax on brandy as increasing the sale of rum and supporting our southern colonies. Indeed it has been justly observed that there are in him several traces of a refined mercantilism, and that he represents a state of opinion in which the transition from the old to the new views is not yet completely effected.

We cannot do more than refer to the essay on taxes, in which, amongst other things, he repudiates the *impôt unique* of the physiocrats, and to that on public credit, in which he criticises the "new paradox that public incumbrances are of themselves advantageous, independent of the necessity of contracting them," and objects, perhaps too absolutely, to the modern expedient of raising the money required for national enterprises by way of loan, and so shifting our burdens upon the shoulders of posterity.

The characteristics of Hume which are most important in the history of economic investigation are (1) his practice of bringing economic facts into connection with all the weighty interests of social and political life, and (2) his tendency to introduce the historical spirit into the study of those facts. He admirably illustrates the mutual action of the several branches of industry, and the influences of progress in the arts of production and in commerce on general civilization, exhibits the striking contrasts of the ancient and modern system of life (see especially the essay *On the Populousness of Ancient Nations*), and considers almost every phenomenon which comes under discussion in its relations to the contemporary stage of social development. It cannot be doubted that Hume exercised a most important influence on Adam Smith, who in the *Wealth of Nations* calls him "by far the most illustrious philosopher and historian of the present age," and who esteemed his character so highly that, after a friendship of many years had been terminated by Hume's decease, he declared him to have "approached as nearly to the idea of a perfectly wise and virtuous man as perhaps the nature of human frailty will permit."

Tucker.

Josiah Tucker, dean of Gloucester (d. 1799), holds a distinguished place among the immediate predecessors of Smith. Most of his numerous productions had direct reference to contemporary questions, and, though marked by much sagacity and penetration are deficient in permanent interest. In some of these he urged the impolicy of restrictions on the trade of Ireland, advocated a union of that country with England, and recommended the recognition of the independence of the United States of America. The most important of his general economic views are those relating to international commerce. He is an ardent supporter of free-trade doctrines, which he bases on the principle that there is between nations no necessary antagonism, but rather a harmony, of interests, and that their several natural advantages and different aptitudes naturally prompt them to exchange. He had not, however, got quite clear of mercantilism, and favored bounties on exported manufactures and the encouragement of population by a tax on celibacy. Dupont, and after him Blanqui, represent Tucker as a follower of the physiocrats, but there seems to be no ground for this opinion except his agreement with them on the subject of the freedom of trade. Turgot translated into French his *Important Questions on Commerce* (1755).

Steuart.

In 1767 was published Sir James Steuart's *Inquiry into the Principles of Political Economy*. This was one of the most unfortunate of books. It was the most complete and systematic survey of the science from the point of view of moderate mercantilism which had appeared in England. Steuart was a man of no ordinary abilities, and had prepared himself for his task by long and serious study. But the time for the mercantile doctrines was past, and the system of natural liberty was in possession of an intellectual ascendency which foreshadowed its political triumph. Nine years later the *Wealth of Nations* was given to the world, a work as superior to Steuart's in attractiveness of style as in scientific soundness. Thus the latter was predestined to fail, and in fact never exercised any considerable theoretic or practical influence. Smith never quotes or mentions it; being acquainted with Steuart, whose conversation he said was better than his book, he probably wished to keep clear of controversy with him. The German economists have examined Steuart's treatise more carefully than English writers have commonly done; and they recognize its high merits, especially in relation to the theory of value and the subject of population. They have also pointed out that, in the spirit of the best recent research, he has dwelt on the special characters which distinguish the economies proper to different nations and different grades in social progress.

Adam Smith.

Coming now to the great name of Adam Smith (1723–1790), it is of the highest importance that we should rightly understand his position and justly estimate his claims. It is plainly contrary to fact to represent him, as some have done, as the creator of political economy. The subject of social wealth had always in some degree, and increasingly in recent times, engaged the attention of philosophic minds. The study had even indisputably assumed a systematic character, and, from being an assemblage of fragmentary disquisitions on particular questions of national interest, had taken the form, notably in Turgot's *Réflexions*, of an organized body of doctrine. The truth is that Smith took up the science when it was already considerably advanced; and it was this very circumstance which enabled him, by the production of a classical treatise, to render most of his predecessors obsolete. But, whilst all the economic labors of the preceding centuries prepared the way for him, they did not anticipate his work. His appearance at an earlier stage, or without those previous labors, would be inconceivable; but he built on the foundation which had been laid by others much of his own that was precious and enduring.

Even those who do not fall into the error of making Smith the creator of the science, often separate him too broadly from Quesnay and his followers, and represent the history of modern economics as consisting of the successive rise and reign of three doctrines—the mercantile, the physiocratic, and the Smithian. The last two are, it is true, at variance in some even important respects. But it is evident, and Smith himself felt, that their agreements were much more fundamental than their differences; and, if we regard them as historical forces, they must be considered as working towards identical ends. They both urged society towards the abolition of the previously prevailing industrial policy of European Governments; and their arguments against that policy rested essentially on the same grounds. Whilst Smith's criticism was more searching and complete, he also analyzed more correctly than the physiocrats some classes of economic phenomena,—in particular dispelling the illusions into which they had fallen with respect to the unproductive nature of manufactures and commerce. Their school disappeared from the scientific field, not merely because it met with a political check in the person of Turgot, but because, as we have already said, the *Wealth of Nations* absorbed into itself all that was valuable in their teaching, whilst it continued more effectually the impulse they had given to the necessary work of demolition.

The history of economic opinion in modern times, down to the third decade of our own century, is, in fact, strictly bipartite. The first stage is filled with the mercantile system, which, as we have shown, was rather a practical policy than a speculative doctrine, and which came into existence as the spontaneous growth of social conditions acting on minds not trained to scientific habits. The second stage is occupied with the gradual rise and ultimate ascendency of another system founded on the idea of the right of the individual to an unimpeded sphere for the exercise of his economic activity. With the latter, which is best designated as the "system of natural liberty," we ought to associate the memory of the physiocrats as well as that of Smith, without, however, maintaining their services to have been equal to his.

The teaching of political economy was in the Scottish miversities associated with that of moral philosophy. Smith, as we are told, conceived the entire subject he rad to treat in his public lectures as divisible into four eads, the first of which was natural theology, the econd ethics, the third jurisprudence; whilst in the ourth "he examined those political regulations which re founded upon expediency, and which are calculated o increase the riches, the power, and the prosperity f a state." The last two branches of inquiry are egarded as forming but a single body of doctrine in he well-known passage of the *Theory of Moral Sentiments* in which the author promises to give in another iscourse "an account of the general principles of law nd government, and of the different revolutions they ave undergone in the different ages and periods of ociety, not only in what concerns justice, but in what oncerns police, revenue, and arms, and whatever else the subject of law." This shows how little it was mith's habit to separate (except provisionally), in his onceptions or his researches, the economic phenomena f society from all the rest. The words above quoted ave, indeed, been not unjustly described as containing 'an anticipation, wonderful for his period, of general ociology, both statical and dynamical, an anticipation hich becomes still more remarkable when we learn rom his literary executors that he had formed the lan of a connected history of the liberal sciences and legant arts, which must have added to the branches f social study already enumerated a view of the intellectual progress of society." Though these large designs were never carried out in their integrity, as ndeed at that period they could not have been adeuately realized, it has resulted from them that, hough economic phenomena form the special subect of the *Wealth of Nations*, Smith yet incorporated nto that work much that relates to the other social spects, incurring thereby the censure of some of his ollowers, who insist with pedantic narrowness on the trict isolation of the economic domain.

There has been much discussion on the question—Vhat is the scientific method followed by Smith in his reat work? By some it is considered to have been urely deductive, a view which Buckle has perhaps arried to the greatest extreme. He asserts that in Scotland the inductive method was unknown, that the nductive philosophy exercised no influence on Scottish thinkers; and, though Smith spent some of the nost important years of his youth in England, where he inductive method was supreme, and though he was widely read in general philosophical literature, he yet thinks he adopted the deductive method because t was habitually followed in Scotland,—and this hough Buckle maintains that it is the only appropriate, or even possible, method in political economy, which surely would have been a sufficient reason for choosing it. That the inductive spirit exercised no influence on Scottish philosophers is certainly not true; s will be presently shown, Montesquieu, whose method s essentially inductive, was in Smith's time studied with quite peculiar care and regarded with special veneration by Smith's fellow-countrymen. As to Smith himself, what may justly be said of him is that the deductive bent was certainly not the predominant character of his mind, nor did his great excellence lie in the "dialectic skill" which Buckle ascribes to him. What strikes us most in his book is his wide and keen observation of social facts, and his perpetual tendency to dwell on these and elicit their significance, instead of drawing conclusions from abstract principles by elaborate chains of reasoning. It is this habit of his mind which gives us, in reading him, so strong and abiding a sense of being in contact with the realities of life.

That Smith does, however, largely employ the deductive method is certain; and that method is quite legitimate when the premises from which the deduction sets out are known universal facts of human nature and properties of external objects. Whether this mode of proceeding will carry us far may indeed well be doubted; but its soundness cannot be disputed. But there is another vicious species of deduction which, as Cliffe Leslie has shown, seriously tainted the philosophy of Smith,—in which the premises are not facts ascertained by observation, but the same *a priori* assumptions, half theological half metaphysical, respecting a supposed harmonious and beneficent natural order of things which we found in the physiocrats, and which, as we saw, were embodied in the name of that sect. In his view Nature has made provision for social well-being by the principle of the human constitution which prompts every man to better his condition: the individual aims only at his private gain, but in doing so is "led by an invisible hand" to promote the public good, which was no part of his intention; human institutions, by interfering with the action of this principle in the name of the public interest, defeat their own end; but when all systems of preference or restraint are taken away, "the obvious and simple system of natural liberty establishes itself of its own accord." This theory is, of course, not explicitly presented by Smith as a foundation of his economic doctrines, but it is really the secret substratum on which they rest. Yet, whilst such latent postulates warped his view of things, they did not entirely determine his method, His native bent towards the study of things as they are preserved him from extravagances into which many of his followers have fallen. But besides this, as Leslie has pointed out, the influence of Montesquieu tended to counterbalance the theoretic prepossessions produced by the doctrine of the *jus naturæ*. That great thinker, though he could not, at his period, understand the historical method which is truly appropriate to sociological inquiry, yet founded his conclusions on induction. It is true, as Comte has remarked, that his accumulation of facts, borrowed from the most different states of civilization, and not subjected to philosophic criticism, necessarily remained on the whole sterile, or at least could not essentially advance the study of society much beyond the point at which he found it. His merit, as we have before mentioned, lay in the recognition of the subjection of all social phenomena to natural laws, not in the discovery of those laws. But this limitation was overlooked by the philosophers of the time of Smith, who were much attracted by the system he followed of tracing social facts to the special circumstances, physical or moral, of the communities in which they were observed. Leslie has shown that Lord Kaimes, Dalrymple, and Millar—contemporaries of Smith, and the last his pupil—were influenced by Montesquieu; and he might have added the more eminent name of Ferguson, whose respect and admiration for the great Frenchman are expressed in striking terms in his *History of Civil Society*. We are even informed that Smith himself in his later years was occupied in preparing a commentary on the *Esprit des Lois*. He was thus affected by two different and incongruous systems of thought,—one setting out from an imaginary code of nature intended for the benefit of man, and leading to an optimistic view of the economic constitution founded on enlightened self-interest; the other following inductive processes, and seeking to explain the several states in which human societies are found existing, as results of circumstances or institutions which have been in actual operation. And we find accordingly in his great work a combination of these two modes of treatment—inductive inquiry on the one hand, and, on the other, *a priori* speculation founded on the "Nature" hypothesis. The latter vicious proceeding has in some of his followers been greatly aggravated, while the countervailing spirit of inductive investigation has fallen into the background, and indeed the necessity or utility of any such investigation in the economic field has been sometimes altogether denied.

Some have represented Smith's work as of so loose a texture and so defective in arrangement that it may be justly described as consisting of a series of monographs. But this is certainly an exaggeration. The book, it is true, is not framed on a rigid mould, nor is there any parade of systematic divisions and subdivisions; and this doubtless recommended it to men of the world and of business, for whose instruction it was, at least primarily, intended. But, as a body of exposition, it has the real and pervading unity which results from a mode of thinking homogeneous throughout and the general absence of such contradictions as would arise from an imperfect digestion of the subject.

Smith sets out from the thought that the annual labor of a nation is the source from which it derives its supply of the necessaries and conveniences of life. He does not of course contemplate labor as the only factor in production; but it has been supposed that by emphasizing it at the outset he at once strikes the note of difference between himself on the one hand and both the mercantilists and the physiocrats on the other. The improvement in the productiveness of labor depends largely on its division; and he proceeds accordingly to give his unrivalled exposition of that principle, of the grounds on which it rests, and of its greater applicability to manufactures than to agriculture, in consequence of which the latter relatively lags behind in the course of economic development. The origin of the division of labor he finds in the propensity of human nature "to truck, barter, or exchange one thing for another." He shows that a certain accumulation of capital is a condition precedent of this division, and that the degree to which it can be carried is dependent on the extent of the market. When the division of labor has been established, each member of the society must have recourse to the others for the supply of most of his wants; a medium of exchange is thus found to be necessary, and money comes into use. The exchange of goods against each other or against money gives rise to the notion of value. This word has two meanings—that of utility, and that of purchasing power; the one may be called value in use, the other value in exchange. Merely mentioning the former, Smith goes on to study the latter. What, he asks, is the measure of value? what regulates the amount of one thing which will be given for another? "Labor," Smith answers, "is the real measure of the exchangeable value of all commodities." "Equal quantities of labor, at all times and places, are of equal value to the laborer." "Labor alone, therefore, never varying in its own value, is alone the ultimate and real standard by which the value of all commodities can at all times and places be estimated and compared. It is their real price; money is their nominal price only." Money, however, is in men's actual transactions the measure of value, as well as the vehicle of exchange; and the precious metals are best suited for this function, as varying little in their own value for periods of moderate length; for distant times, corn is a better standard of comparison. In relation to the earliest social stage, we need consider nothing but the amount of labor employed in the production of an article as determining its exchange value; but in more advanced periods price is complex, and consists in the most general case of three elements—wages, profit, and rent. Wages are the reward of labor. Profit arises as soon as stock, being accumulated in the hands of one person, is employed by him in setting others to work, and supplying them with materials and subsistence, in order to make a gain by what they produce. Rent arises as soon as the land of a country has all become private property; "the landlords, like all other men, love to reap where they never sowed, and demand a rent even for its natural produce." In every improved society, then, these three elements enter more or less into the price of the far greater part of commodities. There is in every society or neighborhood an ordinary or average rate of wages and profit in every different employment of labor and stock regulated by principles to be explained hereafter, as also an ordinary or average rate of rent. These may be called the natural rates at the time when and the place where they prevail; and the natural price of a commodity is what is sufficient to pay for the rent of the land, the wages of the labor, and the profit of the stock necessary for bringing the commodity to market. The market price may rise above or fall below the amount so fixed, being determined by the proportion between the quantity brought to market and the demand of those who are willing to pay the natural price. Towards the natural price as a centre the market-price, regulated by competition, constantly gravitates. Some commodities, however, are subject to a monopoly of production, whether from the peculiarities of a locality or from legal privilege: their price is always the highest that can be got; the natural price of other commodities is the lowest which can be taken for any length of time together. The three component parts or factors of price vary with the circumstances of the society. The rate of wages is determined by a "dispute" or struggle of opposite interests between the employer and the workman. A minimum rate is fixed by the condition that they must be at least sufficient to enable a man and his wife to maintain themselves and, in general, bring up a family. The excess above this will depend on the circumstances of the country, and the consequent demand for labor,—wages being high when national wealth is increasing, low when it is declining. The same circumstances determine the variation of profits, but in an opposite direction; the increase of stock, which raises wages, tending to lower profit through the mutual competition of capitalists. "The whole of the advantages and disadvantages of the different employments of labor and stock must, in the same neighborhood, be either perfectly equal or continually tending to equality;" if one had greatly the advantage over the others, people would crowd into it, and the level would soon be restored. Yet pecuniary wages and profits are very different in different employments,—either from certain circumstances affecting the employments, which recommend or disparage them in men's notions, or from national policy, "which nowhere leaves things at perfect liberty." Here follows Smith's admirable exposition of the causes which produce the inequalities in wages and profits just referred to, a passage affording ample evidence of his habits of nice observation of the less obvious traits in human nature, and also of the operation both of these and of social institutions on economic facts. The rent of land comes next to be considered, as the last of the three elements of price. Rent is a monopoly price, equal, not to what the landlord could afford to take, but to what the farmer can afford to give. "Such parts only of the produce of land can commonly be brought to market, of which the ordinary price is sufficient to replace the stock which must be employed in bringing them thither, together with the ordinary profits. If the ordinary price is more than this, the surplus part will naturally go to the rent of the land. If it is not more, though the commodity may be brought to market, it can afford no rent to the landlord. Whether the price is or is not more depends on the demand." "Rent, therefore, enters into the price of commodities in a different way from wages and profits. High or low wages and profit are the causes of high or low price; high or low rent is the effect of it."

Rent, wages, and profits, as they are the elements of price, are also the constituents of income; and the three great orders of every civilized society, from whose revenues that of every order is ultimately derived, are the landlords, the laborers, and the capitalists. The relation of the interests of these three classes to those of society at large is different. The interest of the landlord always coincides with the general interest; whatever promotes or obstructs the one has the same effect on the other. So also does that of the laborer: when the wealth of the nation is progressive, his wages are high; they are low when it is stationary or retrogressive. "The interest of the third order has not the same connection with the general interest of the society as that of the other two; . . . it is always in some respects different from and opposite to that of the public."

The subject of the second book is "the nature, accumulation, and improvement of stock." A man's whole stock consists of two portions—that which is reserved for his immediate consumption, and that which is employed so as to yield a revenue to its owner. This latter, which is his "capital," is divisible into the two classes of "fixed" and "circulating." The first is such as yields a profit without passing into other hands. The second consists of such goods, raised, manufactured, or purchased, as are sold for a profit and replaced by other goods; this sort of capital is therefore constantly going from and returning to the hands of its owner. The whole capital of a society falls under the same two heads. Its fixed capital consists chiefly of (1) machines, (2) buildings which are the means of procuring a revenue, (3) agricultural improvements, and (4) the acquired and useful abilities of all members of the society (since sometimes known as "personal capital"). Its circulating capital is also composed of four parts—(1) money, (2) provisions in the hands of the dealers, (3) materials, and (4) completed work in the hands of the manufacturer or merchant. Next comes the distinction of the gross national revenue from the net,—the first being the whole produce of the land and labor of a country, the second what remains after deducting the expense of maintaining the fixed capital of the country and that part of its circulating capital which consists of money. Money, "the great wheel of circulation," is altogether different from the goods which are circulated by means of it; it is a costly instrument by means of which all that each individual receives is distributed to him; and the expenditure required, first to provide it, and afterwards to maintain it, is a deduction from the net revenue of the society. In development of this consideration, Smith goes on to explain the gain to the community arising from the substitution of paper money for that composed of the precious metals; and here occurs the remarkable illustration in which the use of gold and silver money is compared to a highway on the ground, that of paper money to a wagon way through the air. In proceeding to consider the accumulation of capital, he is led to the distinction between productive and unproductive labor,—the former being that which is fixed or realized in a particular object or vendible article, the latter that which is not so realized. The former is exemplified in the labor of the manufacturing workman, the latter in that of the menial servant. A broad line of demarcation is thus drawn between the labor which results in commodities or increased value of commodities, and that which does no more than render services: the former is productive, the latter unproductive. "Productive" is by no means equivalent to "useful": the labors of the magistrate, the soldier, the churchman, lawyer, and physician, are, in Smith's sense, unproductive. Productive laborers are alone employed out of capital; unproductive laborers, as well as those who do not labor at all, are all maintained by revenue. In advancing industrial communities, the portion of annual produce set apart as capital, bears an increasing proportion to that which is immediately destined to constitute a revenue, either as rent or as profit. Parsimony is the source of the increase of capital; by augmenting the fund devoted to the maintenance of productive hands, it puts in motion an additional quantity of industry, which adds to the value of the annual produce. What is annually saved is as regularly consumed as what is spent, but by a different set of persons, by productive laborers instead of idlers or unproductive laborers; and the former reproduce with a profit the value of their consumption. The prodigal, encroaching on his capital, diminishes, as far as in him lies, the amount of productive labor, and so the wealth of the country; nor is this result affected by his expenditure being on home-made, as distinct from foreign, commodities. Every prodigal, therefore, is a public enemy; every frugal man a public benefactor. The only mode of increasing the annual produce of the land and labor is to increase either the number of productive laborers or the productive powers of those laborers. Either process will in general require additional capital, the former to maintain the new laborers, the latter to provide improved machinery to enable the employer to introduce a more complete division of labor. In what are commonly called loans of money, it is not really the money, but the money's worth, that the borrower wants; and the lender really assigns to him the right to a certain portion of the annual produce of the land and labor of the country. As the general capital of a country increases, so also does the particular portion of it from which the possessors wish to derive a revenue without being at the trouble of employing it themselves; and, as the quantity of stock thus available for loans is augmented, the interest diminishes, not merely "from the general causes which make the market price of things commonly diminish as their quantity increases," but because with the increase of capital, "it becomes gradually more and more difficult to find within the country a profitable method of employing any new capital,"—whence arises a competition between different capitals, and a lowering of profits, which must diminish the price which can be paid for the use of capital, or in other words the rate of interest. It was formerly wrongly supposed, and even Locke and Montesquieu did not escape this error, that the fall in the value of the precious metals consequent on the discovery of the American mines was the real cause of the general lowering of the rate of interest in Europe. But this view, already refuted by Hume, is easily seen to be erroneous. "In some countries the interest of money has been prohibited by law. But, as something can everywhere be made by the use of money, something ought everywhere to be paid for the use of it," and will in fact be paid for it; and the prohibition will only heighten the evil of usury by increasing the risk to the lender. The legal rate should be a very little above the lowest market rate; sober people will then be preferred as borrowers to prodigals and projectors, who at a higher legal rate would have an advantage over them, being alone willing to offer that higher rate.

As to the different employments of capital, the quantity of productive labor put in motion by an equal amount varies extremely according as that amount is employed—(1) in the improvement of lands, mines, or fisheries, (2) in manufactures, (3) in wholesale or (4) retail trade. In agriculture "Nature labors along with man," and not only the capital of the farmer is reproduced with his profits, but also the rent of the landlord. It is therefore the employment of a given capital which is most advantageous to society. Next in order come manufacturers; then wholesale trade—first the home trade, secondly the foreign trade of consumption, last the carrying trade. All these employments of capital, however, are not only advantageous, but necessary, and will introduce themselves in the due degree, if they are left to the spontaneous action of individual enterprise.

These first two books contain Smith's general economic scheme; and we have stated it as fully as was consistent with the brevity here necessary, because from this formulation of doctrine the English classical school set out, and round it the discussions of more recent times in different countries have in a great measure revolved. Some of the criticisms of his successors and their modifications of his doctrines will come under our notice as we proceed.

The critical philosophers of the 18th century were often destitute of the historical spirit, which was no part of the endowment needed for their principal social office. But some of the most eminent of them, especially in Scotland, showed a marked capacity and predilection for historical studies. Smith was amongst the latter; Knies and others justly remark on the masterly sketches of this kind which occur in the *Wealth of Nations*. The longest and most elaborate of these occupies the third book; it is an account of the course followed by the nations of modern Europe in the successive development of the several forms of industry. It affords a curious example of the effect of doctrinal prepossessions in obscuring the results of historical inquiry. Whilst he correctly describes the European movement of industry, and explains it as arising out of adequate social causes, he yet, in accordance with the absolute principles which tainted his philosophy, protests against it as involving an entire inversion of the "natural order of things." First agriculture, then manufactures, lastly foreign commerce; any other order than this he considers "unnatural and retrograde." Hume, a more purely positive thinker, simply sees the facts, accepts them, and classes them under a general law. "It is a violent method," he says, "and in most cases impracticable, to oblige the laborer to toil in order to raise from the land more than what subsists himself and family. Furnish him with manufactures and commodities, and he will do it of himself." "If we consult history, we shall find that, in most nations, foreign trade has preceded any refinement in home manufactures, and given birth to domestic luxury."

The fourth book is principally devoted to the elaborate and exhaustive polemic against the mercantile system which finally drove it from the field of science, and has exercised a powerful influence on economic legislation. When protection is now advocated, it is commonly on different grounds from those which were in current use before the time of Smith. He believed that to look for the restoration of freedom of foreign trade in Great Britain would have been "as absurd as to expect that an Oceana or Utopia should be established in it;" yet, mainly in consequence of his labors, that object has been completely attained; and it has lately been said with justice that free trade might have been more generally accepted by other nations if the patient reasoning of Smith had not been replaced by dogmatism. His teaching on the subject is not altogether unqualified; but, on the whole, with respect to exchanges of every kind, where economic motives alone enter, his voice is in favor of freedom. He has regard, however, to political as well as economic interests, and on the ground that "defence is of much more importance than opulence," pronounces the Navigation Act to have been "perhaps the wisest of all the commercial regulations of England." Whilst objecting to the prevention of the export of wool, he proposes a tax on that export as somewhat less injurious to the interest of growers than the prohibition, whilst it would "afford a sufficient advantage" to the domestic over the foreign manufacturer. This is, perhaps, his most marked deviation from the rigor of principle; it was doubtless a concession to popular opinion with a view to an attainable practical improvement. The wisdom of retaliation in order to procure the repeal of high duties or prohibitions imposed by foreign Governments depends, he says, altogether on the likelihood of its success in effecting the object aimed at, but he does not conceal his contempt for the practice of such expedients. The restoration of freedom in any manufacture, when it has grown to considerable dimensions by means of high duties, should, he thinks, from motives of humanity, be brought about only by degrees and with circumspection,—though the amount of evil which would be caused by the immediate abolition of the duties is, in his opinion, commonly exaggerated. The case in which J. S. Mill justified protection—that, namely, in which an industry well-adapted to a country is kept down by the acquired ascendency of foreign producers—is referred to by Smith; but he is opposed to the admission of this exception for reasons which do not appear to be conclusive. He is perhaps scarcely consistent in approving the concession of temporary monopolies to joint-stock companies undertaking risky enterprises "of which the public is afterwards to reap the benefit."[1]

He is less absolute in his doctrine of Governmental non-interference when he comes to consider in his fifth book the "expenses of the sovereign or the commonwealth." He recognizes as coming within the functions of the state the erection and maintenance of those public institutions and public works which, though advantageous to the society, could not repay, and therefore must not be thrown upon individuals or small groups of individuals. He remarks in a just historical spirit that the performance of these functions requires very different degrees of expense in the different periods of society. Besides the institutions and works intended for public defence and the administration of justice, and those required for facilitating the commerce of the society, he considers those necessary for promoting the instruction of the people. He thinks the public at large may with propriety not only facilitate and encourage, but even impose upon almost the whole body of the people, the acquisition in youth of the most essential elements of education. He suggests as the mode of enforcing this obligation the requirement of submission to a test examination "before any one could obtain the freedom in any corporation, or be allowed to set up a trade in any village or town corporate." Similarly, he is of opinion that some probation, even in the higher and more difficult sciences, might be enforced as a condition of exercising any liberal profession, or becoming a candidate for any honorable office. The expense of the institutions for religious instruction as well as for general education, he holds, may without injustice be defrayed out of the funds of the whole society, though he would apparently prefer that it should be met by the voluntary contributions of those who think they have occasion for such education or instruction. There is much that is sound, as well as interesting and suggestive, in this fifth book, in which he shows a political instinct and a breadth of view by which he is favorably contrasted with the Manchester school. But, if we may say so without disrespect to so great a man, there are traces in it of what is now called Philistinism—a low view of the ends of art and poetry—which arose perhaps in part from personal defect, though it was common enough in even the higher minds in his century. There are also indications of a certain deadness to the lofty aims and perennial importance of religion, which was no doubt chiefly due to the influences of an age when the critical spirit was doing an indispensable work, in the performance of which the
transitory was apt to be confounded with the p
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For the sake of considering as a whole S
view of the functions of government, we have
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other members of their group during his sojo
France in 1765, and would, as he told Dugald St
had the patriarch of the school lived long e
have dedicated to him the *Wealth of Nation*
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nothing, man does all; and his distinction b
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which seems to be inconsistent with his recogn
what is now called "personal capital." To th
source M'Culloch and others refer the ori
Smith's view, which they represent as an
error, that "individual advantage is not alway
test of the public advantageousness of differ
ployments." But that view is really quite cor
Professor Nicholson has recently made plain.
the form taken by the use of capital, profit
given, is not indifferent to the working class as
even Ricardo admitted; and Cairnes, as we sh
built on this consideration some of the most fa
ing conclusions in his *Leading Principles*.

On Smith's theory of taxation in his fifth b
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wrong in principle.

We shall not be held to anticipate unduly if
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cently prompted the suggestion that we ought
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line of the economical succession. But notwit
ing his indisputable superiority, and whils
recognizing the great services rendered by his
tal work, we must not forget that, as has been
said, that work was, on the whole, a product,
an exceptionally eminent one, of the negative

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[1] Professor Bastable calls our attention to the interesting fact that the proposal of an export duty on wool and the justification of a temporary monopoly to joint-stock companies both appear for the first time in the edition of 1784.

phy of the last century, resting largely in its ultimate foundation on metaphysical bases. The mind of Smith was mainly occupied with the work of criticism so urgent in his time; his principal task was to discredit and overthrow the economic system then prevalent, and to demonstrate the radical unfitness of the existing European Governments to direct the industrial movement. This office of his fell in with, and formed a part of, the general work of demolition carried on by the thinkers who gave to the 18th century its characteristic tone. It is to his honor that, besides this destructive operation, he contributed valuable elements to the preparation of an organic system of thought and of life. In his special domain he has not merely extinguished many errors and prejudices, and cleared the ground for truth, but has left us a permanent possession in the judicious analyses of economic facts and ideas, the wise practical suggestions, and the luminous indications of all kinds, with which his work abounds. Belonging to the best philosophical school of his period, that with which the names of Hume and Diderot are associated, he tended strongly towards the positive point of view. But it was not possible for him to attain it; and the final and fully normal treatment of the economic life of societies must be constituted on other and more lasting foundations than those which underlie his imposing construction.

It has been well said that of philosophic doctrines the saying "by their fruit ye shall know them" is eminently true. And it cannot be doubted that the germs of the vicious methods and false or exaggerated theories of Smith's successors are to be found in his own work, though his good sense and practical bent prevented his following out his principles to their extreme consequences. The objections of Hildebrand and others to the entire historical development of doctrine which the Germans designate as "Smithianismus" are regarded by those critics as applicable, not merely to his school as a whole, but, though in a less degree, to himself. The following are the most important of these objections. It is said—(1) Smith's conception of the social economy is essentially individualistic. In this he falls in with the general character of the negative philosophy of his age. That philosophy, in its most typical forms, even denied the natural existence of the disinterested affections, and explained the altruistic feelings as secondary results of self-love. Smith, however, like Hume, rejected these extreme views; and hence it has been held that in the *Wealth of Nations* he consciously, though tacitly, abstracted from the benevolent principles in human nature, and as a logical artifice supposed an "economic man" actuated by purely selfish motives. However this may be, he certainly places himself habitually at the point of view of the individual, whom he treats as a purely egoistic force, working uniformly in the direction of private gain, without regard to the good of others or of the community at large. (2) He justifies this personal attitude by its consequences, presenting the optimistic view that the good of the community is best attained through the free play of individual cupidities, provided only the law prevents the interference of one member of the society with the self-seeking action of another. He assumes with the negative school generally—though he has passages which are not in harmony with these propositions—that every one knows his true interest and will pursue it, and that the economic advantage of the individual coincides with that of the society. To this last conclusion he is secretly led, as we have seen, by *a priori* theological ideas, and also by metaphysical conceptions of a supposed system of nature, natural right, and natural liberty. (3) By this reduction of every question to one of individual gain, he is led to a too exclusive consideration of exchange value as distinct from wealth in the proper sense. This, whilst lending a mechanical facility in arriving at conclusions, gives a superficial character to economic investigation, divorcing it from the physical and biological sciences, excluding the question of real social utility, leaving no room for a criticism of production, and leading to a denial, like J. S. Mill's, of any economic doctrine dealing with consumption—in other words, with the use of wealth. (4) In condemning the existing industrial policy, he tends too much towards a glorification of non-government, and a repudiation of all social intervention for the regulation of economic life. (5) He does not keep in view the moral destination of our race, nor regard wealth as a means to the higher ends of life, and thus incurs, not altogether unjustly, the charge of materialism, in the wider sense of that word. Lastly, (6) his whole system is too absolute in its character; it does not sufficiently recognize the fact, that in the language of Hildebrand, man, as a member of society, is a child of civilization and a product of history, and that account ought to be taken of the different stages of social development as implying altered economic conditions and calling for altered economic action, or even involving a modification of the actor. Perhaps in all the respects here enumerated, certainly in some of them and notably in the last, Smith is less open to criticism than most of the later English economists; but it must, we think, be admitted that to the general principles which lie at the basis of his scheme the ultimate growth of these several vicious tendencies is traceable.

Great expectations had been entertained respecting Smith's work by competent judges before its publication, as is shown by the language of Fergnson on the subject in his *History of Civil Society*. That its merits received prompt recognition is proved by the fact of six editions having been called for within the fifteen years after its appearance.[1] From the year 1783 it was more and more quoted in parliament. Pitt was greatly impressed by its reasonings; Smith is reported to have said that that minister understood the book as well as himself. Pulteney said in 1797 that Smith would convince the then living generation and would rule the next.

Smith's earliest critics were Bentham and Lauderdale, who, though in general agreement with him, differed on special points. Jeremy Bentham was author of a short treatise entitled *A Manual of Political Economy* (1843), and various economic monographs, the most celebrated of which was his *Defence of Usury* (1787). This contained (Letter xiii.) an elaborate criticism of a passage in the *Wealth of Nations*, already cited, in which Smith had approved of a legal maximum rate of interest fixed but a very little above the lowest market rate, as tending to throw the capital of the country into the hands of sober persons, as opposed to "prodigals and projectors." Smith is said to have admitted that Bentham had made out his case. He certainly argues it with great ability; and the true doctrine no doubt is that, in a developed industrial society, it is expedient to let the rate be fixed by contract between the lender and the borrower, the law interfering only in case of fraud.

Bentham's main significance does not belong to the economic field. But, on the one hand, what is known as Benthamism was undoubtedly, as Comte has said, a derivative from political economy, and in particular from the system of natural liberty; and, on the other, it promoted the temporary ascendency of that system by extending to the whole of social and moral theory the use of the principle of individual interest and the method of deduction from that interest. This alliance between political economy and the scheme of Bentham is seen in the personal group of thinkers which formed itself round him,—thinkers most inaptly characterized by J. S. Mill as "profound," but certainly possessed of much acuteness and logical power, and tending, though vaguely, towards a positive sociology, which, from their want of genuinely scientific culture and their absolute and unhistorical modes of thought, they were incapable of founding.

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[1] Five editions of the *Wealth of Nations* appeared during the life of the author:—the second in 1779, the third in 1784, the fourth in 1786, and the fifth in 1789. After the third edition Smith made no change in the text of his work. The principal editions containing matter added by other economists are those by David Buchanan, with notes and an additional volume, 1814; by J. R. M'Culloch, with life of the author, introductory discourse, notes, and supplemental dissertations, 1828 (also, with numerous additions, 1839; since reprinted several times with further additions); by the author of *England and America* (Edward Gibbon Wakefield), with a commentary, which, however, is not continued beyond the second book, 1835–9; by James E. Thorold Rogers,* now professor of political economy at Oxford, with biographical preface and a careful verification of all Smith's quotations and references, 1869 (2d ed., 1880); and by J. S. Nicholson, professor at Edinburgh, with notes referring to sources of further information on the various topics handled in the text, 1884. There is a careful *Abridgment* by W. P. Emerton (2d ed., 1881), founded on the earlier *Analysis* of Jeremiah Joyce (3d ed., 1821).

*[An Oxford graduate, who, after publishing researches in economics, especially on prices and wages in England, died, October 12, 1890, at the age of sixty-six.—AM. ED.]

Lord Lauderdale, in his *Inquiry into the Nature and Origin of Public Wealth* (1804), a book still worth reading, pointed out certain real weaknesses in Smith's account of value and the measure of value, and of the productivity of labor, and threw additional light on several subjects, such as the true mode of estimating the national income, and the reaction of the distribution of wealth on its production.

Malthus.

Smith stood just at the beginning of a great industrial revolution. The world of production and commerce in which he lived was still, as Cliffe Leslie has said, a "very early" and comparatively narrow one; "the only steam-engine he refers to is Newcomen's," and the cotton trade is mentioned by him only once, and that incidentally. "Between the years 1760 and 1770," says Mr. Marshall, "Roebuck began to smelt iron by coal, Brindley connected the rising seats of manufactures with the sea by canals, Wedgwood discovered the art of making earthenware cheaply and well, Hargreaves invented the spinning jenny, Arkwright utilized Wyatt's and High's inventions for spinning by rollers and applied water power to move them, and Watt invented the condensing steam-engine. Crompton's mule and Cartwright's power-loom came shortly after." Out of this rapid evolution followed a vast expansion of industry, but also many deplorable results, which, had Smith been able to foresee them, might have made him a less enthusiastic believer in the benefits to be wrought by the mere liberation of effort, and a less vehement denouncer of old institutions which in their day had given a partial protection to labor. Alongside of these evils of the new industrial system, socialism appeared as the alike inevitable and indispensable expression of the protest of the working-classes and the aspiration after a better order of things; and what we now call "the social question," that inexorable problem of modern life, rose into the place which it has ever since maintained. This question was first effectually brought before the English mind by Thomas Robert Malthus (1766–1834), not however, under the impulse of revolutionary sympathies, but in the interests of a conservative policy.

The first edition of the work which achieved this result appeared anonymously in 1798 under the title—*An Essay on the Principle of Population, as it affects the future improvement of Society, with remarks on the speculations of Mr. Godwin, M. Condorcet, and other writers.* This book arose out of certain private controversies of its author with his father Daniel Malthus, who had been a friend of Rousseau, and was an ardent believer in the doctrine of human progress as preached by Condorcet and other French thinkers and by their English disciples. The most distinguished of the latter was William Godwin, whose *Enquiry concerning Political Justice* had been published in 1793. The views put forward in that work had been restated by its author in the *Enquirer* (1797), and it was on the essay in this volume entitled "Avarice and Profusion" that the discussion between the father and the son arose, "the general question of the future improvement of society" being thus raised between them—the elder Malthus defending the doctrines of Godwin, and the younger assailing them. The latter "sat down with an intention of merely stating his thoughts on paper in a clearer manner than he thought he could do in conversation," and the *Essay* on population was the result.

The social scheme of Godwin was founded on the idea that the evils of society arise from the vices of human institutions. There is more than enough of wealth available for all, but it is not equally shared: one has too much, another has little or nothing. Let this wealth, as well as the labor of producing it, be equally divided; then every one will by moderate exertion obtain sufficient for plain living; there will be abundant leisure, which will be spent in intellectual and moral self-improvement; reason will determine human actions; government and every kind of force will be unnecessary; and, in time, by the peaceful influence of truth, perfection and happiness will be established on earth. To these glowing anticipations Malthus opposes the facts of the necessity of food, and the tendency of mankind to increase up to the limit of the available supply of it. In a state of universal physical well-being, this tendency, which in real life is held in check by the difficulty of procuring a subsistence, would operate without restraint. Scarcity would follow the increase of numbers; the leisure would soon cease to exist; the old struggle for life would recommence; and inequality would reign once more. If Godwin's ideal system, therefore, could be established, the single force of the principle of population, Malthus maintained, would suffice to break it down.

It will be seen that the essay was written with a polemical object; it was an occasional pamphlet directed against the utopias of the day, not at all a systematic treatise on population suggested by a purely scientific interest. As a polemic, it was decidedly successful; it was no difficult task to dispose of the scheme of equality propounded by Godwin. Already in 1761, Dr. Robert Wallace had published a work (which was used by Malthus in the composition of his essay) entitled *Various Prospects of Mankind, Nature and Providence*, in which, after speaking of a community of goods as a remedy for the ills of society, he confessed that he saw one fatal objection to such a social organization, namely, "the excessive population that would ensue." With Condorcet's extravagances too, Malthus easily dealt. That eminent man, amids the tempest of the French Revolution, had written whilst in hiding from his enemies, his *Esquisse d'u tableau historique de l'esprit humain.* The genera conception of this book makes its appearance an epoch in the history of the rise of sociology. In it, if we except some partial sketches by Turgot, is for the firs time explained the idea of a theory of social dynamic founded on history; and its author is on this ground recognized by Comte as his principal immediate predecessor. But in the execution of his great projec Condorcet failed. His negative metaphysics preven his justly appreciating the past, and he indulges, a the close of his work, in vague hypotheses respecting the perfectibility of our race, and in irrational expectations of an indefinite extension of the duration of human life. Malthus seems to have little sense of the nobleness of Cordorcet's attitude, and no appreciation of the grandeur of his leading idea. But of his chimerical hopes he is able to make short work; his good sense, if somewhat limited and prosaic, is at least effectual in detecting and exposing utopias.

The project of a formal and detailed treatise on population was an afterthought of Malthus. The essay in which he had studied a hypothetic future led him t examine the effects of the principle he had put forward on the past and present state of society; and he undertook an historical examination of these effects and sought to draw such inferences in relation to the actual state of things as experience seemed to warrant The consequence of this was such a change in the nature and composition of the essay as made it, in his own language, "a new work." The book, so altered, appeared in 1803 under the title—*An Essay on the Principle of Population, or a view of its Past and Pre-ent Effects on Human Happiness; with an Enquiry nto our prospects respecting the future removal or mitigation of the evils which it occasions.*

In the original form of the essay he had spoken of no checks to population but those which came under he head either of vice or of misery. He now introduces the new element of the preventive check supplied by what he calls "moral restraint," and is thus nabled to "soften some of the harshest conclusions" t which he had before arrived. The treatise passed hrough six editions in his lifetime, and in all of them e introduced various additions and corrections. That of 1816 is the last he revised, and supplies he final text from which it has since been reprinted.

Notwithstanding the great development which he ave to his work and the almost unprecedented amount f discussion to which it gave rise, it remains a matter of some difficulty to discover what solid contribution he has made to our knowledge, nor is it easy to scertain precisely what practical precepts, not already amiliar, he founded on his theoretic principles. This wofold vagueness is well brought out in his celebrated orrespondence with Senior, in the course of which it eems to be made apparent that his doctrine is new ot so much in its essence as in the phraseology in which it is couched. He himself tells us that when, fter the publication of the original essay, the main rgument of which he had deduced from Hume, Wal-ace, Smith, and Price, he began to inquire more losely into the subject, he found that "much more ad been done" upon it "than he had been aware of." t had "been treated in such a manner by some of the French economists, occasionally by Montesquieu, and, mong our own writers, by Dr. Franklin, Sir James Steuart, Mr. Arthur Young, and Mr. Townsend, as to reate a natural surprise that it had not excited more f the public attention." "Much, however," he hought, "remained yet to be done. The comparison etween the increase of population and food had not, erhaps, been stated with sufficient force and precision," and "few inquiries had been made into the vaious modes by which the level" between population nd the means of subsistence "is effected." The first esideratum here mentioned—the want, namely, of an ccurate statement of the relation between the increase f population and food—Malthus doubtless supposed have been supplied by the celebrated proposition hat "population increases in a geometrical, food in an rithmetical ratio." This proposition, however, has een conclusively shown to be erroneous, there being o such difference of law between the increase of man nd that of the organic beings which form his food. . S. Mill is indignant with those who criticise Malthus's formula, which he groundlessly describes as a ere "passing remark," because, as he thinks, though rroneous, it sufficiently suggests what is true; but it s surely important to detect unreal science, and to test trictly the foundations of beliefs. When the formula which we have cited is not used, other somewhat neblous expressions are sometimes employed, as, for xample, that "population has a tendency to increase aster than food," a sentence in which both are treated s if they were spontaneous growths, and which, on ccount of the ambiguity of the word "tendency," is dmittedly consistent with the fact asserted by Senior, hat food tends to increase faster than population. It ust always have been perfectly well known that population will probably (though not necessarily) increase ith every augmentation of the supply of subsistence, nd may, in some instances, inconveniently press upon, r even for a certain time exceed, the number properly orresponding to that supply. Nor could it ever have een doubted that war, disease, poverty—the last two ften the consequences of vice—are causes which keep population down. In fact, the way in which abundance, increase of numbers, want, increase of deaths, succeed each other in the natural economy, when reason does not intervene, had been fully explained by the Rev. Joseph Townsend in his *Dissertation on the Poor Laws* (1786), which was known to Malthus. Again, it is surely plain enough that the apprehension by individuals of the evils of poverty, or a sense of duty to their possible offspring, may retard the increase of population, and has in all civilized communities operated to a certain extent in that way. It is only when such obvious truths are clothed in the technical terminology of "positive" and "preventive checks" that they appear novel and profound; and yet they appear to contain the whole message of Malthus to mankind. The laborious apparatus of historical and statistical facts respecting the several countries of the globe, adduced in the altered form of the essay, though it contains a good deal that is curious and interesting, establishes no general result which was not previously well known, and is accordingly ignored by James Mill and others, who rest the theory on facts patent to universal observation. Indeed, as we have seen, the entire historical inquiry was an afterthought of Malthus, who, before entering on it, had already announced his fundamental principle.

It would seem, then, that what has been ambitiously called Malthus's theory of population, instead of being a great discovery, as some have represented it, or a poisonous novelty, as others have considered it, is no more than a formal enunciation of obvious, though sometimes neglected, facts. The pretentious language often applied to it by economists is objectionable, as being apt to make us forget that the whole subject with which it deals is as yet very imperfectly understood—the causes which modify the force of the sexual instinct, and those which lead to variations in fecundity, still awaiting a complete investigation.

It is the law of diminishing returns from land (of which we shall hear more hereafter), involving as it does—though only hypothetically—the prospect of a continuously increasing difficulty in obtaining the necessary sustenance for all the members of a society, that gives the principal importance to population as an economic factor. It is, in fact, the confluence of the Malthusian ideas with the theories of Ricardo, especially with the corollaries which the latter, as we shall see, deduced from the doctrine of rent (though these were not accepted by Malthus), that has led to the introduction of population as an element in the discussion of so many economic questions in recent times.

Malthus had undoubtedly the great merit of having called public attention in a striking and impressive way to a subject which had neither theoretically nor practically been sufficiently considered. But he and his followers appear to have greatly exaggerated both the magnitude and the urgency of the dangers to which they pointed.[1] In their conceptions a single social imperfection assumed such portentous dimensions that it seemed to overcloud the whole heaven and threaten the world with ruin. This doubtless arose from his having at first omitted altogether from his view of the question the great counteracting agency of moral restraint. Because a force exists, capable, if unchecked, of producing certain results, it does not follow that those results are imminent or even possible in the sphere of experience. A body thrown from the hand would, under the single impulse of projection, move forever in a straight line; but it would not be reasonable to take special action for the prevention of this result, ignoring the fact that it will be sufficiently counteracted by the other forces which will come into play. And such other forces exist in the case we are considering. If the inherent energy of the principle of population (supposed everywhere the same) is measured by the rate at which numbers increase under the most favorable circumstances, surely the force of less favorable circumstances, acting through prudential or altruistic motives, is measured by the great difference between this maximum rate and those which are observed to prevail in most European countries. Under a rational system of institutions, the adaptation of numbers to the means available for their support is effected by the felt or anticipated pressure of circumstances and the fear of social degradation, within a tolerable degree of approximation to what is desirable. To bring the result nearer to the just standard, a higher measure of popular enlightenment and more serious habits of moral reflection ought indeed to be encouraged. But it is the duty of the individual to his possible offspring, and not any vague notions as to the pressure of the national population on subsistence, that will be adequate to influence conduct.

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[1] Malthus himself said, "It is probable that, having found the bow bent too much one way, I was induced to bend it too much the other in order to make it straight."

The only obligation on which Malthus insists is that of abstinence from marriage so long as the necessary provision for a family has not been acquired or cannot be reasonably anticipated. The idea of post-nuptial continence, which has since been put forward by J. S. Mill and others, is foreign to his view. He even suggests that an allowance might be made from the public funds for every child in a family beyond the number of six, on the ground that when a man marries, he cannot tell how many children he shall have, and that the relief from an unlooked-for distress afforded by such a grant would not operate as an encouragement to marriage. The duty of economic prudence in entering on the married state is plain; but in the case of workingmen the idea of a secured provision must not be unduly pressed, and it must also be remembered that the proper age for marriage in any class depends on the duration of life in that class. Too early marriages, however, are certainly not unfrequent, and they are attended with other than material evils, so that possibly even legal measures might with advantage be resorted to for preventing them in all ranks by somewhat postponing the age of full civil competence. On the other hand, however, the Malthusians often speak too lightly of involuntary celibacy, not recognizing sufficiently that it is a deplorable necessity. They do not adequately estimate the value of domestic life as a school of the civic virtues, and the social importance (even apart from personal happiness) of the mutual affective education arising from the relations of the sexes in a well-constituted union.

Malthus further infers from his principles that states should not artificially stimulate population, and in particular that poor-laws should not be established, and, where they exist, should be abolished. The first part of this proposition cannot be accepted as applying to every social phase, for it is evident that in a case like that of ancient Rome, where continuous conquest was the chief occupation of the national activity, or in other periods when protracted wars threatened the independence or security of nations, statesmen might wisely take special action of the kind deprecated by Malthus. In relation to modern industrial communities he is doubtless in general right, though the promotion of immigration in new states is similar in principle to the encouragement of population. The question of poor-laws involves other considerations. The English system of his day was certainly a vicious one, though acting in some degree as a corrective of other evils in our social institutions; and efforts for its amendment tended to the public good. But the proposal of abolition is one from which statesmen have recoiled, and which general opinion has never adopted. It is difficult to believe that the present system will be permanent; it is too mechanical and undiscriminating; on some sides too lax, it is often unduly rigorous in the treatment of the worthy poor who are the victims of misfortune; and, in its ordinary modes of dealing with the young, it is open to grave objection. But it would certainly be rash to abolish it; it is one of several institutions which will more wisely be retained until the whole subject of the life of the working classes has been more thoroughly, and also more sympathetically, studied. The position of Malthus with respect to the relief of destitution is subject to this general criticism that, first proving too much, he then shrinks from the consequences of his own logic. It follows from his arguments, and is indeed explicitly stated in a celebrated passage of his original essay, that he who has brought children into the world without adequate provision for them should be left to the punishment of Nature, that "it is a miserable ambition to wish to snatch the rod from her hand," and to defeat the action of her laws, which are the laws of God, and which "have doomed him and his family to suffer." Though his theory leads him to this conclusion, he could not, as a Christian cle gyman, maintain the doctrine that, seeing our brother i need, we ought to shut up our bowels of compassion fro him; and thus he is involved in the radical inconsequence o admitting the lawfulness, if not the duty, of relieving distress, whilst he yet must regard the act as doing mischief t society. Buckle, who was imposed on by more than one of the exaggerations of the economists, accepts the logica inference which Malthus evaded. He alleges that the only ground on which we are justified in relieving destitution i the essentially self-regarding one, that by remaining deaf to the appeal of the sufferer we should probably blunt the edge of our own finer sensibilities.

It can scarcely be doubted that the favor which was at once accorded to the views of Malthus in certai circles was due in part to an impression, very welcome to the higher ranks of society, that they tended to relieve the rich and powerful of responsibility for the condition of the working classes, by showing that the latter had chiefly themselves to blame, and not eithe the negligence of their superiors or the institutions of the country. The application of his doctrines, too, made by some of his successors had the effect of discouraging all active effort for social improvement. Thus Chalmers "reviews *seriatim* and gravely sets aside all the schemes usually proposed for the amelioration of the economic condition of the people" on the ground that an increase of comfort will lead to an increase of numbers, and so the last state of things wil be worse than the first.

Malthus has in more recent times derived a certai degree of reflected lustre from the rise and wid acceptance of the Darwinian hypothesis. Its autho himself, in tracing its filiation, points to the phras "struggle for existence" used by Malthus in relatio to the social competition. Darwin believes that ma has advanced to his present high condition throug such a struggle, consequent on his rapid multiplication He regards, it is true, the agency of this cause for the improvement of our race as largely superseded b moral influences in the more advanced social stages Yet he considers it even in these stages, of so muc importance towards that end that, notwithstandin the individual suffering arising from the struggle fo life, he deprecates any great reduction in the natural by which he seems to mean the ordinary, rate of increase.

There has been of late exhibited in some quarters tendency to apply the doctrine of the "survival o the fittest" to human society in such a way as to intensify the harsher features of Malthus's exposition b encouraging the idea that whatever cannot sustai itself is fated, and must be allowed to disappear. Bu what is repellent in this conception is removed by wider view of the influence of Humanity, as the pre siding race, alike on vital and on social conditions. A in the general animal domain the supremacy of ma introduces a new force consciously controlling and ul timately determining the destinies of the subordinat species, so human providence in the social sphere ca intervene for the protection of the weak, modifying b its deliberate action what would otherwise be a mer contest of comparative strengths inspired by selfis instincts.

Ricardo

David Ricardo (1772–1823) is essentially of the schoo of Smith, whose doctrines he in the main accepts, whilst he seeks to develop them, and to correct them in certain particulars. But hi mode of treatment is very different from Smith's. Th latter aims at keeping close to the realities of life a he finds them,—at representing the conditions and re lations of men and things as they are; and, as Hume remarked on first reading his great work, his principle are everywhere exemplified and illustrated with curi ous facts. Quite unlike this is the way in which Ri cardo proceeds. He moves in a world of abstractions He sets out from more or less arbitrary assumptions reasons deductively from these, and announces his con clusions as true, without allowing for the partial un reality of the conditions assumed or confronting his results with experience. When he seeks to illustrate his doctrines it is from hypothetical cases,—his favorite device being that of imagining two contracting savages, and considering how they would be likely to act. He does not explain—probably he had not systematically examined, perhaps was not competent to examine—the appropriate method of political economy, and the theoretic defence of his mode of proceeding was left to be elaborated by J. S. Mill and Cairnes. But his example had a great effect in determining the practice of his successors. There was something highly attractive to the ambitious theorist in the sweeping march of logic which seemed in Ricardo's hands to emulate the certainty and comprehensiveness of mathematical proof, and in the portable and pregnant formulæ which were so convenient in argument, and gave a prompt, if often a more apparent than real, solution of difficult problems. Whatever there was of false or narrow in the fundamental positions of Smith had been in a great degree corrected by his practical sense and strong instinct for reality, but was brought out in its full dimensions and even exaggerated in the abstract theorems of Ricardo and his followers.

The dangers inherent in his method were aggravated by the extreme looseness of his phraseology. Senior pronounces him "the most incorrect writer who ever attained philosophical eminence." His most ardent admirers find him fluctuating and uncertain in the use of words, and generally trace his errors to a confusion between the ordinary employment of a term and some special application of it which he has himself devised.

The most complete exposition of his system is to be found in his *Principles of Political Economy and Taxation* (1817). This work is not a complete treatise on the science, but a rather loosely connected series of disquisitions on value and price, rent, wages and profits, taxes, trade, money and banking. Yet, though the connection of the parts is loose, the same fundamental ideas recur continually, and determine the character of the entire scheme.

The principal problem to which he addresses himself in this work is that of distribution,—that is to say, the proportions of the whole produce of the country which will be allotted to the proprietor of land, to the capitalist, and to the laborer. And it is important to observe that it is especially the variations in their respective portions which take place in the progress of society that he professes to study,—one of the most unhistorical of writers thus indicating a sense of the necessity of a doctrine of economic dynamics—a doctrine which, from his point of view, it was impossible to supply.

The principle which he puts first in order, and which is indeed the key to the whole, is this—that the exchange value of any commodity the supply of which can be increased at will is regulated, under a régime of free competition, by the labor necessary for its production. Similar propositions are to be found in the *Wealth of Nations*, not to speak of earlier English writings. Smith had said that, "in the early and rude state of society which precedes both the accumulation of stock and the appropriation of land, the proportion between the quantities of labor necessary for acquiring different objects seems to be the only circumstance which can afford any rule for exchanging them with one another." But he wavers in his conception, and presents as the measure of value sometimes the quantity of labor necessary for the production of the object, sometimes the quantity of labor which the object would command in the market, which are identical only for a given time and place. The theorem requires correction for a developed social system by the introduction of the consideration of capital, and takes the form in which it is elsewhere quoted from Malthus by Ricardo, that the real price of a commodity "depends on the greater or less quantity of capital and labor which must be employed to produce it." (The expression "quantity of capital" is lax, the element of time being omitted, but the meaning is obvious). Ricardo, however, constantly takes no notice of capital, mentioning labor alone in his statement of this principle, and seeks to justify his practice by treating capital as "accumulated labor"; but this artificial way of viewing the facts obscures the nature of the co-operation of capital in production, and by keeping the necessity of this co-operation out of sight has encouraged some socialistic errors. Ricardo does not sufficiently distinguish between the cause or determinant and the measure of value; nor does he carry back the principle of cost of production as regulator of value to its foundation in the effect of that cost on the limitation of supply. It is the "natural price" of a commodity that is fixed by the theorem we have stated; the market price will be subject to accidental and temporary variations from this standard, depending on changes in demand and supply; but the price will, permanently and in the long run, depend on cost of production defined as above. On this basis Ricardo goes on to explain the laws according to which the produce of the land and the labor of the country is distributed amongst the several classes which take part in production.

The theory of rent, with which he begins, though commonly associated with his name, and though it certainly forms the most vital part of his general economic scheme, was not really his, nor did he lay claim to it. He distinctly states in the preface to the *Principles*, that "in 1815 Mr. Malthus, in his *Inquiry into the Nature and Progress of Rent*, and a fellow of University College, Oxford, in his *Essay on the Application of Capital to Land*, presented to the world, nearly at the same moment, the true doctrine of rent." The second writer here referred to was Sir Edward West, afterwards a judge of the supreme court of Bombay. Still earlier than the time of Malthus and West, as M'Culloch has pointed out, this doctrine had been clearly conceived and fully stated by Dr. James Anderson in his *Enquiry into the Nature of Corn-Laws*, published at Edinburgh in 1777. That this tract was unknown to Malthus and West we have every reason to believe; but the theory is certainly as distinctly enunciated and as satisfactorily supported in it as in their treatises; and the whole way in which it is put forward by Anderson strikingly resembles the form in which it is presented by Ricardo.

The essence of the theory is that rent, being the price paid by the cultivator to the owner of land for the use of its productive powers, is equal to the excess of the price of the produce of the land over the cost of production on that land. With the increase of population, and therefore of demand for food, inferior soils will be taken into cultivation; and the price of the entire supply necessary for the community will be regulated by the cost of production of that portion of the supply which is produced at the greatest expense. But for the land which will barely repay the cost of cultivation no rent will be paid. Hence the rent of any quality of land will be equal to the difference between the cost of production on that land and the cost of production of that produce which is raised at the greatest expense.

The doctrine is perhaps most easily apprehended by means of the supposition here made of the coexistence in a country of a series of soils of different degrees of fertility which are successively taken into cultivation as population increases. But it would be an error to believe, though Ricardo sometimes seems to imply it, that such difference is a necessary condition of the existence of rent. If all the land of a country were of equal fertility, still if it were appropriated, and if the price of the produce were more than an equivalent for the labor and capital applied to its production, rent would be paid. This imaginary case, however, after using it to clear our conceptions, we may for the future leave out of account.

The price of produce being, as we have said, regulated by the cost of production of that which pays no rent, it is evident that "corn is not high because a rent is paid, but a rent is paid because corn is high," and that "no reduction would take place in the price of corn although landlords should forego the whole of their rent." Rent is, in fact, no determining element of price; it is paid, indeed, out of the price, but the price would be the same if no rent were paid, and the whole price were retained by the cultivator.

It has often been doubted whether or not Adam Smith held this theory of rent. Sometimes he uses language which seems to imply it, and states propositions which, if developed, would infallibly lead to it. Thus he says, in a passage already quoted, "such parts only of the produce of land can commonly be brought to market of which the ordinary price is sufficient to replace the stock which must be employed in bringing them thither, together with its ordinary profits. If the ordinary price is more than this, the surplus part of it will naturally go to the rent of land. If it is not more, though the commodity can be brought to market, it can afford no rent to the landlord. Whether the price is or is not more depends on the demand." Again, in Smith's application of these considerations to mines, "the whole principle of rent," Ricardo tells us, "is admirably and perspicuously explained." But he had formed the opinion that there is in fact no land which does not afford a rent to the landlord; and, strangely, he seems not to have seen that this appearance might arise from the aggregation into an economic whole of parcels of land which can and others which cannot pay rent. The truth, indeed, is that the fact, if it were a fact, that all the land in a country pays rent would be irrelevant as an argument against the Andersonian theory, for it is the same thing in substance if there be any capital employed on land already cultivated which yields a return no more than equal to ordinary profits. Such last-employed capital cannot afford rent at the existing rate of profit, unless the price of produce should rise.

The belief which some have entertained that Smith, notwithstanding some vague or inaccurate expressions, really held the Andersonian doctrine, can scarcely be maintained when we remember that Hume, writing to him after having read for the first time the *Wealth of Nations*, whilst expressing general agreement with his opinions, said (apparently with reference to bk. I. chap. vii.), "I cannot think that the rent of farms makes any part of the price of the produce, but that the price is determined altogether by the quantity and the demand." It is further noteworthy that a statement of the theory of rent is given in the same volume, published in 1777, which contains Anderson's polemic against Smith's objections to a bounty on the exportation of corn; this volume can hardly have escaped Smith's notice, yet neither by its contents nor by Hume's letter was he led to modify what he had said in his first edition on the subject of rent.

It must be remembered that not merely the unequal fertilities of different soils will determine differences of rent; the more or less advantageous situation of a farm in relation to markets, and therefore to roads and railways, will have a similar effect. Every diminution of the cost of transit will enable the produce to be brought to market at a smaller expense, and will thus increase the surplus which constitutes rent. This consideration is indicated by Ricardo, though he does not give it prominence, but dwells mainly on the comparative productiveness of soils.

Rent is defined by Ricardo as the price paid for the use of "the original and indestructible powers of the soil." He thus differentiates rent, as he uses the term, from what is popularly designated by the word; and, when it is to be taken in his sense, it is often qualified as the "true" or "economic" rent. Part of what is paid to the landlord is often really profit on his expenditure in preparing the farm for cultivation by the tenant. But it is to be borne in mind that wherever such improvements are "amalgamated with the land" and "add permanently to its productive powers," the return for them follows the laws, not of profit, but of rent. Hence it becomes difficult, if not impossible, in practice to discriminate with any degree of accuracy the amount received by the landlord "for the use of the original powers of the soil" from the amount received by him as remuneration for his improvements or those made by his predecessors. These have raised the farm, as an instrument for producing food, from one class of productiveness to a higher, and the case is the same as if nature had originally placed the land in question in that higher class.

Smith had treated it as the peculiar privilege of agriculture, as compared with other forms of production, that in it "nature labors along with man," and therefore, whilst the workmen in manufactures occasion the reproduction merely of the capital which employs them with its owner's profits, the agricultural laborer occasions the reproduction, not only of the employer's capital with profits, but also of the rent of the landlord. This last he viewed as the free gift of nature which remained "after deducting or compensating everything which can be regarded as the work of man." Ricardo justly observes in reply that "there is not a manufacture which can be mentioned in which nature does not give her assistance to man." He then goes on to quote from Buchanan the remark that "the notion of agriculture yielding a produce and a rent in consequence, because nature concurs with industry in the process of cultivation, is a mere fancy. It is not from the produce, but from the price at which the produce is sold, that the rent is derived, and this price is got, not because nature assists in the production, but because it is the price which suits the consumption to the supply."[1] There is no gain to the society at large from the rise of rent; it is advantageous to the landlords alone, and their interests are thus permanently in opposition to those of all other classes. The rise of rent may be retarded or prevented, or even temporarily changed to a fall by agricultural improvements, such as the introduction of new manures or of machines o of a better organization of labor (though there is not s much room for this last as in other branches of produc tion), or the opening of new sources of supply in foreig countries; but the tendency to a rise is constant so long a the population increases.

The great importance of the theory of rent in Ricardo's system arises from the fact that he makes the general eco nomic condition of the society to depend altogether on th position in which agricultural exploitation stands. Thi will be seen from the following statement of his theory o wages and profits. The produce of every expenditure o labor and capital being divided between the laborer and th capitalist, in proportion as one obtains more the other wi necessarily obtain less. The productiveness of labor bein given, nothing can diminish ·profit but a rise of wages, increase it but a fall of wages. Now the price of labo being the same as its cost of production, is deter mined by the price of the commodities necessary for th support of the laborer. The price of such manufacture articles as he requires has a constant tendency to fall, prin cipally by reason of the progressive application of the div sion of labor to their production. But the cost of h maintenance essentially depends, not on the price of tho articles, but on that of his food, and as the production food will in the progress of society and of population requi the sacrifice of more and more labor, its price will ris money wages will consequently rise, and with the rise wages profits will fall. Thus it is to the necessary gradu descent to inferior soils or less productive expenditure the same soil that the decrease in the rate of profit whi has historically taken place is to be attributed (Smit ascribed this decrease to the competition of capitalis though in one place, book I. chap. ix., he had a glimpse the Ricardian view). This gravitation of profits toward minimum is happily checked at times by improvements the machinery employed in the production of necessari and especially by such discoveries in agriculture and oth causes as reduce the cost of the prime necessary of t laborer; but, here again, the tendency is constant. Whi the capitalist thus loses, the laborer does not gain; his creased money wages only enable him to pay the increas price of his necessaries, of which he will have no great and probably a less share than he had before. In fact, t laborer can never for any considerable time earn more th what is required to enable the class to subsist in such degree of comfort as custom has made indispensable them, and to perpetuate their race without either incre or diminution. That is the "natural" price of labor, a if the market rate temporarily rises above it population w be stimulated and the rate of wages will again fall. Th whilst rent has a constant tendency to rise and profit to f the rise or fall of wages will depend on the rate of incre of the working classes. For the improvement of their c dition Ricardo thus has to fall back on the Malthusi remedy, of the effective application of which he does n however, seem to have much expectation. The securit against a superabundant population to which he points the gradual abolition of the poor laws—for their amendme would not content him—and the development amongst working classes of a taste for greater comforts and enjo ments.

It will be seen that the socialists have somewhat exagg rated in announcing, as Ricardo's "iron law" of wages, th absolute identity with the amount necessary to sustain t existence of the laborer and enable him to continue t race. He recognizes the influence of a "standard of livin as limiting the increase of the numbers of the worki classes, and so keeping their wages above the lowest poi But he also holds that, in long-settled countries, in the dinary course of human affairs and in the absence of spec efforts restricting the growth of population, the conditi of the laborer will decline as surely, and from the sa causes, as that of the landlord will be improved.

If we are asked whether this doctrine of rent, and t consequences which Ricardo deduced from it, are true, must answer that they are hypothetically true in the m advanced industrial communities, and there only (thou they have been rashly applied to the cases of India a Ireland), but that even in those communities neither s inference nor sound action can be built upon them. As shall see hereafter, the value of most ot the theorems of t classical economics is a good deal attenuated by the habit assumptions that we are dealing with "economic me actuated by one principle only; that custom, as agai ompetition, has no existence; that there is no such thing combination; that there is equality of contract between he parties to each transaction, and that there is a definite niversal rate of profit and wages in a community, which nplies that the capital embarked in any undertaking will ss at once to another in which larger profits are for e time to be made; that a laborer, whatever his local ties f feeling, family, habit or other engagements, will transfer imself immediately to any place where, or employment in hich, for the time, larger wages are to be earned than those e had previously obtained; and that both capitalists and borers have a perfect knowledge of the condition and pros- ects of industry throughout the country, both in their own d other occupations. But in Ricardo's speculations on rent d its consequences there is still more of abstraction. The fluence of emigration, which has assumed vast dimensions nce his time, is left out of account, and the amount of land the disposal of a community is supposed limited to its n territory, whilst contemporary Europe is in fact rgely fed by the Western States of America. He did not equately appreciate the degree in which the augmented oductiveness of labor, whether from increased intelli- nce, improved organization, introduction of machinery, more rapid and cheaper communication, steadily keeps wn the cost of production. To these influences must be ded those of legal reforms in tenure and fairer conditions contracts, which operate in the same direction. As a sult of all these causes, the pressure anticipated by Ricardo not felt, and the cry is rather of the landlords over falling nts than of the consumer over rising prices. The entire nditions are in fact so altered that Prof. Nicholson, no emy to the "orthodox" economics, when recently con- cting an inquiry into the present state of the agricultural estion, pronounced the so-called Ricardian theory of rent too abstract to be of practical utility."

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[1] Senior, however, has pointed out that Smith is partly right; whilst it is true that rent is demanded because the productive powers of nature are limited and increased population requires a less remunerative expenditure in order to obtain the necessary supply, on the other hand, it is the power which most land possesses of producing the subsistence of more persons than are required for its cultivation that supplies the fund out of which rent can be paid.

A particular economic subject on which Ricardo has rown a useful light is the nature of the advantages de- ved from foreign commerce and the conditions under hich such commerce can go on. Whilst preceding writers d represented those benefits as consisting in affording a nt for surplus produce, or enabling a portion of the national pital to replace itself with a profit, he pointed out that ey consist, "simply and solely in this, that it enables each tion to obtain, with a given amount of labor and capital, greater quantity of all commodities taken together." This no doubt the point of view at which we should habitually ace ourselves; but the other forms of expression em- oyed by his predecessors are sometimes useful as repre- nting real considerations affecting national production, d need not be absolutely disused. Ricardo proceeds to ow that what determines the purchase of any commodity om a foreign country is not the circumstance that it can produced there with less labor and capital than at home. we have a greater positive advantage in the production some other article than in that of the commodity in estion, even though we have an advantage in producing e latter, it may be our interest to devote ourselves to the roduction of that in which we have the greatest advantage d to import that in producing which we should have a less, ough a real, advantage. It is, in short, not absolute cost production, but comparative cost, which determines the terchange. This remark is just and interesting, though n undue importance seems to be attributed to it by J. S. ill and Cairnes, the latter of whom magniloquently de- ribes it as "sounding the depths" of the problem of inter- ational dealings—though, as we shall see hereafter, he odifies it by the introduction of certain considerations especting the conditions of domestic production.

For the nation as a whole, according to Ricardo, it is not he gross produce of the land and labor, as Smith seems assert, that is of importance, but the net income—the xcess, that is, of this produce over the cost of production, r, in other words, the amount of its rent and its profits; or the wages of labor, not essentially exceeding the main- enance of the laborers, are by him considered only as a art of the "necessary expenses of production." Hence it ollows, as he himself in a characteristic and often quoted assage says, that, "provided the net real income of the ation be the same, it is of no importance whether it con- ists of ten or twelve millions of inhabitants. If five nillions of men could produce as much food and clothing s was necessary for ten millions, food and clothing for five nillions would be the net revenue. Would it be of any dvantage to the country that to produce this same net evenue seven millions of men should be required,—that is o say, that seven millions should be employed to produce od and clothing sufficient for twelve millions? The food nd clothing of five millions would be still the net revenue. The employing a greater number of men would enable us neither to add a man to our army and navy nor to contribute one guinea more in taxes." Industry is here viewed, just as by the mercantilists, in relation to the military and political power of the state, not to the maintenance and improvement of human beings, as its end and aim. The laborer, as Held has remarked, is regarded not as a member of society, but as a means to the ends of society, on whose sustenance a part of the gross income must be expended, as another part must be spent on the sustenance of horses. We may well ask, as Sismondi did in a personal interview with Ricardo, "What! is wealth then everything? are men absolutely nothing?"

On the whole, what seems to us true of Ricardo is this, that, whilst he had remarkable powers, they were not the powers best fitted for sociological research. Nature intended him rather for a mathematician of the second order than for a social philosopher. Nor had he the due previous preparation for social studies; for we must decline to accept Bagehot's idea that, though "in no high sense an educated man," he had a specially apt training for such studies in his practice as an eminently successful stockjobber. The same writer justly notices the "anxious penetration with which he follows out rarefied minutiæ." But he wanted breadth of survey, a comprehensive view of human nature and human life, and the strong social sympathies which, as the greatest minds have recognized, are a most valuable aid in this department of study. On a subject like that of money, where a few elementary propositions—into which no moral ingredient enters—have alone to be kept in view, he was well adapted to succeed; but in the larger social field he is at fault. He had great deductive readiness and skill (though his logical accuracy, as Mr. Sidgwick remarks, has been greatly exaggerated). But in human affairs phenomena are so complex, and principles so constantly limit or even compensate one another, that rapidity and daring in deduction may be the greatest of dangers, if they are divorced from a wide and balanced appreciation of facts. Dialectic ability is, no doubt, a valuable gift, but the first condition for success in social investigation is to see things as they are.

A sort of Ricardo-mythus for some time existed in economic circles. It cannot be doubted that the exaggerated estimate of his merits arose in part from a sense of the support his system gave to the manufacturers and other capitalists in their growing antagonism to the old aristocracy of landowners. The same tendency, as well as his affinity to their too abstract and unhistorical modes of thought, and their eudæmonistic doctrines, recommended him to the Benthamite group, and to the so-called Philosophical Radicals generally. Brougham said he seemed to have dropped from heaven—a singular avatar, it must be owned. His real services in connection with questions of currency and banking naturally created a prepossession in favor of his more general views. But, apart from those special subjects, it does not appear that, either in the form of solid theoretic teaching or of valuable practical guidance, he has really done much for the world, whilst he admittedly misled opinion on several important questions. De Quincey's presentation of him as a great revealer of truth is now seen to be an extravagance. J. S. Mill and others speak of his "superior lights" as compared with those of Adam Smith; but his work, as a contribution to our knowledge of human society, will not bear a moment's comparison with the *Wealth of Nations*.

It is interesting to observe that Malthus, though the combination of his doctrine of population with the principles of Ricardo composed the creed for some time professed by all the "orthodox" economists, did not himself accept the Ricardian scheme. He prophesied that "the main part of the structure would not stand." "The theory," he says, "takes a partial view of the subject, like the system of the French economists; and, like that system, after having drawn into its vortex a great number of very clever men, it will be unable to support itself against the testimony of obvious facts, and the weight of those theories which, though less simple and captivating, are more just, on account of their embracing more of the causes which are in actual operation in all economical results."

We saw that the foundations of Smith's doctrine in general philosophy were unsound, and the ethical character of his scheme in consequence injuriously affected; but his method, consisting in a judicious combination of induction and deduction, we found (so far as the statical study of economic laws is concerned) little open to objection. Mainly through the influence of Ricardo, economic method was perverted. The science was led into the mistaken course of turning its back on observation, and seeking to evolve the laws of phenomena out of a few hasty generalizations by a play of logic. The principal vices which have been in recent times not unjustly attributed to the members of the "orthodox" school were all encouraged by his example, namely: (1) the viciously abstract character of the conceptions with which they deal, (2) the abusive preponderance of deduction in their processes of research, and (3) the too absolute way in which their conclusions are conceived and enunciated.

The two works of Malthus already named are by far the most important in the history of the science. He was also author of *Principles of Political Economy* (1820), *Definitions in Political Economy*, and some minor pieces. The works of Ricardo have been collected in one volume, with a biographical notice, by J. R. M'Culloch (1846).

The Epigoni.

After Malthus and Ricardo, the first of whom had fixed public attention irresistibly on certain aspects of society, and the second had led economic research into new, if questionable, paths, came a number of minor writers who were mainly their expositors and commentators, and whom, accordingly, the Germans, with allusion to Greek mythical history, designate as the Epigoni. By them the doctrines of Smith and his earliest successors were thrown into more systematic shape, limited and guarded so as to be less open to criticism, couched in a more accurate terminology, modified in subordinate particulars, or applied to the solution of the practical questions of their day.

James Mill.

M'Culloch.

Senior.

James Mill's *Elements* (1821) deserves special notice, as exhibiting the system of Ricardo with a thorough-going rigor, a compactness of presentation, and a skill in the disposition of materials, which give to it in some degree the character of a work of art. The *a priori* political economy is here reduced to its simplest expression. J. R. M'Culloch (1779–1864)[1], author of a number of laborious statistical and other compilations, criticised current economic legislation in the *Edinburgh Review* from the point of view of the Ricardian doctrine, taking up substantially the same theoretic position as was occupied at a somewhat later period by the Manchester school. He is altogether without originality, and never exhibits any philosophic elevation or breadth. His confident dogmatism is often repellent; he admitted in his later years that he had been too fond of novel opinions, and defended them with more heat and pertinacity than they deserved. It is noticeable that, though often spoken of in his own time both by those who agreed with his views, and those, like Sismondi, who differed from them, as one of the lights of the reigning school, his name is now tacitly dropped in the writings of the members of that school. Whatever may have been his partial usefulness in vindicating the policy of free trade, it is at least plain that for the needs of our social future he has nothing to offer. Nassau William Senior (1790–1864), who was professor of political economy in the university of Oxford, published, besides a number of separate lectures, a treatise on the science, which first appeared as an article in the *Enclyclopædia Metropolitana*. He is a writer of a high order of merit. He made considerable contributions to the elucidation of economic principles, specially studying exactness in nomenclature and strict accuracy in deduction. His explanations on cost of production and the
way in which it affects price, on rent, on the
tween rate of wages and price of labor, on the re
profit and wages (with special reference to Rica
on this subject, which he corrects by the subst
portional for absolute amount), and on the d
the precious metals between different countri
larly valuable. His new term "abstinence,"
express the conduct for which interest is the
was useful, though not quite appropriate, bec
in meaning. It is on the question of wages t
least satisfactory. He makes the average rate
(which, we must maintain, is not a real qua
the rate in a given employment and neighbor
expressed by the fraction of which the num
amount of the wages fund (an unascertainabl
except as actual total of wages paid, imagina
the denominator the number of the working po
from this he proceeds to draw the most impor
reaching consequences, though the equation
founds his inferences conveys at most only an
fact, which would be true of every case of a div
individuals, and contains no economic eleme
The phrase "wages fund" originated in som
of Adam Smith used only for the purpose of
and never intended to be rigorously interpr
shall see that the doctrine has been repudiat
members of what is regarded as the orthodox s
tical economy. As regards method, Senior mak
a purely deductive one, in which there is no r
other "facts" than the four fundamental prop
which he undertakes to deduce all economic tr
does not regard himself as arriving at hypot
sions; his postulates and his inferences are ali
as corresponding to actual phenomena. Col
Torrens (1780–1864) was a prolific writer, partly
on economic theory, but principally on its applications to financial and commercial policy.
whole of the programme which was carried o
tion by Sir Robert Peel had been laid down in
the writings of Torrens. He gave substantia
theory of foreign trade which was afterwards
S. Mill in one of his *Essays on Unsettled Questio*
an early and earnest advocate of the repeal of t
but was not in favor of a general system of a
trade, maintaining that it is expedient to impos
duties to countervail similar duties imposed
countries, and that a lowering of import duties
ductions of countries retaining their hostile t
occasion an abstraction of the precious metals,
in prices, profits, and wages. His principal w
general character were—*The Economist* [i. e.,
refuted, 1808; *Essay on the Production of Wealth*,
on the External Corn-Trade (eulogized by Ricardo
Budget, a Series of Letters on Financial, Commerci
nial Policy, 1841–3. Harriet Martineau (1802–
larized the doctrines of Malthus and Ricardo in
her *Illustrations of Political Economy* (1832–34),
a series of tales, in which there is much excellent description, but the effect of the narrative
is often marred by the somewhat ponderous d
here and there thrown in, usually in the form

Other writers who ought to be named in any
the science are Charles Babbage, *On the Economy*
and Manufactures (1832), chiefly descriptive, but
theoretic; William Thomas Thornton, *Overpop*
its Remedy (1846), *A Plea for Peasant Proprietors*
Labor (1869; 2d ed., 1870); Herman Merivale,
Colonization and Colonies, (1841–2; new ed., 18
Benfield, *The Organization of Industry explained*
ed., 1848); and Edward Gibbon Wakefield, *A*
Art of Colonization, 1849. Thomas Chalmers, w
in other fields of thought, was author of *The*
and Civic Economy of Large Towns (1821–26), and
Economy in Connection with the Moral State and M
pects of Society (1832); he strongly opposed any
legal charity, and, whilst justly insisting on the
importance of morality, industry, and thrift as
of popular well-being, carried the Malthusian do
excess. Nor was Ireland without a share in the
movement of the period. Whately, having be
Drummond professor of political economy at O
succession to Senior), founded (1832), when h
Ireland as archbishop of Dublin, a similar profes
Trinity College, Dublin. It was first held by M
Longfield, afterwards judge of the Landed Esta
Ireland (d. 1884). He published lectures on t
generally (1834), on *Poor Laws* (1834), and on *Com*
Absenteeism (1835), which were marked by indepen
thought and sagacious observation. He was la
from many of the exaggerations of his contempor

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[1] [M'Culloch was born in 1789 as all authorities say, and also Mr. Ingram himself says (See art. M'CULLOCH, vol. xv p. 135) that he died in his seventy-sixth year.—AM. ED.]

said, in 1835, "in political economy we must not abstract too much," and protested against the assumption too often made that "men are guided in all their conduct by a prudent regard to their own interest." James A. Lawson[1] (now Mr. Justice Lawson) also published some lectures (1844) delivered from the same chair, which may still be read with interest and profit; his discussion of the question of population is especially good; he also asserted against Senior that the science is *avide de faits*, and that it must reason about the world and mankind as they really are.

Richard Jones.

The most systematic and thorough-going contemporary critic of the Ricardian system was Richard Jones (1790–1855), professor at Haileybury. Jones has received scant justice at the hands of his successors. J. S. Mill, whilst using his work, gave his merits but faint recognition. Even Roscher says that he did not thoroughly understand Ricardo, without giving any proof of that assertion, whilst he is silent as to the fact that much of what has been preached by the German historical school is found distinctly indicated in Jones's writings. He has been sometimes represented as having rejected the Andersonian doctrine of rent; but such a statement is incorrect. Attributing the doctrine to Malthus, he says that economist "showed satisfactorily that, when land is cultivated by capitalists living on the profits of their stock, and able to move it at pleasure to other employments, the expense of tilling the worst quality of land cultivated determines the average price of raw produce, while the difference of quality on the superior lands measures the rents yielded by them." What he really denied was the application of the doctrine to all cases where rent is paid; he pointed out in his *Essay on the Distribution of Wealth and on the Sources of Taxation*, 1831, that, besides "farmers' rents," which, under the supposed conditions, conform to the above law, there are "peasant rents," paid everywhere through the most extended periods of history, and still paid over by far the largest part of the earth's surface, which are not so regulated. Peasant rents he divided under the heads of (1) serf, (2) métayer, (3) ryot, and (4) cottier rents, a classification afterwards adopted in substance by J. S. Mill; and he showed that the contracts fixing their amount were, at least in the first three classes, determined rather by custom than by competition. Passing to the superstructure of theory erected by Ricardo on the doctrine of rent which he had so unduly extended, Jones denied most of the conclusions he had deduced, especially the following: that the increase of farmers' rents is always contemporary with a decrease in the productive powers of agriculture, and comes with loss and distress in its train; that the interests of landlords are always and necessarily opposed to the interests of the state and of every other class of society; that the diminution of the rate of profits is exclusively dependent on the returns to the capital last employed on the land; and that wages can rise only at the expense of profits.

The method followed by Jones is inductive; his conclusions are founded on a wide observation of contemporary facts, aided by the study of history. "If," he said, "we wish to make ourselves acquainted with the economy and arrangements by which the different nations of the earth produce and distribute their revenues, I really know but of one way to attain our object, and that is, to look and see. We must get comprehensive views of facts, that we may arrive at principles that are truly comprehensive. If we take a different method, if we snatch at general principles, and content ourselves with confined observations, two things will happen to us. First, what we call general principles will often be found to have no generality—we shall set out with declaring propositions to be universally true which, at every step of our further progress, we shall be obliged to confess are frequently false; and, secondly, we shall miss a great mass of useful knowledge which those who advance to principles by a comprehensive examination of facts necessarily meet with on their road." The world he professed to study was not an imaginary world, inhabited by abstract "economic men," but the real world with the different forms which the ownership and cultivation of land, and, in general, the conditions of production and distribution, assume at different times and places. His recognition of such different systems of life in communities occupying different stages in the progress of civilization led to his proposal of what he called a "political economy of nations." This was a protest against the practice of taking the exceptional state of facts which exists, and is indeed only partially realized, in a small corner of our planet as representing the uniform type of human societies, and ignoring the effects of the early history and special development of each community as influencing its economic phenomena.

It is sometimes attempted to elude the necessity for a wider range of study by alleging a universal tendency in the social world to assume this now exceptional shape as its normal and ultimate constitution. Even if this tendency were real (which is only partially true, for the existing order amongst ourselves cannot be regarded as entirely definitive), it could not be admitted that the facts witnessed in our civilization and those exhibited in less advanced communities are so approximate as to be capable of being represented by the same formulæ. As Whewell, in editing Jones's *Remains*, 1859, well observed, it is true in the physical world that "all things tend to assume a form determined by the force of gravity; the hills tend to become plains, the waterfalls to eat away their beds and disappear, the rivers to form lakes in the valleys, the glaciers to pour down in cataracts." But are we to treat these results as achieved, because forces are in operation which may ultimately bring them about? As Comte has said, all human questions are largely questions of time; and the economic phenomena which really belong to the several stages of the human movement must be studied as they are, unless we are content to fall into grievous error both in our theoretic treatment of them and in the solution of the practical problems they present.

Jones is remarkable for his freedom from exaggeration and one-sided statement; thus, whilst holding Malthus in, perhaps, undue esteem, he declines to accept the proposition that an increase of the means of subsistence is necessarily followed by an increase of population; and he maintains what is undoubtedly true, that with the growth of population, in all well-governed and prosperous states, the command over food, instead of diminishing, increases.

Much of what he has left us—a large part of which is unfortunately fragmentary—is akin to the later labors of Cliffe Leslie. The latter, however, had the advantage of acquaintance with the sociology of Comte, which gave him a firmer grasp of method, as well as a wider view of the general movement of society; and whilst the voice of Jones was but little heard amidst the general applause accorded to Ricardo in the economic world of his time, Leslie wrote when disillusion had set in, and the current was beginning to turn in England against the *a priori* economics.

Comte somewhere speaks of the "transient predilection" for political economy which had shown itself generally in western Europe. This phase of feeling was specially noticeable in England from the third to the fifth decade of the present century. "Up to the year 1818," said a writer in the *Westminster Review*, "the science was scarcely known or talked of beyond a small circle of philosophers; and legislation, so far from being in conformity with its principles, was daily receding from them more and more." Mill has told us what a change took place within a few years. "Political economy," he says, "had asserted itself with great vigor in public affairs by the petition of the merchants of London for free trade, drawn up in 1820 by Mr. Tooke and presented by Mr. Alexander Baring, and by the noble exertions of Ricardo during the few years of his parliamentary life. His writings, following up the impulse given by the bullion controversy, and followed up in their turn by the expositions and comments of my father and M'Culloch (whose writings in the *Edinburgh Review* during those years were most valuable), had drawn general attention to the subject, making at least partial converts in the cabinet itself; and Huskisson, supported by Canning, had commenced that gradual demolition of the protective system which one of their colleagues virtually completed in 1846, though the last vestiges were only swept away by Mr. Gladstone in 1860." Whilst the science was thus attracting and fixing the attention of active minds, its unsettled condition was freely admitted. The differences of opinion among its

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[1] [Justice on Queen's Bench, Ireland; escaped an agrarian assassination; translated Latin hymns. Died in 1887, aged seventy years.—AM. ED.]

J. S. Mill.

professors were a frequent subject of complaint. But it was confidently expected that these discrepancies would soon disappear, and Colonel Torrens predicted that in twenty years there would scarcely "exist a doubt respecting any of its more fundamental principles." "The prosperity," says Mr. Sidgwick, "that followed on the abolition of the corn laws gave practical men a most impressive and satisfying proof of the soundness of the abstract reasoning by which the expediency of free trade had been inferred," and when, in 1848, "a masterly expositor of thought had published a skilful statement of the chief results of the controversies of the preceding generation," with the due "explanations and qualifications" of the reigning doctrines, it was for some years generally believed that political economy had "emerged from the state of polemical discussion," at least on its leading doctrines, and that at length a sound construction had been erected on permanent bases.

This expositor was John Stuart Mill (1806–73). He exercised, without doubt, a greater influence in the field of English economics than any other writer since Ricardo. His systematic treatise has been, either directly or through manuals founded on it, especially that of Fawcett, the source from which most of our contemporaries in these countries have derived their knowledge of the science. But there are other and deeper reasons, as we shall see, which make him, in this as in other departments of knowledge, a specially interesting and significant figure.

In 1844 he published five *Essays on some Unsettled Questions of Political Economy*, which had been written as early as 1829 and 1830, but had, with the exception of the fifth, remained in manuscript. In these essays is contained any dogmatic contribution which he can be regarded as having made to the science. The subject of the first is the laws of interchange between nations. He shows that, when two countries trade together in two commodities, the prices of the commodities exchanged on both sides (which, as Ricardo had proved, are not determined by cost of production) will adjust themselves in such a way that the quantities required by each country of the article which it imports from its neighbor shall be exactly sufficient to pay for one another. This is the law which appears, with some added developments, in his systematic treatise under the name of the "equation of international demand." The most important practical conclusion (not, however, by any means an undisputed one) at which he arrives in this essay is, that the relaxation of duties on foreign commodities, not operating as protection but maintained solely for revenue, should be made contingent on the adoption of some corresponding degree of freedom of trade with England by the nation from which the commodities are imported. In the second essay, on the influence of consumption on production, the most interesting results arrived at are the propositions—(1) that absenteeism is a local, not a national, evil, and (2) that, whilst there cannot be permanent excess of production, there may be a temporary excess, not only of any one article, but of commodities generally,—this last, however, not arising from over-production, but from a want of commercial confidence. The third essay relates to the use of the words "productive" and "unproductive" as applied to labor, to consumption, and to expenditure. The fourth deals with profits and interest, especially explaining and so justifying Ricardo's theorem that "profits depend on wages, rising as wages fall and falling as wages rise." What Ricardo meant was that profits depend on the cost of wages estimated in labor. Hence improvements in the production of articles habitually consumed by the laborer may increase profits without diminishing the real remuneration of the laborer. The last essay is on the definition and method of political economy, a subject afterwards more maturely treated in the author's *System of Logic*

In 1848 Mill published his *Principles of Political Economy, with some of their Applications to Social Philosophy*. This title, though, as we shall see, open to criticism, indicated on the part of the author a less narrow and formal conception of the field of the science than had been common amongst his predecessors. He aimed, in fact, at producing a work which might replace in ordinary use the *Wealth of Nations*, which in his opinion was "in many parts obsolete and in all imperfect." Adam Smith had invariably associated the general principles of the subject with their applications, and in treating those applications had perpetually appealed to other and often far larger considerations than pure political economy affords. And in the same spirit Mill desired, whilst incorporating all the results arrived at in the special science by Smith's successors, to exhibit purely economic phenomena in relation to the most advanced conceptions of his own time in the general philosophy of society, as Smith had done in reference to the philosophy of his century.

This design he certainly failed to realize. His book is very far indeed from being a "modern Adam Smith." It is an admirably lucid and even elegant exposition of the Ricardian economics, the Malthusian theory being of course incorporated with these, but, notwithstanding the introduction of many minor novelties, it is, in its scientific substance, little or nothing more. When Cliffe Leslie says that Mill so qualified and amended the doctrines of Ricardo that the latter could scarcely have recognized them, he certainly goes a great deal too far; Senior really did more in that direction. Mill's effort is usually to vindicate his master where others have censured him, and to palliate his admitted laxities of expression. Already his profound esteem for Ricardo's services to economics had been manifest in his *Essays*, where he says of him, with some injustice to Smith, that, "having a science to create," he could not "occupy himself with more than the leading principles," and adds that "no one who has thoroughly entered into his discoveries" will find any difficulty in working out "even the minutiæ of the science." James Mill, too, had been essentially an expounder of Ricardo; and the son, whilst greatly superior to his father in the attractiveness of his expository style, is, in regard to his economic doctrine, substantially at the same point of view. It is in their general philosophical conceptions and their views of social aims and ideals that the elder and younger Mill occupy quite different positions in the line of progress. The latter could not, for example, in his adult period have put forward a theory of government the shallow sophistries which the plain good sense of Macaulay sufficed to expose in the writings of the former; and he had a nobleness of feeling which, in relation to the higher social questions, raised him far above the ordinary coarse utilitarianism of the Benthamites.

The larger and more philosophic spirit in which Mill dealt with social subjects was undoubtedly in great measure due to the influence of Comte, to whom, as Mr. Bain justly says, he was under greater obligations than he himself was disposed to admit. Had he more completely undergone that influence, we are sometimes tempted to think he might have wrought the reform in economics which still remains to be achieved, emancipating the science from the *a priori* system, and founding a genuine theory of industrial life on observation in the broadest sense. But probably the time was not ripe for such a construction, and it is possible that Mill's native intellectual defects might have made him unfit for the task, for, as Roscher has said, "ein historischer Kopf war er nicht." However this might have been, the effects of his early training, in which positive were largely alloyed with metaphysical elements, sufficed in fact to prevent his attaining a perfectly normal mental attitude. He never altogether overcame the vicious direction which he had received from the teaching of his father, and the influence of the Benthamite group in which he was brought up.

Hence it was that, according to the striking expression of Roscher, his whole view of life was "zu wenig aus Einem Gusse." The incongruous mixture of the narrow dogmas of his youthful period with the larger ideas of a later stage gave a wavering and indeterminate character to his entire philosophy. He is, on every side, eminently "un-final"; he represents tendencies to new forms of opinion, and opens new vistas in various directions, but founds scarcely anything, and remains indeed, so far as his own position is concerned, not merely incomplete but incoherent. It is, however, precisely this dubious position which seems to us to give a special interest to his career, by fitting him in a peculiar degree to prepare and facilitate transitions.

What he himself thought to be "the chief merit of his treatise" was the marked distinction drawn between the theory of production and that of distribution, the laws of the former being based on unalterable natural facts, whilst the course of distribution is modified from time to time by the changing ordinances of society. This distinction, we may remark, must not be too absolutely stated, for the organization of production changes with social growth, and, as Lauderdale long ago showed, the nature of the distribution in a community reacts on production. But there is a substantial truth in the distinction, and the recognition of it tends to concentrate attention on the question—How can we improve the existing distribution of wealth? The study of this problem led Mill, as he advanced in years, further and further in the direction of socialism; and, whilst to the end of his life his book continued to deduce the Ricardian doctrines from the principle of enlightened selfishness, he was looking forward to an order of things in which synergy should be founded on sympathy.

The gradual modification of his views in relation to the economic constitution of society is set forth in his *Autobiography*. In his earlier days, he tells us, he "had seen little further than the *old school*" (note this significant title) "of political economy into the possibilities of fundamental improvement in social arrangements. Private property, as now understood, and inheritance appeared the *dernier mot* of legislation." The notion of proceeding to any radical redress of the injustice "involved in the fact that some are born to riches and the vast majority to poverty" he had then reckoned chimerical. But now his views were such as would "class him decidedly under the general designation of socialist"; he had come to believe that the whole contemporary framework of economic life was merely temporary and provisional, and that a time would come when "the division of the produce of labor, instead of depending, as in so great a degree it now does, on the accident of birth, would be made by concert on an acknowledged principle of justice." "The social problem of the future" he considered to be "how to unite the greatest individual liberty of action," which was often compromised in socialistic schemes, "with a common ownership in the raw material of the globe, and an equal participation in all the benefits of combined labor." These ideas were scarcely indicated in the first edition of the *Political Economy*, rather more clearly and fully in the second, and quite unequivocally in the third,—the French Revolution of 1848 having, as he says, made the public more open to the reception of novelties in opinion.

Whilst thus looking forward to a new economic order, he yet thinks its advent very remote, and believes that the inducements of private interest will in the meantime be indispensable. On the spiritual side he maintains a similar attitude of expectancy. He anticipates the ultimate disappearance of theism, and the substitution of a purely human religion, but believes that the existing doctrine will long be necessary as a stimulus and a control. He thus saps existing foundations without providing anything to take their place, and maintains the necessity of conserving for indefinite periods what he has radically discredited. Nay, even whilst sowing the seeds of change in the direction of a socialistic organization of society, he favors present or proximate arrangements which would urge the industrial world towards other issues. The system of peasant proprietorship of land is distinctly individualistic in its whole tendency; yet he extravagantly praises it in the earlier part of his book, only receding from that laudation when he comes to the chapter on the future of the laboring classes. And the system of so-called co-operation in production which he so warmly commended in the later editions of his work, and led some of his followers to preach as the one thing needful, would inevitably strengthen the principle of personal property, and, whilst professing at most to substitute the competition of associations for that of individuals, would by no means exclude the latter.

The elevation of the working classes he bound up too exclusively with the Malthusian ethics, on which he laid quite an extravagant stress, though, as Mr. Bain has observed, it is not easy to make out his exact views, any more than his father's, on this subject. We have no reason to think that he ever changed his opinion as to the necessity of a restriction on population; yet that element seems foreign to the socialistic idea to which he increasingly leaned. It is at least difficult to see how, apart from individual responsibility for the support of a family, what Malthus called moral restraint could be enforced. This difficulty is indeed the fatal flaw which, in Malthus's own opinion, vitiated the scheme of Godwin.

Mill's openness to new ideas and his enthusiasm for improvement cannot be too much admired. But there appears to have been combined with these fine traits in his mental constitution a certain want of practical sense, a failure to recognize and acquiesce in the necessary conditions of human life, and a craving for "better bread than can be made of wheat." He entertained strangely exaggerated, or rather perverted, notions of the "subjection," the capacities, and the rights of women. He encourages a spirit of revolt on the part of working men against their perpetual condemnation, as a class, to the lot of living by wages, without giving satisfactory proof that this state of things is capable of change, and without showing that such a lot, duly regulated by law and morality, is inconsistent with their real happiness. He also insists on the "independence" of the working class—which according to him *farà da se*—in such a way as to obscure, if not to controvert, the truths that superior rank and wealth are naturally invested with social power, and are bound in duty to exercise it for the benefit of the community at large, and especially of its less favored members. And he attaches a quite undue importance to mechanical and, indeed, illusory expedients, such as the limitation of the power of bequest and the confiscation of the "unearned increment" of rent.

With respect to economic method also, he shifted his position; yet to the end occupied uncertain ground. In the fifth of his early essays he asserted that the method *a priori* is the only mode of investigation in the social sciences, and that the method *a posteriori* "is altogether inefficacious in those sciences, as a means of arriving at any considerable body of valuable truth." When he wrote his *Logic*, he had learned from Comte that the *a posteriori* method—in the form which he chose to call "inverse deduction"—was the only mode of arriving at truth in general sociology; and his admission of this at once renders the essay obsolete. But, unwilling to relinquish the *a priori* method of his youth, he tries to establish a distinction of two sorts of economic inquiry, one of which, though not the other, can be handled by that method. Sometimes he speaks of political economy as a department "carved out of the general body of the science of society;" whilst on the other hand the title of his systematic work implies a doubt whether political economy is a part of "social philosophy" at all, and not rather a study preparatory and auxiliary to it. Thus, on the logical as well as the dogmatic side, he halts between two opinions. Notwithstanding his misgivings and even disclaimers, he yet remained, as to method, a member of the old school, and never passed into the new or "historical" school, to which the future belongs.

Cairnes.

The question of economic method was also taken up by the ablest of his disciples, John Elliott Cairnes (1824–75), who devoted a volume to the subject (*Logical Method of Political Economy*, 1857; 2d ed., 1875). Prof. Walker has lately spoken of the method advocated by Cairnes as different from that put forward by Mill, and has even represented the former as similar to, if not identical with, that of the German historical school. But this is certainly an error. Cairnes, notwithstanding some apparent vacillation of view and certain concessions more formal than real, maintains the utmost rigor of the deductive method; he distinctly affirms that in political economy there is no room for induction at all, "the economist starting with a knowledge of ultimate causes," and being thus, "at the outset of his enterprise, at the position which the physicist only attains after ages of laborious research." He does not, indeed, seem to be advanced beyond the point of view of Senior, who professed to deduce all economic truth from four elementary propositions. Whilst Mill in his *Logic* represents verification as an essential part of the process of demonstration of economic laws, Cairnes holds that, as they "are not assertions respecting the character or sequence of phenomena" (though what else can a scientific law be?), "they can neither be established nor refuted by statistical or documentary evidence." A proposition which affirms nothing respecting phenomena cannot be controlled by being confronted with phenomena. Notwithstanding the unquestionable ability of his book, it appears to mark, in some respects, a retrogression in methodology, and can for the future possess only an historical interest.

Regarded in that light, the labors of Mill and Cairnes on the method of the science, though intrinsically unsound, had an important negative effect. They let down the old political economy from its traditional position, and reduced its extravagant pretensions by two modifications of commonly accepted views. First, whilst Ricardo had never doubted that in all his reasonings he was dealing with human beings as they actually exist, they showed that the science must be regarded as a purely hypothetic one. Its deductions are based on unreal, or at least one-sided, assumptions, the most essential of which is that of the existence of the so-called "economic man," a being who is influenced by two motives only, that of acquiring wealth and that of avoiding exertion; and only so far as the premises framed on this conception correspond with fact can the conclusions be depended on in practice. Senior in vain protested against such a view of the science, which, as he saw, compromised its social efficacy; whilst Torrens, who had previously combated the doctrines of Ricardo, hailed Mill's new presentation of political economy as enabling him, whilst in one sense rejecting those doctrines, in another sense to accept them. Secondly, beside economic science, it had often been said, stands an economic art,—the former ascertaining truths respecting the laws of economic phenomena, the latter prescribing the right kind of economic action; and many had assumed that, the former being given, the latter is also in our possession—that, in fact, we have only to convert theorems into precepts, and the work is done. But Mill and Cairnes made it plain that this statement could not be accepted, that action can no more in the economic world than in any other province of life be regulated by considerations borrowed from that department of things only, that economics can suggest ideas which are to be kept in view, but that, standing alone, it cannot direct conduct—an office for which a wider prospect of human affairs is required. This matter is best elucidated by a reference to Comte's classification, or rather hierarchical arrangement, of the sciences. Beginning with the least complex, mathematics, we rise successively to astronomy, physics, chemistry, thence to biology, and from it again to sociology. In the course of this ascent we come upon all the great laws which regulate the phenomena of the inorganic world, of organized beings, and of society. A further step, however, remains to be taken—namely, to morals; and at this point theory and practice tend to coincide, because every element of conduct has to be considered in relation to the general good. In the final synthesis all the previous analyses have to be used as instrumental, in order to determine how every real quality of things or men may be made to converge to the welfare of humanity.

Cairnes's most important economic publication was his last, entitled *Some Leading Principles of Political Economy, newly Expounded*, 1874. In this work, which does not profess to be a complete treatise on the science, he criticizes and emends the statements which preceding writers had given of some of its principal doctrines, and treats elaborately of the limitations with which they are to be understood, and the exceptions to them which may be produced by special circumstances. Whilst marked by great ability, it affords evidence of what has been justly observed as a weakness in Cairnes's mental constitution—his "deficiency in intellectual sympathy," and consequent frequent inability to see more than one side of a truth.

The three divisions of the book relate respectively to (1) value, (2) labor and capital, and (3) international trade. In the first he begins by elucidating the meaning of the word "value," and under this head controverts the view of Jevons that the exchange value of anything depends entirely on its utility, without, perhaps, distinctly apprehending what Jevons meant by this proposition. On supply and demand he shows, as Say had done before, that these, regarded as aggregates, are not independent, but strictly connected and mutually dependent phenomena—identical, indeed, under a system of barter, but, under a money system, conceivable as distinct. Supply and demand with respect to particular commodities must be understood to mean supply and demand at a given price; and thus we are introduced to the ideas of market price and normal price (as, following Cherbuliez, he terms what Smith less happily called natural price). Normal price again leads to the consideration of cost of production, and here, against Mill and others, he denies that profit and wages enter into cost of production; in other words, he asserts what Senior (whom he does not name) had said before him, though he had not consistently carried out the nomenclature, that cost of production is the sum of labor and abstinence necessary to production, wages and profits being the remuneration of sacrifice and not elements of it. But, it may well be asked, How can an amount of labor be added to an amount of abstinence? Must not wages and profits be taken as "measures of cost?" By adhering to the conception of "sacrifice," he exposes the emptiness of the assertion that "dear labor is the great obstacle to the extension of British trade"—a sentence in which "British trade" means capitalists' profits. At this point we are introduced to a doctrine now first elaborated, though there are indications of it in Mill, of whose theory of international values it is in fact an extension. In foreign trade cost of production, in Cairnes's sense, does not regulate values, because it cannot perform that function except under a régime of effective competition, and between different countries effective competition does not exist. But. Cairnes asks, to what extent does it exist in domestic industries? So far as capital is concerned, he thinks the condition is sufficiently fulfilled over the whole field—a position, let it be said in passing, which he does not seem to make out, if we consider the practical immobility of most invested, as distinct from disposable, capital. But in the case of labor the requisite competition takes place only within certain social, or rather industrial, strata. The world of industry may be divided into a series of superposed groups, and these groups are practically "non-competing," the disposable labor in any one of them being rarely capable of choosing its field in a higher. The law that cost of production determines price cannot, therefore. be absolutely stated, respecting domestic any more than respecting international exchange; as it fails for the latter universally, so it fails for the former as between non-competing groups. The law that holds between these is similar to that governing international values, which may be called the equation of reciprocal demand. Such a state of relative prices will establish itself amongst the products of these groups as shall enable that portion of the products of each group which is applied to the purchase of the products of all other groups to discharge its liabilities towards those other groups. The reciprocal demand of the groups determines the "average relative level" of prices within each group; whilst cost of production regulates the distribution of price among the individual products of each group. This theorem is perhaps of no great practical value; but the tendency of the whole investigation is to attenuate the importance of cost of production as a regulator of normal price, and so to show that yet another of the accepted doctrines of the science had been propounded in too rigid and absolute a form. As to market price, the formula by which Mill had defined it as the price which equalizes demand and supply Cairnes shows to be an identical proposition, and he defines it as the price which most advantageously adjusts the existing supply to the existing demand pending the coming forward of fresh supplies from the sources of production.

His second part is chiefly remarkable for his defence of what is known as the wages fund doctrine, to which we adverted when speaking of Senior. Mill had given up this doctrine, having been convinced by Thornton that it was erroneous; but Cairnes refused to follow his leader, who, as he believes, ought not to have been convinced. After having given what is certainly a fallacious reply to Longe's criticism of the expression "average rate of wages," he proceeds to vindicate the doctrine in question by the consideration that the amount of a nation's wealth devoted at any time to the payment of wages—if the character of the national industries and the methods of production employed remain the same—is in a definite relation to the amount of its general capital; the latter being given, the former is also given. In illustrating his view of the subject, he insists on the principle (true in the main, but too absolutely formulated by Mill) that "demand for commodities is not demand for labor." It is not necessary here to follow his investigation, for his reasoning has not satisfied his successors, with the exception of Fawcett, and the question of wages is now commonly treated without reference to a supposed determinate wages fund. Cairnes next studies trades-unionism in relation to wages, and arrives in substance at the conclusion that the only way in which it can affect their rate is by accelerating an advance which must ultimately have taken place independently of its action. He also takes occasion to refute Mr. (now Sir Thomas) Brassey's supposed law of a uniform cost of labor in every part of the world. Turning to consider the material prospects of the working classes, he examines the question of the changes which may be expected in the amount and partition of the fund out of which abstinence and labor are remunerated. He here enunciates the principle (which had been, however, stated before him by Ricardo and Senior) that the increased productiveness of industry will not affect either profit or wages unless it cheapen the commodities which the laborer consumes. These latter being mostly commodities of which raw produce is the only or principal element, their cost of production, notwithstanding improvements in knowledge and art, will increase unless the numbers of the laboring class be steadily kept in check; and hence the possibility of elevating the condition of the laborer is confined within very narrow limits, if he continues to be a laborer only. The condition of any substantial and permanent improvement in his lot is that he should cease to be a mere laborer—that profits should be brought to reinforce the wages fund, which has a tendency to decline relatively to the general capital of a country. And hence Cairnes—abandoning the purely theoretic attitude which he elsewhere represents as the only proper one for the economist—recommends the system of so-called co-operation (that is, in fact, the abolition of the large capitalist) as offering to the working classes "the sole means of escape from a harsh and hopeless destiny," and puts aside rather contemptuously the opposition of the positivists to this solution, which yet many besides the positivists, as, for example, Leslie and F. A. Walker, regard as chimerical.

The third part is devoted mainly to an exposition of Ricardo's doctrine of the conditions of international trade and Mill's theory of international values. The former Cairnes modifies by introducing his idea of the partial influence of reciprocal demand, as distinguished from cost of production, on the regulation of domestic prices, and founds on this rectification an interesting account of the connection between the wages prevailing in a country and the character and course of its external trade. He emends Mill's statement, which represented the produce of a country as exchanging for that of other countries at such values "as are required in order that the whole of her exports may exactly pay for the whole of her imports" by substituting for the latter phrase the condition that each country should by means of her exports discharge all of her foreign liabilities—in other words, by introducing the consideration of the balance of debts. This idea was not new; it had been indicated by J. L. Foster as early as 1804, and was touched on by Mill himself; but he expounds it well; and it is important as clearing away common misconceptions, and sometimes removing groundless alarms. Passing to the question of free trade, he disposes of some often-repeated protectionist arguments, and in particular refutes the American allegation of the inability of the highly-paid labor of that country to compete with the "pauper labor" of Europe. He is not so successful in meeting the "political argument," founded on the admitted importance for civilization of developing diversified national industries; and he meets only by one of the highly questionable commonplaces of the doctrinaire economists Mill's proposition that protection may foster nascent industries really adapted to a country till they have struck root and are able to endure the stress of foreign competition.

We have dwelt at some length on this work of Cairnes, not only because it presents the latest forms of several accepted economic doctrines, but also because it is, and, we believe, will remain, the last important product of the old English school. The author at the outset expresses the hope that it will strengthen and add consistence to the scientific fabric "built up by the labors of Adam Smith, Malthus, Ricardo, and Mill." Whilst recognizing with him the great merits of Smith, and the real abilities and services of his three successors here named, we cannot entertain the same opinion as Cairnes respecting the permanence of the fabric they constructed. We hold that a new edifice is required, incorporating indeed many of the materials of the old, but planned on different ideas and in some respects with a view to different ends—above all, resting on different philosophic foundations, and having relation in its whole design to the more comprehensive structure of which it will form but one department, namely, the general science of society.

We have already had occasion to refer to Cairnes's *Essays in Political Economy*, 1873. His *Slave Power* (1862) was the most valuable work which appeared on the subject of the great American conflict.

France.—All the later European schools presuppose—in part adopting, in part criticising—the work of the English economists from Smith[1] to Ricardo and the Epigoni. The German school has had in a greater degree than any other a movement of its own,—following, at least in its more recent period, an original method, and tending to special and characteristic conclusions. The French school, on the other hand,—if we omit the socialists, who do not here come under consideration,—has in the main reproduced the doctrines of the leading English thinkers,—stopping short, however, in general of the extremes of Ricardo and his disciples. In the field of exposition the French are unrivalled; and in political economy they have produced a series of more or less remarkable sytematic treatises, text books, and compendiums, at the head of which stands the celebrated work of J. B. Say. But the number of seminal minds which have appeared in French economic literature—of writers who have contributed important truths, introduced improvements of method, or presented the phenomena under new lights—has not been large. Sismondi, Dunoyer, and Bastiat will deserve our attention, as being the most important of those who occupy independent positions (whether permanently tenable or not), if we pass over for the present the great philosophical renovation of Auguste Comte, which comprehended actually or potentially all the branches of sociological inquiry. Before estimating the labors of

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[1] The first French translation of the *Wealth of Nations*, by Blavet, appeared in the *Journal de l' Agriculture, du Commerce, des Finances, et des Arts*, 1779-80; new editions of it were published in 1781, 1788, and 1800; it was also printed at Amsterdam in 1784. Smith himself recommended it in his third edition of the original as excellent. In 1790 appeared the translation by Roucher, with notes by Condorcet, and in 1802 that by Count Germain Garnier, executed during his exile in England, which is now considered the standard version, and has been reproduced, with notes by Say, Sismondi, Blanqui, etc., in the *Collection des Principaux Économistes*.

Bastiat, we shall find it desirable to examine the views of Carey, the most renowned of American economists, with which the latest teachings of the ingenious and eloquent Frenchmen are, up to a certain point, in remarkable agreement. Cournot, too, must find a place among the French writers of this period, as the chief representative of the conception of a mathematical method in political economy.

Say.

Of Jean Baptiste Say (1767–1832) Ricardo says—"He was the first, or among the first, of Continental writers who justly appreciated and applied the principles of Smith, and has done more than all other Continental writers taken together to recommend that enlightened and beneficial system to the nations of Europe." The *Wealth of Nations* in the original language was placed in Say's hands by Clavière, afterwards minister, then director of the assurance society of which Say was a clerk; and the book made a most powerful impression on him. Long after, when Dupont de Nemours complained of his injustice to the physiocrats, and claimed him as, through Smith, a spiritual grandson of Quesnay and nephew of Turgot, he replied that he had learned to read in the writings of the mercantile school, had learned to think in those of Quesnay and his followers, but that it was in Smith that he had learned to seek the causes and the effects of social phenomena in the nature of things, and to arrive at this last by a scrupulous analysis. His *Traité d'Économie Politique* (1803) was essentially founded on Smith's work, but he aimed at arranging the materials in a more logical and instructive order. He has the French art of easy and lucid exposition, though his facility sometimes degenerates into superficiality; and hence his book became popular, both directly and through translations obtained a wide circulation, and diffused rapidly through the civilized world the doctrines of the master. Say's knowledge of common life, says Roscher, was equal to Smith's; but he falls far below him in living insight into larger political phenomena, and he carefully eschews historical and philosophical explanations. He is sometimes strangely shallow, as when he says that "the best tax is that smallest in amount." He appears not to have much claim to the position of an original thinker in political economy. Ricardo, indeed, speaks of him as having "enriched the science by several discussions, original, accurate, and profound." What he had specially in view in using these words was what is, perhaps rather pretentiously, called Say's *théorie des débouchés*, with his connected disproof of the possibility of a universal glut. The theory amounts simply to this, that buying is also selling, and that it is by producing that we are enabled to purchase the products of others. Several distinguished economists, especially Malthus and Sismondi, in consequence chiefly of a misinterpretation of the phenomena of commercial crises, maintained that there might be general over-supply or excess of all commodities above the demand. This Say rightly denied. A particular branch of production may, it must indeed be admitted, exceed the existing capabilities of the market; but, if we remember that supply is demand, that commodities are purchasing power, we cannot accept the doctrine of the possibility of a universal glut without holding that we can have too much of everything—that "all men can be so fully provided with the precise articles they desire as to afford no market for each other's superfluities." But, whatever services he may have rendered by original ideas on those or other subjects, his great merit is certainly that of a propagandist and popularizer.

The imperial police would not permit a second edition of his work to be issued without the introduction of changes which, with noble independence, he refused to make; and that edition did not therefore appear till 1814. Three other editions were published during the life of the author—in 1817, 1819 and 1826. In 1828 Say published a second treatise, *Cours complet d'Économie Politique Pratique*, which contained the substance of his lectures at the Conservatoire des Arts et Métiers and at the Collège de France. Whilst in his earlier treatise he had kept within the narrow limits of strict economics, in his later work he enlarged the sphere of discussion, introducing in particular many considerations respecting the economic influence of social institutions.

Sismondi.

Jean Charles L. Simonde de Sismondi (1773–1842), author of the *Histoire des Républiques Italiennes du moyen âge*, represents in the economic field a protest, founded mainly on humanitarian sentiment, against the dominant doctrines. He wrote first a treatise *De la Richesse Commerciale* (1803), in which he followed strictly the principles of Adam Smith. But he afterwards came to regard these principles as insufficient and requiring modification. He contributed an article on political economy to the *Edinburgh Encyclopædia*, in which his new views were partially indicated. They were fully developed in his principal economic work, *Nouveaux Principes d'Économie Politique, ou de la Richesse dans ses rapports avec la Population* (1819; 2d ed., 1827). This work, as he tells us, was not received with favor by economists, a fact which he explains by the consideration that he had "attacked an orthodoxy—an enterprise dangerous in philosophy as in religion." According to his view, the science, as commonly understood, was too much of a mere chrematistic: it studied too exclusively the means of increasing wealth, and not sufficiently the use of this wealth for producing general happiness. The practical system founded on it tended, as he believed, not only to make the rich richer, but to make the poor poorer and more dependent; and he desired to fix attention on the question of distribution as by far the most important, especially in the social circumstances of recent times.

The personal union in Sismondi of three nationalities, the Italian, the French and the Swiss, and his comprehensive historical studies, gave him a special largeness of view; and he was filled with a noble sympathy for the suffering members of society. He stands nearer to socialism than any other French economist proper, but it is only in sentiment, not in opinion, that he approximates to it; he does not recommend any socialistic scheme. On the contrary, he declares in a memorable passage that, whilst he sees where justice lies, he must confess himself unable to suggest the means of realizing it in practice; the division of the fruits of industry between those who are united in their production appears to him vicious; but it is, in his judgment, almost beyond human power to conceive any system of property absolutely different from that which is known to us by experience. He goes no further than protesting, in view of the great evils which he saw around him, against the doctrine of *laissez faire*, and invoking, somewhat vaguely, the intervention of Governments to "regulate the progress of wealth" and to protect the weaker members of the community.

His frank confession of impotence, far wiser and more honorable than the suggestion of precipitate and dangerous remedies, or of a recurrence to outworn mediæval institutions, has not affected the reputation of the work. A prejudice was indeed early created against it in consequence of its partial harmony of tone, though, as we have seen, not of policy, with socialism, which was then beginning to show its strength, as well as by the rude way in which his description of the modern industrial system, especially as it existed in England, disturbed the complacent optimism of some members of the so-called orthodox school. These treated the book with ill-disguised contempt, and Bastiat spoke of it as preaching an *économie politique à rebours*. But it has held its place in the literature of the science, and is now even more interesting than when it first appeared, because in our time there is a more general disposition, instead of denying or glossing over the serious evils of industrial society, to face and remove or at least mitigate them. The *laissez faire* doctrine, too, has been discredited in theory and abandoned in practice; and we are ready to admit Sismondi's view of the state as a power not merely intrusted with the maintenance of peace, but charged also with the mission of extending the benefits of the social union and of modern progress as widely as possible through all classes of the community. Yet the impression which his treatise leaves behind it is a discouraging one; and this because he regards as essentially evil many things which seem to be the necessary results of the development of industry. The growth of a wealthy capitalist class and of manufacture on the great scale, the rise of a vast body of workers who live by their labor alone, the extended application of machines, large landed properties cultivated with the aid of the most advanced appliances—all these he dislikes and deprecates; but they appear to be inevitable. The problem is how to regulate and moralize the system they imply; but we must surely accept it in principle, unless we aim at a thorough social revolution. Sismondi may be regarded as the precursor of the German economists known under the inexact designation of "Socialists of the Chair"; but their writings are much more hopeful and inspiring.

To the subject of population he devotes special care, as of great importance for the welfare of the working classes. So far as agriculturists are concerned, he thinks the system of what he calls patriarchal exploitation, where the cultivator is also proprietor, and is aided by his family in tilling the land—a law of equal division among the natural heirs being apparently presupposed—the one which is most efficacious in preventing an undue increase of the population. The father is, in such a case, able distinctly to estimate the resources available for his children, and to determine the stage of subdivision which would necessitate the descent of the family from the material and social position it had previously occupied. When children beyond this limit are born, they do not marry, or they choose amongst their number one to continue the race. This is the view which, adopted by J. S. Mill, makes so great a figure in the too favorable presentation by that writer of the system of peasant proprietors.

Dunoyer.

In no French economic writer is greater force or general solidity of thought to be found than in Charles Dunoyer (1786–1862), author of *La Liberté du Travail* (1845; the substance of the first volume had appeared under a different title in 1825), honorably known for his integrity and independence under the régime of the Restoration. What makes him of special importance in the history of the science is his view of its philosophical constitution and method. With respect to method, he strikes the keynote at the very outset in the words "rechercher expérimentalement," and in professing to build on "les données de l'observation et de l'expérience." He shows a marked tendency to widen economics into a general science of society, expressly describing political economy as having for its province the whole order of things which results from the exercise and development of the social forces. This larger study is indeed better named sociology; and economic studies are better regarded as forming one department of it. But the essential circumstance is that, in Dunoyer's treatment of his great subject, the widest intellectual, moral, and political considerations are inseparably combined with purely economic ideas. It must not be supposed that by liberty, in the title of his work, is meant merely freedom from legal restraint or administrative interference; he uses it to express all that tends to give increased efficiency to labor. He is thus led to discuss all the causes of human progress, and to exhibit them in their historical working.

Treating, in the first part, of the influence of external conditions, of race, and of culture on liberty in this wider sense, he proceeds to divide all productive effort into two great classes, according as the action is exercised on things or on men, and censures the economists for having restricted their attention to the former. He studies in his second and third parts respectively the conditions of the efficiency of these two forms of human exertion. In treating of economic life, strictly so-called, he introduces his fourfold division of material industry, in part adopted by J. S. Mill, as "(1) extractive, (2) voiturière, (3) manufacturière, (4) agricole," a division which is useful for physical economics, but will always, when the larger social aspect of things is considered, be inferior to the more commonly accepted one into agricultural, manufacturing, and commercial industry, banking being supposed as common president and regulator. Dunoyer, having in view only action on material objects, relegates banking, as well as commerce proper, to the separate head of exchange, which, along with association and gratuitous transmission (whether *inter vivos* or *mortis causa*), he classes apart as being, not industries, in the same sense with the occupations named, but yet functions essential to the social economy. The industries which act on man he divides according as they occupy themselves with (1) the amelioration of our physical nature, (2) the culture of our imagination and sentiments, (3) the education of our intelligence, and (4) the improvement of our moral habits; and he proceeds accordingly to study the social offices of the physician, the artist, the educator, and the priest. We meet in Dunoyer the ideas afterwards emphasized by Bastiat that the real subjects of human exchange are services; that all value is due to human activity; that the powers of nature always render a gratuitous assistance to the labor of man; and that the rent of land is really a form of interest on invested capital. Though he had disclaimed the task of a practical adviser in the often-quoted sentence—"Je n'impose rien; je ne propose même rien; j'expose," he finds himself, like all economists, unable to abstain from offering counsel. And his policy is opposed to any state interference with industry. Indeed he preaches in its extreme rigor the *laissez faire* doctrine, which he maintains principally on the ground that the spontaneous efforts of the individual for the improvement of his condition, by developing foresight, energy, and perseverance, are the most efficient means of social culture. But he certainly goes too far when he represents the action of Governments as normally always repressive and never directive. He was doubtless led into this exaggeration by his opposition to the artificial organizations of labor proposed by so many of his contemporaries, against which he had to vindicate the principle of competition, but his criticism of these schemes took, as Comte remarks, too absolute a character, tending to the perpetual interdiction of a true systematization of industry.

Digression on American economists.

At this point it will be convenient to turn aside and notice the doctrines of the American economist Carey. Not much had been done before him in the science by citizens of the United States. Benjamin Franklin, otherwise of world-wide renown, was author of a number of tracts, in most of which he merely enforces practical lessons of industry and thrift, but in some throws out interesting theoretic ideas. Thus, fifty years before Smith, he suggested (as Petty, however, had already done) human labor as the true measure of value (*Modest Inquiry into the Nature and Necessity of a Paper Currency*, (1721), and in his *Observations concerning the Increase of Mankind* (1751) he expresses views akin to those of Malthus. Alexander Hamilton, secretary of the treasury, in 1791 presented in his official capacity to the House of Representatives of the United States a report on the measures by which home manufactures could be promoted. In this document he gives a critical account of the theory of the subject, represents Smith's system of free trade as possible in practice only if adopted by all nations simultaneously, ascribes to manufactures a greater productiveness than to agriculture, and seeks to refute the objections against the development of the former in America founded on the want of capital, the high rate of wages, and the low price of land. The conclusion at which he arrives is that for the creation of American manufactures a system of moderate protective duties was necessary, and he proceeds to describe the particular features of such a system. There is some reason to believe that the German economist List, of whom we shall speak hereafter, was influenced by Hamilton's work, having, during his exile from his native country, resided in the same State, Pennsylvania, of which Hamilton was a citizen.[1]

Franklin.

Hamilton.

Carey.

Henry Charles Carey (1793–1879), son of an American citizen who had emigrated from Ireland, represents a reaction against the dispiriting character which the Smithian doctrines had assumed in the hands of Malthus and Ricardo. His aim was, whilst adhering to the individualistic economy, to place it on a higher and surer basis, and fortify it against the assaults of socialism, to which some of the Ricardian tenets had exposed it. The most comprehensive as well as mature exposition of his views is contained in his *Principles of Social Science* (1859). Inspired with the optimistic sentiment natural to a young and rising nation with abundant undeveloped resources and an unbounded outlook towards the future, he seeks to show that there exists, independently of human wills, a natural system of economic laws, which is essentially beneficent, and of which the increasing prosperity of the whole community, and especially of the working classes, is the spontaneous result,—capable of being defeated only by the ignorance or perversity of man resisting or impeding its action. He rejects the Malthusian doctrine of population, maintaining that numbers regulate themselves sufficiently in every well governed society, and that their pressure on subsistence characterizes the lower, not the more advanced, stages of civilization. He rightly denies the universal truth, for all stages of cultivation, of the law of diminishing returns from land. His fundamental theoretic position relates to the antithesis of wealth and value.

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[1] [Hamilton was a citizen of New York.—Am. Ed.]

Wealth had been by most economists confounded with the sum of exchange values; even Smith, though at first distinguishing them, afterwards allowed himself to fall into this error. Ricardo had, indeed, pointed out the difference, but only near the end of his treatise, in the body of which value alone is considered. The later English economists had tended to regard their studies as conversant only with exchange; so far had this proceeded that Whately had proposed for the science the name of Catallactics. When wealth is considered as what it really is, the sum of useful products, we see that it has its origin in external nature as supplying both materials and physical forces, and in human labor as appropriating and adapting those natural materials and forces. Nature gives her assistance gratuitously; labor is the sole foundation of value. The less we can appropriate and employ natural forces in any production the higher the value of the product, but the less the addition to our wealth in proportion to the labor expended. Wealth, in its true sense of the sum of useful things, is the measure of the power we have acquired over nature, whilst the value of an object expresses the resistance of nature which labor has to overcome in order to produce the object. Wealth steadily increases in the course of social progress; the exchange-value of objects, on the other hand, decreases. Human intellect and faculty of social combination secure increased command over natural powers, and use them more largely in production, whilst less labor is spent in achieving each result, and the value of the product accordingly falls. The value of the article is not fixed by its cost of production in the past; what really determines it is the cost which is necessary for its reproduction under the present conditions of knowledge and skill. The dependence of value on cost, so interpreted, Carey holds to be universally true; whilst Ricardo maintained it only with respect to objects capable of indefinite multiplication, and in particular did not regard it as applicable to the case of land. Ricardo saw in the productive powers of land a free gift of nature which had been monopolized by a certain number of persons, and which became, with the increased demand for food, a larger and larger value in the hands of its possessors. To this value, however, as not being the result of labor, the owner had no rightful claim; he could not justly demand a payment for what was done by the "original and indestructible powers of the soil." But Carey held that land, as we are concerned with it in industrial life, is really an instrument of production which has been formed as such by man, and that its value is due to the labor expended on it in the past,—though measured, not by the sum of that labor, but by the labor necessary under existing conditions to bring new land to the same stage of productiveness. He studies the occupation and reclamation of land with peculiar advantage as an American, for whom the traditions of first settlement are living and fresh, and before whose eyes the process is indeed still going on. The difficulties of adapting a primitive soil to the work of yielding organic products for man's use can be lightly estimated only by an inhabitant of a country long under cultivation. It is, in Carey's view, the overcoming of these difficulties by arduous and continued effort that entitles the first occupier of land to his property in the soil. Its present value forms a very small proportion of the cost expended on it, because it represents only what would be required, with the science and appliances of our time, to bring the land from its primitive into its present state. Property in land is therefore only a form of invested capital—a quantity of labor or the fruits of labor permanently incorporated with the soil; for which, like any other capitalist, the owner is compensated by a share of the produce. He is not rewarded for what is done by the powers of nature, and society is in no sense defrauded by his sole possession. The so-called Ricardian theory of rent is a speculative fancy, contradicted by all experience. Cultivation does not in fact, as that theory supposes, begin with the best, and move downwards to the poorer soils in the order of their inferiority.[1] The light and dry higher lands are first cultivated; and only when population has become dense and capital has accumulated, are the low-lying lands, with their greater fertility, but also with their morasses, inundations, and miasmas, attacked and brought into occupation. Rent, regarded as a proportion of the produce, sinks, like all interest on capital, in process of time, but, as an absolute amount, increases. The share of the laborer increases, both as a proportion and an absolute amount. And thus the interests of these different social classes are in harmony.

But, Carey proceeds to say, in order that this harmonious progress may be realized, what is taken from the land must be given back to it. All the articles derived from it are really separated parts of it, which must be restored on pain of its exhaustion. Hence the producer and the consumer must be close to each other; the products must not be exported to a foreign country in exchange for its manufactures, and thus go to enrich as manure a foreign soil. In immediate exchange-value the landowner may gain by such exportation, but the productive powers of the land will suffer. And thus Carey, who had set out as an earnest advocate of free trade, arrives at the doctrine of protection: the "coördinating power" in society must intervene to prevent private advantage from working public mischief.[2] He attributes his conversion on this question to his observation of the effects of liberal and protective tariffs respectively on American prosperity. This observation, he says, threw him back on theory, and led him to see that the intervention referred to might be necessary to remove (as he phrases it) the obstacles to the progress of younger communities created by the action of older and wealthier nations. But it seems probable that the influence of List's writings, added to his own deep-rooted and hereditary jealousy and dislike of English predominance, had something to do with his change of attitude.

The practical conclusion at which he thus arrived, though it is by no means in contradiction to the doctrine of the existence of natural economic laws, accords but ill with his optimistic scheme; and another economist, accepting his fundamental ideas, applied himself to remove the foreign accretion, as he regarded it, and to preach the theory of spontaneous social harmonies in relation with the practice of free trade as its legitimate outcome.

Bastiat.

Frédéric Bastiat (1801–1850), though not a profound thinker, was a brilliant and popular writer on economic questions. Though he always had an inclination for such studies, he was first impelled to the active propagation of his views by his earnest sympathy with the English anti-corn-law agitation. Naturally of an ardent temperament, he threw himself with zeal into the free-trade controversy, through which he hoped to influence French economic policy, and published in 1845 a history of the struggle under the title of *Cobden et la Ligue*. In 1845–48 appeared his *Sophismes Économiques* (Eng. trans. by P. J. Stirling, 1873), in which he exhibited his best qualities of mind. Though Cairnes goes too far in comparing this work with the *Lettres Provinciales*, it is certainly marked by much liveliness, point, and vigor. But to expose the absurdities of the ordinary protectionism was no difficult task; it is only in such a form as the doctrine assumed in the hands of List, as a purely provisional and preparatory scheme, that it deserves and demands consideration. After the revolution of 1848, which for a time put an end to the free-trade movement in France, the efforts of Bastiat were directed against the socialists. Besides several minor pieces possessing the same sort of merit as the *Sophismes*, he produced, with a view to this controversy, his most ambitious as well as characteristic work, the *Harmonies Économiques* (Eng. trans. by P. J. Stirling, 1860). Only the first volume was published; it appeared in 1850, and its author died in the same year. Since then the notes and sketches which he had prepared as materials towards the production of the second volume have been given to the public in the collected edition of his writings (by Paillottet, with Life by Fontenay, 7 vols.), and we can thus gather what would have been the spirit and substance of the later portions of the book.

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[1] It is, however, a mistake to suppose that the assumption of this historical order of descent is essential to the theory in question.

[2] This argument seems scarcely met by Prof. F. A. Walker, *Political Economy*, 50–52. But perhaps he is right in thinking that Carey exaggerates the importance of the considerations on which it is founded. Mill and Leslie remark that the transportation of agricultural products from the western to the Atlantic States has the same effect as their export to Europe, so far as this so-called "land-butchery" is concerned; besides, some manures are obtainable from abroad.

It will always be historically interesting as the last incarnation of thorough-going economic optimism. This optimism, recurring to its first origin, sets out from theological considerations, and Bastiat is commended by his English translator for treating political economy "in connection with final causes." The spirit of the work is to represent "all principles, all motives, all springs of action, all interests, as co-operating towards a grand final result which humanity will never reach, but to which it will always increasingly tend, namely, the indefinite approximation of all classes towards a level, which steadily rises,—in other words, the equalization of individuals in the general amelioration."

What claimed to be novel and peculiar in his scheme was principally his theory of value. Insisting on the idea that value does not denote anything inherent in the objects to which it is attributed, he endeavored to show that it never signifies anything but the ratio of two "services." This view he develops with great variety and felicity of illustration. Only the mutual services of human beings, according to him, possess value and can claim a retribution; the assistance given by nature to the work of production is always purely gratuitous, and never enters into price. Economic progress, as, for example, the improvement and larger use of machinery, tends perpetually to transfer more and more of the elements of utility from the domain of property, and therefore of value, into that of community, or of universal and unpurchased enjoyment. It will be observed that this theory is substantially identical with Carey's, which had been earlier propounded; and the latter author in so many words alleges it to have been taken from him without acknowledgment. It has not perhaps been sufficiently attended to that very similar views are found in Dunoyer, of whose work Bastiat spoke as exercising a powerful influence on "the restoration of the science," and whom Fontenay, the biographer of Bastiat, tells us he recognized as one of his masters, Charles Comte being the other.

The mode which has just been explained of conceiving industrial action and industrial progress is interesting and instructive so far as it is really applicable, but it was unduly generalized. Cairnes has well pointed out that Bastiat's theoretic soundness was injuriously affected by his habit of studying doctrines with a direct view to contemporary social and political controversies. He was thus predisposed to accept views which appeared to lend a sanction to legitimate and valuable institutions, and to reject those which seemed to him to lead to dangerous consequences. His constant aim is, as he himself expressed it, to "break the weapons" of antisocial reasoners "in their hands," and this preoccupation interferes with the single-minded effort towards the attainment of scientific truth. The creation or adoption of his theory of value was inspired by the wish to meet the socialistic criticism of property in land; for the exigencies of this controversy it was desirable to be able to show that nothing is ever paid for except personal effort. His view of rent was, therefore, so to speak, foreordained, though it may have been suggested, as indeed the editor of his posthumous fragments admits, by the writings of Carey. He held, with the American writer, that rent is purely the reward of the pains and expenditure of the landlord or his predecessors in the process of converting the natural soil into a *farm* by clearing, draining, fencing, and the other species of permanent improvements.[1] He thus gets rid of (the so-called) Ricardian doctrine, which was accepted by the socialists, and by them used for the purpose of assailing the institution of landed property, or, at least, of supporting a claim of compensation to the community for the appropriation of the land by the concession of the "right to labor." As Cairnes has said, "what Bastiat did was this: having been at infinite pains to exclude gratuitous gifts of nature from the possible elements of value, and pointedly identified [rather, associated] the phenomena with 'human effort' as its exclusive source, he designates human effort by the term 'service,' and then employs this term to admit as sources of value those very gratuitous natural gifts the exclusion of which in this capacity constituted the essence of his doctrine." The justice of this criticism will be apparent to any one who considers the way in which Bastiat treats the question of the value of a diamond. That what is paid for in most cases of human dealings is *effort* no one can dispute. But it is surely a *reductio ad absurdum* of his theory of value, regarded as a doctrine of universal application, to represent the price of a diamond which has been accidentally found as remuneration for the effort of the finder in appropriating and transmitting it. And, with respect to land, whilst a large part of rent, in the popular sense, must be explained as interest on capital, it is plain that the native powers of the soil are capable of appropriation, and that then a price can be demanded and will be paid for their use.

Bastiat is weak on the philosophical side; he is filled with the ideas of theological teleology, and is led by these ideas to form *a priori* opinions of what existing facts and laws must necessarily be. And the *jus naturæ*, which, like metaphysical ideas generally, has its root in theology, is as much a postulate with him as with the physiocrats. Thus, in his essay on *Free Trade*, he says: "Exchange is a natural right like property. Every citizen who has created or acquired a product ought to have the option of either applying it immediately to his own use or ceding it to whosoever on the surface of the globe consents to give him in exchange the object of his desires." Something of the same sort had been said by Turgot; and in his time this way of regarding things was excusable, and even provisionally useful; but in the middle of the 19th century it was time that it should be seen through and abandoned.

Bastiat had a real enthusiasm for a science which he thought destined to render great services to mankind, and he seems to have believed intensely the doctrines which gave a special color to his teaching. If his optimistic exaggerations favored the propertied classes, they certainly were not prompted by self-interest or servility. But they *are* exaggerations; and, amidst the modern conflicts of capital and labor, his perpetual assertion of social harmonies is the cry of peace, peace, where there is no peace. The freedom of industry, which he treated as a sort of panacea, has undoubtedly brought with it great benefits; but a sufficient experience has shown that it is inadequate to solve the social problem. How can the advocates of economic revolution be met by assuring them that everything in the natural economy is harmonious—that, in fact, all they seek for already exists? A certain degree of spontaneous harmony does indeed exist, for society could not continue without it, but it is imperfect and precarious; the question is, How can we give to it the maximum of completeness and stability?

Cournot.

Augustin Cournot (1801-1877) appears to have been the first (the German, H. H. Gossen, praised by Jevons, wrote in 1854) who, with a competent knowledge of both subjects, endeavored to apply mathematics to the treatment of economic questions. His treatise entitled *Recherches sur les Principes Mathématiques de la Théorie des Richesses* was published in 1838. He mentions in it only one previous enterprise of the same kind (though there had in fact been others)—that, namely, of Nicolas François Canard, whose book, published in 1802, was crowned by the Institute, though "its principles were radically false as well as erroneously applied." Notwithstanding Cournot's just reputation as a writer on mathematics, the *Recherches* made little impression. The truth seems to be that his results are in some cases of little importance, in others of questionable correctness, and that, in the abstractions to which he has recourse in order to facilitate his calculations, an essential part of the real conditions of the problem is sometimes omitted. His pages abound in symbols representing unknown functions, the form of the function being left to be ascertained by observation of facts, which he does not regard as a part of his task, or only some known properties of the undetermined function being used as bases for deduction. Jevons includes in his list of works in which a mathematical treatment of economics, is adopted a second treatise which Cournot published in 1863, with the title *Principes de la Théorie des Richesses.* But in reality in the work so named, which is written with great ability, and contains much forcible reasoning in opposition to the exaggerations of economic optimists, the mathematical method is abandoned, and there is not an algebraical formula in the book. The author admits that the public has always shown a repugnance to the use of mathematical symbols in economic discussion, and, though he thinks they might be of service in facilitating exposition, fixing the ideas, and suggesting further developments, he acknowledges that a grave danger attends their use. The danger, according to him, consists in the probability that an undue value may be attached to the abstract hypotheses from which the investigator sets out, and which enable him to construct his formulæ. And his practical conclusion is that mathematical processes should be employed only with great precaution, or even not employed at all if the public judgment is against them, for "this judgment," he says, "has its secret reasons, almost always more sure than those which determine the opinions of individuals." It is an obvious consideration that the acceptance of unsound or one-sided abstract principles as the premises of argument does not depend on the use of mathematical forms, though it is possible that the employment of the latter may by association produce an illusion in favor of the certainty of those premises. But the great objection to the use of mathematics in economic reasoning is that it is necessarily sterile. If we examine the attempts which have been made to employ it, we shall find that the fundamental conceptions on which the deductions are made to rest are vague, indeed metaphysical, in their character. Units of animal or moral satisfaction, of utility, and the like are as foreign to positive science as a unit of dormitive faculty would be; and a unit of value, unless we understand by value the quantity of one commodity exchangeable under given conditions for another, is an equally indefinite idea. Mathematics can indeed formulate ratios of exchange when they have once been observed; but it cannot by any process of its own determine those ratios, for quantitative conclusions imply quantitative premises, and these are wanting. There is then no future for this kind of study, and it is only waste of intellectual power to pursue it. But the importance of mathematics as an educational introduction to all the higher orders of research is not affected by this conclusion. The study of the physical medium, or environment, in which economic phenomena take place, and by which they are affected, requires mathematics as an instrument; and nothing can ever dispense with the didactic efficacy of that science, as supplying the primordial type of rational investigation, giving the lively sentiment of decisive proof, and disinclining the mind to illusory conceptions and sophistical combinations. And a knowledge of at least the fundamental principles of mathematics is necessary to economists to keep them right in their statements of doctrine, and prevent their enunciating propositions which have no definite meaning. Even distinguished writers sometimes betray a serious deficiency in this respect; thus they assert that one quantity "varies inversely as" another when what is meant is that the sum (not the product) of the two is constant; and they treat as capable of numerical estimation the amount of an aggregate of elements which, differing in kind, cannot be reduced to a common standard. As an example of the latter error, it may be mentioned that "quantity of labor," so often spoken of by Ricardo, and in fact made the basis of his system, includes such various species of exertion as will not admit of summation or comparison.

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[1] M. Leroy-Beaulieu has recently maintained (*Essai sur la Répartition des Richesses*, 2d ed., 1882) that this, though not strictly, is approximately true—that economic forms a very small part of actual rent.

Italy.—The first Italian translation of the *Wealth of Nations* appeared in 1780. The most distinguished Italian economist of the period here dealt with was, however, no disciple of Smith. This was Melchiorre Gioja, author, besides statistical and other writings, of a voluminous work entitled *Nuovo Prospetto delle Scienze Economiche* (6 vols., 1815–17; the work was never completed), intended to be an encyclopædia of all that had been taught by theorists, enacted by Governments, or effected by populations in the field of public and private economy. It is a learned and able treatise, but so overladen with quotations and tables as to repel rather than attract readers. Gioja admired the practical economic system of England, and enlarges on the advantages of territorial properties, manufactures, and mercantile enterprises on the large as opposed to the small scale. He defends a restrictive policy, and insists on the necessity of the action of the state as a guiding, supervising, and regulating power in the industrial world. But he is in full sympathy with the sentiment of his age against ecclesiastical domination and other mediæval survivals. We can but very briefly notice Romagnosi (d. 1835), who, by his contributions to periodical literature, and by his personal teaching, greatly influenced the course of economic thought in Italy; Antonio Scialoja (*Principii d'Economia Sociale*, 1840; and *Carestia e Governo*, 1853), an able advocate of free trade (d. 1877); Luigi Cibrario, well known as the author of *Economia Politica del medio evo* (1839; 5th ed. 1861; French trans. by Barneaud, 1859), which is in fact a view of the whole social system of that period; Girolamo Boccardo (b. 1829; *Trattato Teorico-pratico di Economia politica*, 1853); the brilliant controversialist Francesco Ferrara, professor at Turin from 1849 to 1858 (in whose school most of the present Italian teachers of the science were, directly or indirectly, educated), a partisan of the *laissez faire* doctrine in its most extreme form, and an advocate of the peculiar opinions of Carey and Bastiat on the subject of rent; and, lastly, the Neapolitan minister Ludovico Bianchini (*Principii della Scienza del Ben Vivere Sociale*, 1845 and 1855), who is remarkable as having followed in some degree an historical direction, and asserted the principle of relativity, and who also dwelt on the relations of economics with morals, by a due attention to which the Italian economists have, indeed, in general been honorably distinguished.

Gioja.

Spain.—*The Wealth of Nations* was translated into Spanish by Ortiz in 1794. It may perhaps have influenced Gaspar de Jovellanos, who in 1795 presented to the council of Castile and printed in the same year his celebrated *Informe de la Sociedad Economica de Madrid en expediente de Ley Agraria*, which was a powerful plea for reform, especially in taxation and the laws affecting agriculture, including those relating to the systems of entail and mortmain. An English version of this memoir is given in the translation (1809) of Laborde's *Spain*, vol. iv.

Jovellanos.

Germany.—Roscher observes that Smith did not at first produce much impression in Germany.[1] He does not appear to have been known to Frederick the Great; he certainly exercised no influence on him. Nor did Joseph II. take notice of his work. And of the minor German princes, Karl Friedrich of Baden, as a physiocrat, would not be accessible to his doctrines. It was otherwise in the generation whose principal activity belongs to the first decade of the 19th century. The Prussian statesmen who were grouped round Stein had been formed as economists by Smith, as had also Gentz, intellectually the most important man of the Metternich régime in Austria.

The first German expositors of Smith who did more than merely reproduce his opinions were Christian Jacob Kraus (1753–1807), George Sartorius (1766–1828), and August Ferdinand Lüder (1760–1819). They contributed independent views from different standpoints,—the first from that of the effect of Smith's doctrine on practical government, the second from that of its bearing on history, the third from that of its relation to statistics. Somewhat later came Gottlieb Hufeland (1760–1817), Johann Friedrich Eusebius Lotz (1771–1838), and Ludwig Heinrich von Jakob (1759–1827), who, whilst essentially of the school of Smith, apply themselves to a revision of the fundamental conceptions of the science. These authors did not exert anything like the wide influence of Say, partly on account of the less attractive form of their writings, but chiefly because Germany had not then, like France, a European audience. Julius von Soden (1754–1831) is largely founded on Smith, whom, however, he criticises with undue severity, especially in regard to his form and arrangement; the *Wealth of Nations* he describes as a series of precious fragments, and censures Smith for the absence of a comprehensive view of his whole subject, and also as one-sidedly English in his tendencies.

The highest form of the Smithian doctrine in Germany is represented by four distinguished names: Karl Heinrich Rau (1792–1870), Friedrich Nebenius (1784–1857), Friedrich Benedict Wilhelm Hermann (1795–1868), and Johann Heinrich von Thünen (1783–1850).

Rau.

Rau's characteristic is "erudite thoroughness." His *Lehrbuch* (1826–32) is an encyclopædia of all that up to his time had appeared in Germany under the several heads of *Volkswirthschaftslehre*, *Volkswirthschaftspolitik*, and *Finanzwissenschaft*. His book is rich in statistical observations, and is particularly instructive on the economic effects of different geographical conditions. It is well adapted for the teaching of public servants whose duties are connected with economics, and it has in fact been the source from which the German official world down to the present time has derived its knowledge of the science. In his earlier period Rau had insisted on the necessity of a reform of economic doctrine (*Ansichten der Volkswirthschaft*, 1821), and had tended towards relativity and the historical method; but he afterwards conceived the mistaken notion that that method "only looked into the past without studying the means of improving the present," and became himself purely practical in the narrower sense of that word. He has the merit of having given a separate treatment of *Unternehmergewinn*, or wages of management.

Nebenius.

The Prussian minister Nebenius, who was largely instrumental in the foundation of the Zollverein, was author of a highly esteemed monograph on public credit (1820).

Hermann.

The *Staatswirthschaftliche Untersuchungen* (1832; 2d ed., 1870) of Hermann do not form a regular system, but treat a series of important special subjects. His rare technological knowledge gave him a great advantage in dealing with some economic questions. He reviewed the principal fundamental ideas of the science with great thoroughness and acuteness. "His strength," says Roscher, "lies in his clear, sharp, exhaustive distinction between the several elements of a complex conception, or the several steps comprehended in a complex act." For keen analytical power his German brethren compare him with Ricardo. But he avoids several one-sided views of the English economist. Thus he places public spirit beside egoism as an economic motor, regards price as not measured by labor only but as a product of several factors, and habitually contemplates the consumption of the laborer, not as a part of the cost of production to the capitalist but as the main practical end of economics.

Von Thünen.

Von Thünen is known principally by his remarkable work entitled *Der Isolirte Staat in Beziehung auf Landwirthschaft und Nationalökonomie* (1826; 2d ed., 1842). In this treatise, which is a classic in the political economy of agriculture, there is a rare union of exact observation with creative imagination. With a view to exhibit the natural development of agriculture, he imagines a state, isolated from the rest of the world, circular in form and of uniform fertility, without navigable rivers or canals, with a single large city at its centre, which supplies it with manufactures and receives in exchange for them its food products, and proceeds to study the effect of distance from this central market on the agricultural economy of the several concentric spaces which compose the territory. The method, it will be seen, is highly abstract, but, though it may not be fruitful, it is quite legitimate. The author is under no illusion blinding him to the unreality of the hypothetic case. The supposition is necessary, in his view, in order to separate and consider apart one essential condition—that, namely, of situation with respect to the market. It was his intention (imperfectly realized, however) to institute afterwards several different hypotheses in relation to his isolated state, for the purpose of similarly studying other conditions which, in real life are found in combination or conflict. The objection to this method lies in the difficulty of the return from the abstract study to the actual facts; and this is probably an insuperable one in regard to most of its applications. The investigation, however, leads to trustworthy conclusions as to the conditions of the succession of different systems of land economy. The book abounds in calculations relating to agricultural expenditure and income, which diminish its interest to the general reader, though they are considered valuable to the specialist. They embody the results of the practical experience of the author on his estate of Tellow in Mecklenburg-Schwerin. Von Thünen was strongly impressed with the danger of a violent conflict between the middle class and the proletariate, and studied earnestly the question of wages, which he was one of the first to regard, not merely as the price of the commodity labor, but as the means of subsistence of the mass of the community. He arrived by mathematical reasonings of some complexity at a formula which expresses the amount of "natural wages" as $=\sqrt{ap}$, where a is the necessary expenditure of the laborer for subsistence, and p is the product of his labor. To this formula he attributed so much importance that he directed it to be engraved on his tomb. It implies that wages ought to rise with the amount of the product; and this conclusion led him to establish on his estate a system of participation by the laborers in the profits of farming, of which some account will be found in Mr. Sedley Taylor's *Profit-sharing between Capital and Labor* (1884). Von Thünen deserves more attention than he has received in England; both as a man and as a writer he was eminently interesting and original; and there is much in *Der Isolirte Staat* and his other works that is awakening and suggestive.

Roscher recognizes what he calls a Germano-Russian (deutsch-russische) school of political economy, represented principally by Heinrich Storch (1766–1825). Mercantilist principles had been preached by a native ("autochthonen") economist, Ivan Possoschkoff, in the time of Peter the Great. The new ideas of the Smithian system were introduced into Russia by Christian von Schlözer (1774–1831) in his professorial lectures and in his *Anfangsgründe der Staatswirthschaft, oder die Lehre von National-reichthume* (1805–1807).

Storch.

Storch was instructor in economic science of the future emperor Nicholas and his brother the grand-duke Michael, and the substance of his lessons to them is contained in his *Cours d'Économie Politique* (1815). The translation of this treatise into Russian was prevented by the censorship; Rau published a German version of it, with annotations, in 1819. It is a work of a very high order of merit. The epithet "deutsch-russisch" seems little applicable to Storch; as Roscher himself says, he follows mainly English and French writers—Say, Sismondi, Turgot, Bentham, Steuart, and Hume, but, above all, Adam Smith. His personal position (and the same is true of Schlözer) led him to consider economic doctrines in connection with a stage of culture different from that of the Western populations amongst which they had been formulated; this change of the point of view opened the door to relativity, and helped to prepare the historical method. Storch's study of the economic and moral effects of serfdom is regarded as especially valuable. The general subjects with which he has particularly connected his name are (1) the doctrine of immaterial commodities (or elements of national prosperity), such as health, talent, morality, and the like; (2) the question of "productive" and "unproductive," as characters of labor and of consumption, on which he disagreed with Smith and may have furnished indications to Dunoyer; and (3) the differences between the revenue of nations and that of individuals, on which he follows Lauderdale and is opposed to Say. The latter economist having published at Paris (1823) a new edition of Storch's *Cours*, with criticisms sometimes offensive in tone, he published by way of reply to some of Say's strictures what is considered his ripest and scientifically most important work, *Considérations sur la nature du Revenu National* (1824; translated into German by the author himself, 1825).

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[1] The first German version of the *Wealth of Nations* was that by Johann Friedrich Schiller, published 1776–78. The second, which is the first good one, was by Christian Garve (1794, and again 1799 and 1810). A recent one by C. W. Asher (1861) is highly commended.

A distinct note of opposition to the Smithian economics was sounded in Germany by two writers, who setting out from somewhat different points of view, animated by different sentiments, and favoring different practical systems, yet so far as their criticisms are concerned, arrive at similar conclusions; we mean Adam Müller and Frederich List.

Müller.

Adam Müller (1779–1829) was undoubtedly a man of real genius. In his principal work *Elemente der Staatskunst* (1809), and his other writings, he represents a movement of economic thought which was in relation with the (so-called) Romanic literature of the period. The reaction against Smithianism of which he was the coryphæus was founded on an attachment to the principles and social system of the Middle Ages. It is possible that the political and historical ideas which inspire him, his repugnance to contemporary liberalism, and his notions of regular organic development, especially in relation to England, were in some degree imbibed from Edmund Burke, whose *Reflections on the Revolution in France* had been translated into German by Frederich Gentz, the friend and teacher of Müller. The association of his criticisms with mediæval prepossessions ought not to prevent our recognizing the elements of truth which they contain.

He protests against the doctrine of Smith and against modern political economy in general on the ground that it presents a mechanical, atomistic, and purely material conception of society, that it reduces to nullity all moral forces and ignores the necessity of a moral order, that it is at bottom no more than a theory of private property and private interests, and takes no account of the life of the people as a whole in its national solidarity and historical continuity. Exclusive attention, he complains, is devoted to the immediate production of objects possessing exchange-value and to the transitory existence of individuals; whilst to the maintenance of the collective production for future generations, to intellectual products, powers, possessions, and enjoyments, and to the state with its higher tasks and aims, scarcely a thought is given. The truth is that nations are specialized organisms with distinct principles of life, having definite individualities which determine the course of their historical development. Each is through all time one whole; and, as the present is the heir of the past, it ought to keep before it constantly the permanent good of the community in the future. The economic existence of a people is only one side or province of its entire activity, requiring to be kept in harmony with the higher ends of society; and the proper organ to effect this reconciliation is the state, which, instead of being merely an apparatus for the administration of justice, represents the totality of the national life. The division of labor, Müller holds, is imperfectly developed by Smith, who makes it to arise out of a native bent for truck or barter; whilst its dependence on capital—on the labors and accumulations of past generations—is not duly emphasized, nor is the necessary counterpoise and completion of the division of labor, in the principle of the national combination of labor, properly brought out. Smith recognizes only material, not spiritual, capital; yet the latter, represented in every nation by language, as the former by money, is a real national store of experience, wisdom, good sense, and moral feeling, transmitted with increase by each generation to its successor, and enables each generation to produce immensely more than by its own unaided powers it could possibly do. Again the system of Smith is one-sidedly British; if it is innocuous on the soil of England, it is because in her society the old foundations on which the spiritual and material life of the people can securely rest are preserved in the surviving spirit of feudalism and the inner connection of the whole social system—the national capital of laws, manners, reputation, and credit, which has been handed down in its integrity in consequence of the insular position of the country. For the continent of Europe a quite different system is necessary, in which, in place of the sum of the private wealth of individuals being viewed as the primary object, the real wealth of the nation and the production of national power shall be made to predominate, and along with the division of labor its national union and concentration—along with the physical, no less the intellectual and moral, capital shall be embraced. In these leading traits of Müller's thought there is much which foreshadows the more recent forms of German economic and sociolological speculation, especially those characteristic of the "Historical" school.

List.

Another element of opposition was represented by Friedrich List (1798–1846), a man of great intellectual vigor as well as practical energy, and notable as having powerfully contributed by his writings to the formation of the German Zollverein. His principal work is entitled *Das Nationale System der Politischen Oekonomie* (1841; 6th ed., 1877). Though his practical conclusions were different from Müller's, he was largely influenced by the general mode of thinking of that writer and by his strictures on the doctrine of Smith. It was particularly against the cosmopolitan principle in the modern economical system that he protested, and against the absolute doctrine of free trade, which was in harmony with that principle. He gave prominence to the national idea, and insisted on the special requirements of each nation according to its circumstances and especially to the degree of its development.

He refuses to Smith's system the title of the industrial, which he thinks more appropriate to the mercantile system, and designates the former as "the exchange-value system." He denies the parallelism asserted by Smith between the economic conduct proper to an individual and to a nation, and holds that the immediate private interest of the separate members of the community will not lead to the highest good of the whole. The nation is an existence, standing between the individual and humanity, and formed into a unity by its language, manners, historical development, culture, and constitution. This unity is the first condition of the security, well being, progress, and civilization of the individual; and private economic interests, like all others, must be subordinated to the maintenance, completion, and strengthening of the nationality. The nation having a continuous life, its true wealth consists—and this is List's fundamental doctrine—not in the quantity of exchange-values which it possesses, but in the full and many-sided development of its productive powers. Its economic education, if we may so speak, is more important than the immediate production of values, and it may be right that the present generation should sacrifice its gain and enjoyment to secure the strength and skill of the future. In the sound and normal condition of a nation which has attained economic maturity, the three productive powers of agriculture, manufactures, and commerce should be alike developed. But the two latter factors are superior in importance, as exercising a more effective and fruitful influence on the whole culture of the nation, as well as on its independence. Navigation, railways, all higher technical arts, connect themselves specially with these factors; whilst in a purely agricultural state there is a tendency to stagnation, absence of enterprise, and the maintenance of antiquated prejudices. But for the growth of the higher forms of industry all countries are not adapted—only those of the temperate zones, whilst the torrid regions have a natural monopoly in the production of certain raw materials; and thus between these two groups of countries a division of labor and confederation of powers spontaneously takes place. List then goes on to explain his theory of the stages of economic development through which the nations of the temperate zone, which are furnished with all the necessary conditions, naturally pass, in advancing to their normal economic state. These are (1) pastoral life, (2) agriculture, (3) agriculture united with manufactures; whilst in the final stage agriculture, manufactures, and commerce are combined. The economic task of the state is to bring into existence through legislative and administrative action the conditions required for the progress of the nation through these stages. Out of this view arises List's scheme of industrial politics. Every nation, according to him, should begin with free trade, stimulating and improving its agriculture by intercourse with richer and more cultivated nations, importing foreign manufactures and exporting raw products. When it is economically so far advanced that it can manufacture for itself, then a system of protection should be employed to allow the home industries to develop themselves fully, and save them from being overpowered in their earlier efforts by the competition of more matured foreign industries in the home market. When the national industries have grown strong enough no longer to dread this competition, then the highest stage of progress has been reached; free trade should again become the rule, and the nation be thus thoroughly incorporated with the universal industrial union. In List's time, according to his view, Spain, Portugal, and Naples were purely agricultural countries; Germany and the United States of North America had arrived at the second stage, their manufactures being in process of development; France was near the boundary of the third or highest stage, which England alone had reached. For England, therefore, as well as for the agricultural countries first-named, free trade was the right economic policy, but not for Germany or America. What a nation loses for a time in exchange-values during the protective period she much more than gains in the long run in productive power,—the temporary expenditure being strictly analogous, when we place ourselves at the point of view of the life of the nation, to the cost of the industrial education of the individual. The practical conclusion which List drew for his own country was that she needed for her economic progress an extended and conveniently bounded territory reaching to the sea-coast both on north and south, and a vigorous expansion of manufactures and commerce, and that the way to the latter lay through judicious protective legislation with a customs union comprising all German lands, and a German marine with a Navigation Act. The national German spirit, striving after independence and power through union, and the national industry, awakening from its lethargy and eager to recover lost ground, were favorable to the success of List's book, and it produced a great sensation. He ably represented the tendencies and demands of his time in his own country; his work had the effect of fixing the attention, not merely of the speculative and official classes, but of practical men generally, on questions of political economy; and he had without doubt an important influence on German industrial policy. So far as science is concerned, the emphasis he laid on the relative historical study of stages of civilization as affecting economic questions, and his protest against absolute formulas, had a certain value; and the preponderance given to the national development over the immediate gains of individuals was sound in principle; though his doctrine was, both on its public and private sides, too much of a mere chrematistic, and tended in fact to set up a new form of mercantilism, rather than to aid the contemporary effort towards social reform.

Most of the writers at home or abroad hitherto mentioned continued the traditions of the school of Smith, only developing his doctine in particular directions, sometimes not without one-sidedness or exaggeration, or correcting minor errors into which he had fallen, or seeking to give to the exposition of his principles more of order and lucidity. Some assailed the abuse of abstraction by Smith's successors, objected to the conclusions of Ricardo and his followers their non-accordance with the actual facts of human life, or protested against the anti-social consequences which seemed to result from the application of the (so-called) orthodox formulas. A few challenged Smith's fundamental ideas, and insisted on the necessity of altering the basis of general philosophy on which his economics ultimately rest. But, notwithstanding various premonitory indications, nothing substantial, at least nothing effective, was done, within the field we have as yet surveyed, towards the establishment of a really new order of thinking, or new mode of proceeding, in this branch of inquiry. Now, however, we have to describe a great and growing movement, which has already considerably changed the whole character of the study in the conceptions of many, and which promises to exercise a still more potent influence in the future. We mean the rise of the Historical School, which we regard as marking the third epoch in the modern development of economic science.

THE HISTORICAL SCHOOL.

The negative movement which filled the 18th century had for its watchword on the economic side the liberation of industrial effort from both feudal survivals and Governmental fetters. But in all the aspects of that movement, the economic as well as the rest, the process of demolition was historically only the necessary preliminary condition of a total renovation, towards which western Europe was energetically tending, though with but an indistinct conception of its precise nature. The disorganization of the body of opinion which underlay the old system outran the progress towards the establishment of new principles adequate to form a guidance in the future. The critical philosophy which had wrought the disorganization could only repeat its formulas of absolute liberty, but was powerless for reconstruction. And hence there was seen throughout the West, after the French explosion, the remarkable spectacle of a continuous oscillation between the tendency to recur to outworn ideas and a vague impulse towards a new order in social thought and life, this impulse often taking an anarchical character.

From this state of oscillation, which has given to our century its equivocal and transitional aspect, the only possible issue was in the foundation of a scientific social doctrine which should supply a basis for the gradual convergence of opinion on human questions. The foundation of such a doctrine is the immortal service for which the world is indebted to Auguste Comte.

Comte.

The leading features of sociology, as he conceived it, are the following: (1) it is essentially *one* science, in which all the elements of a social state are studied in their relations and mutual actions; (2) it includes a dynamical as well as a statical theory of society; (3) it thus eliminates the absolute, substituting for an imagined fixity the conception of ordered change; (4) its principal method, though others are not excluded, is that of historical comparison; (5) it is pervaded by moral ideas, by notions of social duty, as opposed to the individual rights which were derived as corollaries from the *jus naturæ*; and (6) in its spirit and practical consequences it tends to the realization of all the great ends which compose "the popular cause"; yet (7) it aims at this through peaceful means, replacing revolution by evolution. The several characteristics we have enumerated are not independent; they may be shown to be vitally connected with each other. Several of these features must now be more fully described; the others will meet us before the close of the present survey.

In the masterly exposition of sociological method which is contained in the fourth volume of the *Philosophie Positive* (1839),[1] Comte marks out the broad division between social statics and social dynamics—the former studying the laws of social coexistence, the latter those of social development. The fundamental principle of the former is the general consensus between the several social organs and functions, which, without unduly pressing a useful analogy, we may regard as resembling that which exists between the several organs and functions of an animal body. The study of dynamical is different from, and necessarily subordinated to, that of statical sociology, progress being in fact the development of order, just as the study of evolution in biology is different from, and subordinated to, that of the structures and functions which are exhibited by evolution as they exist at the several points of an ascending scale. The laws of social co-existence and movement are as much subjects for observation as the corresponding phenomena in the life of an individual organism. For the study of development in particular, a modification of the comparative method familiar to biologists will be the appropriate mode of research. The several successive stages of society will have to be systematically compared, in order to discover their laws of sequence, and to determine the filiation of their characteristic features.

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[1] He had already in 1822 stated his fundamental principles in an opuscule which is reproduced in the Appendix to his *Politique Positive*.

Though we must take care that both in our statical and dynamical studies we do not ignore or contradict the fundamental properties of human nature, the project of deducing either species of laws from those properties independently of direct observation is one which cannot be realized. Neither the general structure of human society nor the march of its development could be so predicted. This is especially evident with respect to dynamical laws, because, in the passage of society from one phase to another, the preponderating agency is the accumulated influence of past generations, which is much too complex to be investigated deductively—a conclusion which it is important to keep steadily before us now that some of the (so-called) anthropologists are seeking to make the science of society a mere annex and derivative of biology. The principles of biology unquestionably lie at the foundation of the social science, but the latter has, and must always have, a field of research and a method of inquiry peculiar to itself. The field is history in the largest sense, including contemporary fact; and the principal, though not exclusive, method is, as we have said, that process of sociological comparison which is most conveniently called the historical method.

These general principles affect the economic no less than other branches of social speculation; and with respect to that department of inquiry they lead to important results. They show that the idea of forming a true theory of the economic frame and working of society apart from its other sides is illusory. Such study is indeed provisionally indispensable, but no rational theory of the economic organs and functions of society can be constructed if they are considered as isolated from the rest. In other words, a separate economic science is, strictly speaking, an impossibility, as representing only one portion of a complex organism, all whose parts and their actions are in a constant relation of correspondence and reciprocal modification. Hence, too, it will follow that, whatever useful indications may be derived from our general knowledge of individual human nature, the economic structure of society and its mode of development cannot be deductively foreseen, but must be ascertained by direct historical investigation. We have said "its mode of development"; for it is obvious that, as of every social element, so of the economic factor in human affairs, there must be a dynamical doctrine, a theory of the successive phases of the economic condition of society; yet in the accepted systems this was a desideratum, nothing but some partial and fragmentary notions on this whole side of the subject being yet extant. And, further, the economic structure and working of one historic stage being different from those of another, we must abandon the idea of an absolute system possessing universal validity, and substitute that of a series of such systems, in which, however, the succession is not at all arbitrary, but is itself regulated by law.

Though Comte's enterprise was a constructive one, his aim being the foundation of a scientific theory of society, he could not avoid criticising the labors of those who before him had treated several branches of social inquiry. Amongst them the economists were necessarily considered; and he urged or implied, in various places of his above-named work, as well as of his *Politique Positive*, objections to their general ideas and methods of procedure essentially the same with those which we stated in speaking of Ricardo and his followers. J. S. Mill shows himself much irritated by these comments, and remarks on them as showing "how extremely superficial M. Comte" (whom he yet regards as a thinker quite comparable with Descartes and Leibnitz) "could sometimes be"—an unfortunate observation, which he would scarcely have made if he could have foreseen the subsequent march of European thought, and the large degree in which the main points of Comte's criticism have been accepted or independently reproduced.

Germany.—The second manifestation of this new movement in economic science was the appearance of the German historical school. The views of this school do not appear to have arisen, like Comte's theory of sociological method, out of general philosophic ideas; they seem rather to have been suggested by an extension to the economic field of the conceptions of the historical school of jurisprudence of which Savigny was the most eminent representative. The juristic system is not a fixed social phenomenon, but is variable from one stage in the progress of society to another—it is in vital relation with the other coexistent social factors; and what is, in the jural sphere, adapted to one period of development is often unfit for another. These ideas were seen to be applicable to the economic system also; the relative point of view was thus reached, and the absolute attitude was found to be untenable. Cosmopolitanism in theory, or the assumption of a system equally true of every country, and what has been called perpetualism, or the assumption of a system applicable to every social stage, were alike discredited. And so the German historical school appears to have taken its rise.

Roscher.

Omitting preparatory indications and undeveloped germs of doctrine, we must trace the origin of the school to Wilhelm Roscher. Its fundamental principles are stated, though with some hesitation, and with an unfortunate contrast of the historical with the "philosophical" method,[1] in his *Grundriss zu Vorlesungen über die Staatswirthschaft nach geschichtlicher Methode* (1843). The following are the leading heads insisted on in the preface to that work.

"The historical method exhibits itself not merely in the external form of a treatment of phenomena according to their chronological succession, but in the following fundamental ideas. (1) The aim is to represent what nations have thought, willed, and discovered in the economic field, what they have striven after and attained, and why they have attained it. (2) A people is not merely the mass of individuals now living; it will not suffice to observe contemporary facts. (3) All the peoples of whom we can learn anything must be studied and compared from the economic point of view, especially the ancient peoples, whose development lies before us in its totality. (4) We must not simply praise or blame economic institutions; but few of them have been salutary or detrimental to all peoples and at all stages of culture; rather it is a principal task of science to show how and why, out of what was once reasonable and beneficent, the unwise and inexpedient has often gradually arisen." Of the principles enunciated in this paraphrase of Roscher's words a portion of the third alone seems open to objection; the economy of ancient peoples is not a more important subject of study than that of the moderns; indeed the question of the relative importance of the two is one that ought not to be raised. For the essential condition of all sound sociological inquiry is the comparative consideration of the entire series of the most complete evolution known to history—that, namely, of the group of nations forming what is known as the Occidental

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[1] This phraseology was probably borrowed from the controversy on the method of jurisprudence between Thibault on the one hand and Savigny and Hugo on the other.

Commonwealth, or, more briefly, "the West." The reasons for choosing this social series, and for provisionally restricting our studies almost altogether to it, have been stated with unanswerable force by Comte in the *Philosophie Positive*. Greece and Rome are, indeed, elements in the series; but it is the development as a whole, not any special portions of it, that sociology must keep in view in order to determine the laws of the movement,—just as, in the study of biological evolution, no one stage of an organism can be considered as of preponderating importance, the entire succession of changes being the object of research. Of Roscher's further eminent services we shall speak hereafter; he is now mentioned only in relation to the origin of the new school.

Hildebrand.

In 1848 Bruno Hildebrand published the first volume of a work, which, though he lived for many years after (d. 1878), he never continued, entitled *Die Nationalökonomie der Gegenwart und Zukunft*. Hildebrand was a thinker of a really high order; it may be doubted whether amongst German economists there has been any endowed with a more profound and searching intellect. He is quite free from the wordiness and obscurity which too often characterize German writers, and traces broad outlines with a sure and powerful hand. His book contains a masterly criticism of the economic systems which preceded, or belonged to, his time, including those of Smith, Müller, List, and the socialists. But it is interesting to us at present mainly from the general position he takes up, and his conception of the real nature of political economy. The object of his work, he tells us, is to open a way in the economic domain to a thorough historical direction and method, and to transform the science into a doctrine of the laws of the economic development of nations. It is interesting to observe that the type which he sets before him in his proposed reform of political economy is not that of historical jurisprudence, but of the science of language as it has been reconstructed in the present century, a selection which indicates the comparative method as the one which he considered appropriate. In both sciences we have the presence of an ordered variation in time, and the consequent substitution of the relative for the absolute.

Knies.

In 1853 appeared the work of Karl Knies, entitled *Die Politische Oekonomie vom Standpunkte der geschichtlichen Methode*. This is an elaborate exposition and defence of the historical method in its application to economic science, and is the most systematic and complete manifesto of the new school, at least on the logical side. The fundamental propositions are that the economic constitution of society at any epoch on the one hand, and on the other the contemporary theoretic conception of economic science, are results of a definite historical development; that they are both in vital connection with the whole social organism of the period, having grown up along with it and under the same conditions of time, place, and nationality; that the economic system must therefore be regarded as passing through a series of phases correlative with the successive stages of civilization, and can at no point of this movement be considered to have attained an entirely definitive form; that no more the present than any previous economic organization of society is to be regarded as absolutely good and right, but only as a phase in a continuous historical evolution; and that in like manner the now prevalent economic doctrine is not to be viewed as complete and final, but only as representing a certain stage in the unfolding or progressive manifestation of the truth.

The theme of the book is handled with, perhaps, an undue degree of expansion and detail. The author exhibits much sagacity as well as learning, and criticises effectively the errors, inconsistencies, and exaggerations of his predecessors. But in chacterizing and vindicating the historical method he has added nothing to Comte. A second edition of his treatise was published in 1883, and in this he makes the singular confession that, when he wrote in 1852, the *Philosophie Positive*, the six volumes of which had appeared from 1830 to 1842, was entirely unknown to him and, he adds, probably to all German economists. This is not to the credit of their open-mindedness or literary vigilance, if we remember that Mill was already in correspondence with Comte in 1841, and that his eulogistic notice of him in the *Logic* appeared in 1843. When, however, Knies at a later period examined Comte's work, he was, he tells us, surprised at finding in it so many anticipations of, or "parallelisms" with, his own conclusions. And well he might; for all that is really valuable in his methodology is to be found in Comte, applied on a larger scale, and designed with the broad and commanding power which marks the *dii majores* of philosophy.

There are two points which seem to be open to criticism in the position taken by some German economists of the historical school.

1. Knies and some other writers, in maintaining the principle of relativity in economic theory, appear not to preserve the due balance in one particular. The two forms of absolutism in doctrine, cosmopolitanism and what Knies calls perpetualism, he seems to place on exactly the same footing; in other words, he considers the error of overlooking varieties of local circumstances and nationality to be quite as serious as that of neglecting differences in the stage of historical development. But this is certainly not so. In every branch of sociology the latter is much the graver error, vitiating radically, wherever it is found, the whole of our investigations. If we ignore the fact, or mistake the direction, of the social movement, we are wrong in the most fundamental point of all—a point, too, which is involved in every question. But the variations depending on difference of race, as affecting bodily and mental endowment, or on diversity of external situation, are secondary phenomena only; they must be postponed in studying the general theory of social development, and taken into account afterwards when we come to examine the modifications in the character of the development arising out of peculiar conditions. And, though the physical nature of a territory is a condition which is likely to operate with special force on economic phenomena, it is rather on the technical forms and comparative extension of the several branches of industry that it will act than on the social conduct of each branch, or the co-ordination and relative action of all, which latter are the proper subjects of the inquiries of the economist.

2. Some members of the school appear, in their anxiety to assert the relativity of the science, to fall into the error of denying economic laws altogether; they are at least unwilling to speak of "natural laws" in relation to the economic world. From a too exclusive consideration of law in the inorganic sphere, they regard this phraseology as binding them to the notion of fixity and of an invariable system of practical economy. But, if we turn our attention rather to the organic sciences, which are more kindred to the social, we shall see that the term "natural law" carries with it no such implication. As we have more than once indicated, an essential part of the idea of life is that of development, in other words, of "ordered change." And that such a development takes place in the constitution and working of society in all its elements is a fact which cannot be doubted, and which these writers themselves emphatically assert. That there exist between the several social elements such relations as make the change of one element involve or determine the change of another is equally plain; and why the name of natural laws should be denied to such constant relations of coexistence and succession it is not easy to see. These laws, being universal, admit of the construction of an abstract theory of economic development; whilst a part of the German historical school tends to substitute for such a theory a mere description of different national economies, introducing prematurely—as we have pointed out—the action of special territorial or ethnological conditions, instead of reserving this as the ground of later modifications, in concrete cases, of the primary general laws deduced from a study of the common human evolution.

To the three writers above named, Roscher, Hildebrand, and Knies, the foundation of the German historical school of political economy belongs. It does not appear that Roscher in his own subsequent labors has been much under the influence of the method which he has in so many places admirably characterized. In his *System der Volkswirthschaft* (vol. i., *Grundlagen der Nationalökonomie*, 1854, 15th ed., 1880; vol. ii., *N. O. des Ackerbaues*, 1860, 10th ed., 1882; vol. iii., *N. O. des Handels und Gewerbfleisses*, 3d ed., 1882) the dogmatic and the historical matter are rather juxtaposed than vitally combined. It is true that he has most usefully applied his vast learning to special historical studies, in relation especially to the progress of the science itself. His treatise *Ueber das Verhältniss der Nationalökonomie zum classischen Alterthume*, his *Zur Geschichte der Englischen Volkswirthschaftslehre* (Leipsic, 1851-2), and, above all, that marvellous monument of erudition and industry, his *Geschichte der National-Oekonomik in Deutschland* (1874), to which he is said to have devoted fifteen years of study, are among the most valuable extant works of this kind, though the last by its accumulation of detail is unfitted for general study outside of Germany itself. Several interesting and useful monographs are collected in his *Ansichten der Volkswirthschaft vom geschichtlichen Standpunkte* (3d ed., 1878). His systematic treatise, too, above referred to, abounds in historical notices of the rise and development of the several doctrines of the science. But it cannot be alleged that he has done much towards the transformation of political economy which his earliest labors seemed to announce; and Cossa appears to be right in saying that his dogmatic work has not effected any substantial modification of the principles of Hermann and Rau.

The historical method has exhibited its essential features more fully in the hands of the younger generation of scientific economists in Germany, amongst whom may be reckoned Lujo Brentano, Adolf Held, Erwin Nasse, Gustav Schmoller, H. Rösler, Albert Schäffle, Hans von Scheel, Gustav Schönberg, and Adolf Wagner. Besides the general principle of an historical treatment of the science, the leading ideas which have been most strongly insisted on by this school are the following: I. The necessity of accentuating the moral element in economic study. This consideration has been urged with special emphasis by Schmoller in his *Grundfragen* (1875) and by Schäffle in his *Das gesellschaftliche System der menschlichen Wirthschaft* (3d ed., 1873). G. Kries (d. 1858) appears also to have handled the subject well in a review of J. S. Mill. According to the most advanced organs of the school, three principles of organization are at work in practical economy; and, corresponding with these, there are three different systems or spheres of activity. The latter are (1) private economy; (2) the compulsory public economy; (3) the "caritative" sphere. In the first alone personal interest predominates; in the second the general interest of the society; in the third the benevolent impulses. Even in the first, however, the action of private interest cannot be unlimited; not to speak here of the intervention of the public power, the excesses and abuses of the fundamental principle in this department must be checked and controlled by an economic morality, which can never be left out of account in theory any more than in practical applications. In the third region above named, moral influences are of course supreme. II. The close relation which necessarily exists between economics and jurisprudence. This has been brought out by L. von Stein and H. Rösler, but is most systematically established by Wagner—who is, without doubt, one of the most eminent of living German economists—especially in his *Grundlegung*, now forming part of the *Lehrbuch der politischen Oekonomie* in course of publication by him and Professor Nasse jointly. The doctrine of the *jus naturæ*, on which the physiocrats, as we have seen, reared their economic structure, has lost its hold on belief, and the old *a priori* and absolute conceptions of personal freedom and property have given way along with it. It is seen that the economic position of the individual, instead of depending merely on so-called natural rights or even on his natural powers, is conditioned by the contemporary juristic system, which is itself an historical product. The above-named conceptions, therefore, half economic, half juristic, of freedom and property require a fresh examination. It is principally from this point of view that Wagner approaches economic studies. The point, as he says, on which all turns is the old question of the relation of the individual to the community. Whoever with the older juristic and political philosophy and national economy places the individual in the centre comes necessarily to the untenable results which, in the economic field, the physiocratic and Smithian school of free competition has set up. Wagner on the contrary investigates, before anything else, the conditions of the economic life of the community, and, in subordination to this, determines the sphere of the economic freedom of the individual. III. A different conception of the functions of the state from that entertained by the school of Smith. The latter school has in general followed the view of Rousseau and Kant that the sole office of the state is the protection of the members of the community from violence and fraud. This doctrine, which was in harmony with those of the *jus naturæ* and the social contract, was temporarily useful for the demolition of the old economic system with its complicated apparatus of fetters and restrictions. But it could not stand against a rational historical criticism, and still less against the growing practical demands of modern civilization. In fact, the abolition of the impolitic and discredited system of European Governments, by bringing to the surface the evils arising from unlimited competition, irresistibly demonstrated the necessity of public action according to new and more enlightened methods. The German historical school recognizes the state as not merely an institution for the maintenance of order, but as the organ of the nation for all ends which cannot be adequately effected by voluntary individual effort. Whenever social aims can be attained only or most advantageously through its action, that action is justified. The cases in which it can properly interfere must be determined separately on their own merits and in relation to the stage of national development. It ought certainly to promote intellectual and æsthetic culture. It ought to enforce provisions for public health and regulations for the proper conduct of production and transport. It ought to protect the weaker members of society, especially women, children, the aged, and the destitute, at least in the absence of family maintenance and guardianship. It ought to secure the laborer against the worst consequences of personal injury not due to his own negligence, to assist through legal recognition and supervision the efforts of the working classes for joint no less than individual self-help, and to guarantee the safety of their earnings when entrusted to its care.

A special influence which has worked on this more recent group is that of theoretic socialism; we shall see hereafter that socialism as a party organization has also affected their practical politics. With such writers as St. Simon, Fourier, and Proudhon, Lassalle, Marx, Engels, Marlo, and Rodbertus (who, notwithstanding a recent denial, seems rightly described as a socialist) we do not deal in the present sketch (see SOCIALISM); but we must recognize them as having powerfully stimulated the younger German economists (in the strict sense of this last word). They have even modified the scientific conclusions of the latter, especially through criticism of the so-called orthodox system. Schäffle and Wagner may be especially named as having given a large space and a respectful attention to their arguments. In particular, the important consideration, to which we have already referred, that the economic position of the individual depends on the existing legal system, and notably on the existing organization of property, was first insisted on by the socialists. They had also pointed out that the present institutions of society in relation to property, inheritance, contract, and the like are (to use Lassalle's phrase) "historical categories which have changed, and are subject to further change," whilst in the orthodox economy they are generally assumed as a fixed order of things on the basis of which the invidual creates his own position. J. S. Mill called attention to the fact of the distribution of wealth depending, unlike its production, not on natural laws alone, but on the ordinances of society, but it is some of the German economists of the younger historical school who have most strongly emphasized this view. To rectify and complete the conception, however, we must bear in mind that those ordinances themselves are not arbitrarily changeable, but are conditioned by the stage of general social development.

In economic politics these writers have taken up a position between the German free-trade (or, as it is sometimes with questionable propriety called, the Manchester) party and the democratic socialists. The latter invoke the omnipotence of the state to transform radically and immediately the whole economic organization of society in the interest of the proletariate. The free-traders seek to minimize state action for any end except that of maintaining public order, and securing the safety and freedom of the individual. The members of the school of which we are now speaking, when intervening in the discussion of practical questions, have occupied an intermediate standpoint. They are opposed alike to social revolution and to rigid *laissez faire*. Whilst rejecting the socialistic programme, they call for the intervention of the state, in accordance with the theoretic principles already mentioned, for the purpose of mitigating the pressure of the modern industrial system on its weaker members, and extending in greater measure to the working classes the benefits of advancing civilization. Schäffle in his *Capitalismus und Socialismus* (1870; now absorbed into a larger work), Wagner in his *Rede über die sociale Frage* (1871), and Schönberg in his *Arbeitsämter: eine Aufgabe des deutschen Reichs* (1871) advocated this policy in relation to the question of the laborer. These expressions of opinion, with which most of the German professors of political economy sympathized, were violently assailed by the organs of the free-trade party, who found in them "a new form of socialism." Out of this arose a lively controversy; and, the necessity of a closer union and a practical political organization being felt amongst the partisans of the new direction, a congress was held at Eisenach in October, 1872, for the consideration of "the social question." It was attended by almost all the professors of economic science in the German universities, by representatives of the several political parties, by leaders of the working men, and by some of the large capitalists. At this meeting the principles above explained were formulated. Those who adopted them obtained from their opponents the appellation of "Katheder-Socialisten," or "socialists of the (professorial) chair," a nickname invented by H. B. Oppenheim, and which those to whom it was applied were not unwilling to accept. Since 1873 this group has been united in the "Verein für Socialpolitik," in which, as the controversy became mitigated, free-traders also have taken part. Within the Verein a division has shown itself. The left wing has favored a systematic gradual modification of the law of property in such a direction as would tend to the fulfilment of the socialistic aspirations, so far as these are legitimate, whilst the majority advocate reform through state action on the basis of existing jural institutions. Schäffle goes so far as to maintain that the present "capitalistic" régime will be replaced by a socialistic organization; but, like J. S. Mill, he adjourns this change to a more or less remote future, and expects it as the result of a natural development, or process of "social selection";[1] he repudiates any immediate or violent revolution, and rejects any system of life which would set up "abstract equality" against the claims of individual service and merit.

The further the investigations of the German historical school have been carried in the several lines of inquiry it has opened, the more clearly it has come to light that the one thing needful is not merely a reform of political economy, but its fusion in a complete science of society. This is the view long since insisted on by Auguste Comte; and its justness is daily becoming more apparent. The best economists of Germany now tend strongly in this direction. Schäffle, who is largely under the influence of Comte and Herbert Spencer, has actually attempted the enterprise of widening economic into social studies. In his most important work, which had been prepared by previous publications, *Bau und Leben des socialen Körpers* (1875–1878; new ed., 1881), he proposes to give a comprehensive plan of an anatomy, physiology, and psychology of human society. He considers social processes as analogous to those of organic bodies; and sound and suggestive as the idea of this analogy, already used by Comte, undoubtedly is, he carries it, perhaps, to an undue degree of detail and elaboration. The same conception is adopted by P. von Lilienfeld in his *Gedanken über die Social wissenschaft der Zukunft* (1873–79). A tendency to the fusion of economic science in sociology is also found in Adolph Samter's *Sozial-lehre* (though the economic aspect of society is there specially studied) and in Schmoller's treatise *Ueber einige Grundfragen des Rechts und der Volkswirthschaftslehre*; and the necessity of such a transformation is energetically asserted by H. von Scheel in the preface to his German version (1879) of an English tract *On the present Position and Prospects of Political Economy*.

The name "Realistic," which has sometimes been given to the historical school, especially in its more recent form, appears to be injudiciously chosen. It is intended to mark the contrast with the "abstract" complexion of the orthodox economics. But the error of these economics lies, not in the use, but in the abuse of abstraction. All science implies abstraction, seeking, as it does, for unity in variety; the question in every branch is as to the right constitution of the abstract theory in relation to the concrete facts. Nor is the new school quite correctly distinguished as "inductive." Deduction doubtless unduly preponderates in the investigations of the older economists; but it must be remembered that it is a legitimate process, when it sets out, not from *a priori* assumptions, but from proved generalisations. And the appropriate method of economics, as of all sociology, is not so much induction as the specialized form of induction known as comparison, especially the comparative study of "social series" (to use Mill's phrase), which is properly designated as the "historical" method. If the denominations here criticized were allowed to prevail, there would be a danger of the school assuming an unscientific character. It might occupy itself too exclusively with statistical inquiry, and forget in the detailed examination of particular provinces of economic life the necessity of large philosophic ideas and of a systematic coördination of principles. So long as economics remain a separate branch of study, and until they are absorbed into sociology, the thinkers who follow the new direction will do wisely in retaining their original designation of the historical school.

The members of the historical school have produced many valuable works besides those which there has been occasion to mention above. Ample notices of their contributions to the several branches of the science, (including its applications) will be found dispersed through Wagner and Nasse's *Lehrbuch* and the comprehensive *Handbuch* edited by Schönberg. The following list, which does not pretend to approach to completeness, is given for the purpose of directing the student to a certain number of books which ought not to be overlooked in the study of the subjects to which they respectively refer:

Knies, *Die Eisenbahnen und ihre Wirkungen* (1853), *Der Telegraph* (1857), *Geld und Credit* (1873-76-79); Rösler, *Zur Kritik der Lehre*

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[1] This should be remembered by readers of M. Leroy-Beaulieu's recent work on Collectivism (1884), in which he treats Schäffle as the principal theoretic representative of that form of socialism.

vom Arbeitslohn, 1861; Schmoller, *Zur Geschichte der deutschen Kleingewerbe im* 19 *Jahrh.*, 1870; Schäffle, *Theorie der ausschliessenden Absatzverhältnisse* (1867), *Quintessenz des Socialismus* (6th ed., 1878), *Grundsätze der Steuerpolitik* (1880); Nasse, *Mittelalterliche Feldgemeinschaft in England*, 1869; Brentano, *On the History and Development of Gilds*, prefixed to Toulmin Smith's *English Gilds* (1870), *Die Arbeiter gilden der Gegenwart* (1871-72), *Das Arbeitsverhältniss gemäss dem heutigen Recht* (1877), *Die Arbeitsversicherung gemäss der heutigen Wirthschaftsordnung* (1879), *Der Arbeitsversicherungszwang* (1881); Held (born 1844, accidentally drowned in the Lake of Thun, 1880), *Die Einkommensteuer* (1872), *Die deutsche Arbeiterpresse der Gegenwart* (1873), *Sozialismus, Sozialdemokratie, und Sozialpolitik* (1878), *Grundriss für Vorlesungen über National-ökonomie* (2d ed., 1878); *Zwei Bücher zur socialen Geschichte Englands* (posthumously published, 1881); Von Scheel (born 1839), *Die Theorie der socialen Frage* (1871), *Unsere social-politischen Parteien* (1878). To these may be added L. Von Stein, *Die Verwaltungslehre* (1876–79), *Lehrbuch der Finanzwissenschaft* (4th ed., 1878). E. Dühring is the ablest of the few German followers of Carey; we shall mention his history hereafter. To the Russian-German school belongs the work of T. von Bernhardi, which is written from the historical point of view, *Versuch einer Kritik der Gründe welche für grosses und kleines Grundeigenthum angeführt werden*, 1848. The free-trade school of Germany is recognized as having rendered great practical services in that country, especially by its systematic warfare against antiquated privileges and restrictions. Cobden has furnished the model of its political action, whilst, on the side of theory, it is founded chiefly on Say and Bastiat. The members of this school whose names have been most frequently heard by the English public are those of J. Prince Smith, who may be regarded as its head; H. von Treitschke, author of *Der Socialismus und seine Gönner*, 1875 (directed against the Katheder-Socialisten); V. Böhmert, who has advocated the participation of workmen in profits (*Die Gewinnbetheiligung* (1878); and J. H. Schultze-Delitzsch, well-known as the founder of the German popular banks, and a strenuous supporter of the system of "co-operation." The socialist writers, as has been already mentioned, are not included in the present historical survey, nor do we in general notice writings of the economists (properly so-called) having relation to the history of socialism or the controversy with it.

The movement which created this school in Germany, with the developments which have grown out of it, has without doubt given to that country at the present time the primacy in economic studies. German influence has been felt in the modification of opinion in other countries—most strongly, perhaps, in Italy, and least so in France. In England it has been steadily making way, though retarded by the insular indifference to the currents of foreign thought which has eminently marked our dominant school. Alongside of the influence thus exerted, a general distaste for the "orthodox" system has been spontaneously growing, partly from a suspicion that its method was unsound, and partly from a profound dissatisfaction with the practice it inspired, and the detected hollowness of the "Manchester" policy of mere *laissez faire.* Hence everywhere a mode of thinking and a species of research have shown themselves, and come into favor, which are in harmony with the systematic conceptions of the historical economists. Thus a dualism has established itself in the economic world, a younger school advancing towards predominance, whilst the old school still defends its position, though its adherents tend more and more to modify their attitude and to admit the value of the new lights.

Italy.—It is to be regretted that very little is known in England of the writings of the recent Italian economists. Luigi Cossa's *Guida*, which was translated at the suggestion of Jevons, has given us some notion of the character and importance of their labors. The urgency of questions of finance in Italy since its political renaissance has turned their researches for the most part into practical channels, and they have produced numerous monographs on statistical and administrative questions. But they have also dealt ably with the general doctrines of the science. Cossa pronounces Angelo Messedaglia (b. 1820), professor at Padua, to be the foremost of contemporary Italian economists; he has written on public loans (1850) and on population (1858), and is regarded as a master of the subjects of money and credit. His pupil Fedele Lampertico (b. 1833) is author of many writings, among which the most systematic and complete is his *Economia dei popoli e degli stati* (1874–1880). Marco Minghetti,[1] distinguished as a minister, is author, besides other writings, of *Economia pubblica e le sue attinenze colla morale e col diritto* (1859). Luigi Luzzati, also known as an able administrator, has by several publications sought to prepare the way for reforms. The Sicilians Vito Cusumano and Giuseppe Ricca Salerno have produced excellent works: the former on the history of political economy in the Middle Ages (1876), and the economic schools of Germany in their relation to the social question (1875); the latter on the theories of capital, wages, and public loans (1877–8–9). Cossa, to whom we are indebted for most of these particulars, is himself author of several works which have established for him a high reputation, as his *Scienza delle Finanze* (1875; 3d ed., 1882), and his *Primi Elementi di Economia Politica* (1875; 4th. ed., 1878), which latter has been translated into several European languages.

Of greater interest than such an imperfect catalogue of writers is the fact of the appearance in Italy of the economic dualism to which we have referred as characterizing our time. There also the two schools—the old or so-called orthodox and the new or historical—with their respective modified forms, are found face to face. Cossa tells us that the instructors of the younger economists in northern Italy were publicly denounced in 1874 as Germanists, socialists, and corrupters of the Italian youth. In reply to this charge Luzzati, Lambertico, and Scialoja convoked in Milan the first congress of economists (1875) with the objec of proclaiming their resistance to the idea which wa sought to be imposed on them "that the science wa born and died with Adam Smith and his commentators." M. de Laveleye's interesting *Lettres d'Itali* (1878–79) throw light on the state of economic studie in that country in still more recent years. Minghetti presiding at the banquet at which M. de Laveleye wa entertained by his Italian brethren, spoke of the "tw tendencies" which had manifested themselves, an implied his own inclination to the new views. Carl Ferraris, a pupil of Wagner, follows the sam direction. Formal expositions and defences of the historical method have been produced by Schiattarell (*Del metodo in Economia Sociale*, 1875) and Cognett de Martiis (*Della attinenze tra l'Economia Sociale* *la Storia*, 1865). A large measure of acceptance ha also been given to the historical method in learned an judicious monographs by Ricca Salerno (see especiall his essay *Del metodo in Econ. Pol.*, 1878). Luzzat and Forti for some time edited a periodical, the *Giorna degli Economisti*, which was the organ of the ne school, but which, we gather from Cossa, has cease to appear. Cossa himself, whilst refusing his adhesio to this school on the ground that it reduces politic economy to a mere narrative of facts,—an observatio which, we must be permitted to say, betrays an entir misconception of its true principles,—admits that i has been most useful in several ways, and especially a having given the signal for a salutary, though, as h thinks, an excessive, reaction against the doctrinair exaggerations of the older theorists.

France.—In France the historical school has no made so strong an impression,—partly, no doubt because the extreme doctrines of the Ricardian system never obtained much hold there. It was by hi recognition of its freedom from those exaggeration that Jevons was led to declare that "the truth i with the French school," whilst he pronounced ou English economists to have been "living in a fool's paradise." National prejudice may also have contributed to the result referred to, the ordinary Frenchman being at present disposed to ask whether any good thing can come out of Germany. But, as we have shown, the philosophic doctrines on which the whole proceeding of the historical school is founded were first enunciated by a great French thinker, to whose splendid services most of his fellow-countrymen are singularly dead. Perhaps another determining cause is to be looked for in official influences, which in France, by their action on the higher education impede the free movement of independent conviction as was seen notably in the temporary éclat they gave on the wider philosophic stage to the shallow eclecticism of Cousin. The tendency to the historical point of view has appeared in France, as elsewhere; but it has shown itself not so much in modifying general doctrine as in leading to a more careful study of the economic opinions and institutions of the past.

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[1] [A Bolognese, papal minister of education, went to Sardinia in 1848, was financial and prime minister of united Italy, wrote also of fine arts. Died December 10, 1886, aged sixty-eight years.—AM. ED.]

Much useful work has been done by Frenchmen (with whom Belgians may here be associated) in the history of political economy, regarded either as a body of theory or as a system—or series of systems—of policy. Blanqui's history (1837–38) is not, indeed, entitled to a very high rank, but it was serviceable as a first general draught. That of Villeneuve-Bargemont (1839) was also interesting and useful, as presenting the Catholic view of the development and tendencies of the science. C. Perin's *Les doctrines économiques depuis un siècle* (1880) is written from the same point of view. A number of valuable monographs on particular statesmen or thinkers has also been produced by Frenchmen,—as, for example, that of A. Batbie, on Turgot (*Turgot Philosophe, Économiste, et Administrateur*, 1861); of Pierre Clément on Colbert (*Histoire de Colbert et de son Administration*, 2d. ed., 1875); of H. Baudrillart on Bodin (*J. Bodin et son Temps; Tableau des Théories politiques et des Idées économiques au 16e siècle*, 1853); of L. de Lavergne on the physiocrats (*Les Économistes Français du 18e siècle*, 1870). Works, too, of real importance have been produced on particular aspects of the industrial development, as those of Léonce de Lavergne on the rural economy of France (1857), and of England, Scotland, and Ireland (1854). The treatise of Émile de Laveleye, *De la Propriété et de ses formes primitives* (1874; Eng. trans. by G. R. Marriott, 1878), is specially worthy of notice, not merely for its array of facts respecting the early forms of property, but because it co-operates strongly with the tendency of the new school to regard each stage of economic life from the relative point of view, as resulting from an historic past, harmonizing with the entire body of contemporary social conditions, and bearing in its bosom the germs of a future, predetermined in its essential character, though modifiable in its secondary dispositions.

Laveleye.

M. de Laveleye has done much to call attention to the general principles of the historical school, acting in this way most usefully as an interpreter between Germany and France. But he appears in his most recent manifesto (*Les Lois naturelles et l'objet de l'Économie Politique*, 1883) to separate himself from the best members of that school, and to fall into positive error, when he refuses to economics the character of a true science (or department of a science) as distinguished from an art, and denies the existence of economic laws or tendencies independent of individual wills. Such a denial seems to involve that of social laws generally, which is a singularly retrograde attitude for a thinker of our time to take up, and one which cannot be excused since the appearance of the *Philosophie Positive*. The use of the metaphysical phrase "necessary laws" obscures the question; it suffices to speak of laws which do in fact prevail. M. de Laveleye relies on morals as supplying a parallel case, where we deal, not with natural laws, but with "imperative prescriptions," as if these prescriptions did not imply, as their basis, observed coexistences and sequences, and as if there were no such thing as moral evolution. He seems to be as far from the right point of view in one direction as his opponents of the old school in another. All that his arguments have really any tendency to prove is the proposition, undoubtedly a true one, that economic facts cannot be explained by a theory which leaves out of account the other social aspects, and therefore that our studies and expositions of economic phenomena must be kept in close relation with the conclusions of the larger science of society.

We cannot do more than notice in a general way some of the expository treatises of which there has been an almost continuous series from the time of Say downwards, or indeed from the date of Germain Garnier's *Abrégé des Principes de l'Économie Politique* (1796). That of Destutt de Tracy forms a portion of his *Éltments d'Idéologie* (1823). Droz brought out especially the relations of economics to morals and of wealth to human happiness (*Économie Politique*, 1829). Pellegrino Rossi,—an Italian, formed, however, as an economist by studies in Switzerland, professing the science in Paris, and writing in French (*Cours d'Économie Politique*, 1838–54),—gave in classic form an exposition of the doctrines of Say, Malthus, and Ricardo. Michel Chevalier (1806–1879), specially known in England by his tract, translated by Cobden, on the fall in the value of gold (*La Baisse d'Or*, 1858), gives in his *Cours d'Économie Politique* (1845–50) particularly valuable matter on the most recent industrial phenomena, and on money and the production of the precious metals. Henri Baudrillart, author of *Les Rapports de la Morale et de l'Économie Politique* (1860, 2d ed., 1883), and of *Histoire du Luxe* (1878), published in 1857 a *Manuel d'Économie Politique* (3d ed., 1872), which Cossa calls an "admirable compendium." Joseph Garnier (*Traité de l'Économie Politique*, 1860, 8th ed., 1880) in some respects follows Dunoyer. J. G. Courcelle-Seneuil, the translator of J. S. Mill, whom Prof. F. A. Walker calls "perhaps the ablest economist writing in the French language since J. B. Say," besides a *Traité théorique et pratique des opérations de Banque* and *Théorie des Enterprises Industrielles* (1856), wrote a *Traité de l'Économie Politique* (1858–59), which is held in much esteem. Finally, the Genevese, Antoine Elise Cherbuliez (d. 1869) was author of what Cossa pronounces to be the best treatise on the science in the French language (*Précis de la Science Économique*, 1862). L. Walras, in *Éléments d'Économie Politique pure* (1874–77), and *Théorie Mathématique de la Richesse Sociale* (1883), has followed the example of Cournot in attempting a mathematical treatment of the subject.

England.—Sacrificing the strict chronological order of the history of economics to deeper considerations, we have already spoken of Cairnes, describing him as the last original English writer who was an adherent of the old school pure and simple. Both in method and doctrine he was essentially Ricardian; though professing and really feeling profound respect for Mill, he was disposed to go behind him and attach himself rather to their common master. Mr. Sidgwick is doubtless right in believing that his *Leading Principles* did much to shake "the unique prestige which Mill's exposition had enjoyed for nearly half a generation," and in this, as in some other ways, Cairnes may have been a dissolving force, and tended towards radical change; but, if he exercised this influence, he did so unconsciously and involuntarily. Many influences had, however, for some time been silently sapping the foundations of the old system. The students of Comte had seen that its method was an erroneous one. The elevated moral teaching of Carlyle had disgusted the best minds with the low maxims of the Manchester school. Ruskin had not merely protested against the egoistic spirit of the prevalent doctrine, but had pointed to some of its real weaknesses as a scientific theory.[1] It began to be felt, and even its warmest partisans sometimes admitted, that it had done all the work, mainly a destructive one, of which it was capable. Cairnes himself declared that, whilst most educated people believed it doomed to sterility for the future, some energetic minds thought it likely to be a positive obstruction in the way of useful reform. Miss Martineau, who had in earlier life been a thorough Ricardian, came to think that political economy, as it had been elaborated by her contemporaries, was, strictly speaking, no science at all, and must undergo such essential change that future generations would owe little to it beyond the establishment of the existence of general laws in one department of human affairs. The instinctive repugnance of the working classes had continued, in spite of the efforts of their superiors to recommend its lessons to them—efforts which were perhaps not unfrequently dictated rather by class interest than by public spirit. All the symptoms boded impending change, but they were visible rather in general literature and in the atmosphere of social opinion than within the economic circle. But when it became known that a great movement had taken place, especially in Germany, on new and more hopeful lines, the English economists themselves began to recognize the necessity of a reform and even to further its advent. The principal agencies of this kind, in marshalling the way to a renovation of the science, have been those of Bagehot, Leslie, and Jevons,—the first limiting the sphere of the dominant system, while seeking to conserve it within narrower bounds; the second directly assailing it and setting up the new method as the rival and destined successor of the old; and the third acknowledging the collapse of the hitherto reigning dynasty, proclaiming the necessity of an altered régime, and admitting the younger claimant as joint possessor in the future. Thus, in England too, the dualism which exists on the Continent has been established; and there is reason to expect that here more speedily and decisively than in France or Italy the historical school will displace its antagonist. It is certainly in England next after Germany that the preaching of the new views has been most vigorously and effectively begun.

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[1] The remarkable book *Money and Morals*, by John Lalor, 1852, was written partly under the influence of Carlyle. There is a good monograph entitled *John Ruskin, Economist*, by P. Geddes, 1884.

Bagehot.

Walter Bagehot (1826–1877) was author of an excellent work on the English money market and the circumstances which have determined its peculiar character (*Lombard Street*, 1873; 7th ed., 1878), and of several monographs on particular monetary questions, which his practical experience, combined with his scientific habits of thought, eminently fitted him to handle. On the general principles of economics he wrote some highly important essays collected in *Economic Studies* (edited by R. H. Hutton, 1880), the object of which was to show that the traditional system of political economy—the system of Ricardo and J. S. Mill—rested on certain fundamental assumptions, which, instead of being universally true in fact, were only realized within very narrow limits of time and space. Instead of being applicable to all states of society, it holds only in relation to those "in which commerce has largely developed, and where it has taken the form of development, or something like the form, which it has taken in England." It is "the science of business such as business is in large and trading communities—an analysis of the great commerce by which England has become rich." But more than this it is not; it will not explain the economic life of earlier times, nor even of other communities in our own time; and for the latter reason it has remained insular; it has never been fully accepted in other countries as it has been at home. It is, in fact, a sort of ready reckoner, enabling us to calculate roughly what will happen under given conditions in Lombard Street, on the Stock Exchange, and in the great markets of the world. It is a "convenient series of deductions from assumed axioms which are never quite true, which in many times and countries would be utterly untrue, but which are sufficiently near to the principal conditions of the modern" English "world to make it useful to consider them by themselves."

Mill and Cairnes had already shown that the science they taught was a hypothetic one, in the sense that it dealt not with real but with imaginary men—"economic men" who were conceived as simply "money-making animals." But Bagehot went further: he showed what those writers, though they may have indicated, had not clearly brought out,[1] that the world in which these men were supposed to act is also "a very limited and peculiar world." What marks off this special world, he tells us, is the promptness of transfer of capital and labor from one employment to another, as determined by differences in the remuneration of those several employments—a promptness, about the actual existence of which in the contemporary English world he fluctuates a good deal, but which on the whole he recognizes as substantially realized.

Bagehot described himself as "the last man of the ante-Mill period," having learned his economics from Ricardo; and the latter writer he appears to have to the end greatly over-estimated. But he lived long enough to gain some knowledge of the historical method, and with it he had "no quarrel, but rather much sympathy." "Rightly conceived," he said, "it is no rival to the abstract method rightly conceived." We will not stop to criticize a second time the term "abstract method" here applied to that of the old school, or to insist on the truth that all science is necessarily abstract, the only question that can arise being as to the just degree of abstraction, or, in general, as to the right constitution of the relation between the abstract and the concrete. It is more apposite to remark that Bagehot's view of the reconciliation of the two methods is quite different from that of most "orthodox" economists. They commonly treat the historical method with a sort of patronizing toleration as affording useful exemplifications or illustrations of their theorems. But, according to him, the two methods are applicable in quite different fields. For what he calls the "abstract" method he reserves the narrow, but most immediately interesting, province of modern advanced industrial life, and hands over to the historical the economic phenomena of all the human past and all the rest of the human present. He himself exhibits much capacity for such historical research, and in particular has thrown real light on the less-noticed economic and social effects of the institution of money, and on the creation of capital in the earlier stages of society. But his principal efficacy has been in reducing, by the considerations we have mentioned, still further than his predecessors had done, our conceptions of the work which the *a priori* method can do. He in fact dispelled the idea that it can ever supply the branch of general sociology which deals with wealth. As to the relations of economics to the other sides of sociology, he holds that the "abstract" science rightly ignores them. It does not consider the differences of human wants, or the social results of their several gratifications, except so far as these affect the production of wealth. In its view "a pot of beer and a picture—a book of religion and a pack of cards—are equally worthy of regard." It therefore leaves the ground open for a science which will, on the one hand, study wealth as a social fact in all its successive forms and phases, and, on the other, will regard it in its true light as an instrument for the conservation and evolution—moral as well as material—of human societies.

Though it will involve a slight digression, it is desirable here to notice a further attenuation of the functions of the deductive method, which is well pointed out in Mr. Sidgwick's recent remarkable work on political economy. He observes that, whilst J. S. Mill declares that the method *a priori* is the true method of the science, and that "it has been so understood and taught by all its most distinguished teachers," he yet himself in the treatment of production followed an inductive method (or at least one essentially different from the deductive), obtaining his results by "merely analyzing and systematizing our common empirical knowledge of the facts of industry." To explain this characteristic inconsistency, Mr. Sidgwick suggests that Mill, in making his general statement as to method, had in contemplation only the statics of distribution and exchange. And in this latter field Mr. Sidgwick holds that the *a priori* method, if it be pursued with caution, if the simplified premises be well devised and the conclusions "modified by a rough conjectural allowance" for the elements omitted in the premises, is not, for the case of a developed industrial society, "essentially false or misleading." Its conclusions are hypothetically valid, though "its utility as a means of interpreting and explaining concrete facts depends on its being used with as full a knowledge as possible of the results of observation and induction." We do not think this statement need be objected to, though we should prefer to regard deduction from hypothesis as a useful occasional logical artifice, and, as such, perfectly legitimate in this as in other fields of inquiry, rather than as the main form of method in any department of economics. Mr. Sidgwick, by his limitation of deduction in distributional questions to "a state of things taken as the type to which civilized society generally approximates," seems to agree with Bagehot that for times and places which do not correspond to this type the historical method must be used—a method which, be it observed, does not exclude, but positively implies, "reflective analysis" of the facts, and their interpretation from "the motives of human agents" as well as from other determining conditions. In the dynamical study of wealth—of the changes in its distribution no less than its production—Mr. Sidgwick admits that the method *a priori* "can occupy but a very subordinate place." We should say that here also, though to a less extent, as a logical artifice it may sometimes be useful, though the hypotheses assumed ought not to be the same that are adapted to a mature industrial stage. But the essential organ must be the historical method, studying comparatively the different phases of social evolution.

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[1] Jones, whose writings were apparently unknown to Bagehot, had, as we have seen, in some degree anticipated him in this exposition.

Connected with the theory of modern industry is one subject which Bagehot treated, though only in an incidental way, much more satisfactorily than his predecessors,—namely, the function of the entrepreneur, who in Mill and Cairnes is scarcely recognized except as the owner of capital. It is quite singular how little, in the *Leading Principles* of the latter, his active co-operation is taken into account. Bagehot objects to the phrase "wages of superintendence," commonly used to express his "reward," as suggesting altogether erroneous ideas of the nature of his work, and well describes the large and varied range of his activity and usefulness, and the rare combination of gifts and acquirements which go to make up the perfection of his equipment. It can scarcely be doubted that a foregone conclusion in favor of the system of (so-called) co-operation has sometimes led economists to keep these important considerations in the background. They have been brought into due prominence of late in the treatises of Profs. Marshall and F. A. Walker, who, however, have scarcely made clear, and certainly have not justified, the principle on which the amount of the remuneration of the entrepreneur is determined.

Leslie.

We have seen that Jones had in his dogmatic teaching anticipated in some degree the attitude of the new school; important works had also been produced, notably by Thomas Tooke and William Newmarch (*History of Prices*, 1838–1857), and by James E. Thorold Rogers (*History of Agriculture and Prices in England*, 1866–82), on the course of English economic history. But the first systematic statement by an English writer of the philosophic foundation of the historical method, as the appropriate organ of economic research, is to be found in an essay by T. E. Cliffe Leslie (printed in the Dublin University periodical, *Hermathena*, 1876; since included in his *Essays Moral and Political*, 1879). This essay was the most important publication on the logical aspect of economic science which had appeared since Mill's essay in his *Unsettled Questions*. Though Cairnes had expanded and illustrated the views of Mill, he had really added little to their substance. Leslie takes up a position directly opposed to theirs. He criticises with much force and verve the principles and practice of the "orthodox" school. Those who are acquainted with what has been written on this subject by Knies and other Germans will appreciate the freshness and originality of Leslie's treatment. He points out the loose and vague character of the principle to which the classical economists profess to trace back all the phenomena with which they deal—namely, the "desire of wealth." This phrase really stands for a variety of wants, desires, and sentiments, widely different in their nature and economic effects, and undergoing important changes (as, indeed, the component elements of wealth itself also do) in the several successive stages of the social movement. The truth is that there are many different economic motors, altruistic as well as egoistic; and they cannot all be lumped together by such a coarse generalization. The *a priori* and purely deductive method cannot yield an explanation of the causes which regulate either the nature or the amount of wealth, nor of the varieties of distribution in different social systems, as, for example, in those of France and England. "The whole economy of every nation is the result of a long evolution in which there has been both continuity and change, and of which the economical side is only a particular aspect. And the laws of which it is the result must be sought in history and the general laws of society and social evolution." The intellectual, moral, legal, political, and economic sides of social progress are indissolubly connected. Thus, juridical facts relating to property, occupation, and trade, thrown up by the social movement, are also economic facts. And, more generally, "the economic condition of English" or any other "society at this day is the outcome of the entire movement which has evolved the political constitution, the structure of the family, the forms of religion, the learned professions, the arts and sciences, the state of agriculture, manufactures, and commerce." To understand existing economic relations we must trace their historical evolution; and "the philosophical method of political economy must be one which expounds that evolution." This essay was the most distinct challenge ever addressed to the ideas of the old school on method, and, though its conclusions have been protested against, the arguments on which they are founded have never been answered.

With respect to the dogmatic generalizations of the "orthodox" economics, Leslie thought some of them were false, and all of them required careful limitation. Early in his career he had shown the hollowness of the wage-fund theory, though he was not the first to repudiate it.[1] The doctrine of an average rate of wages and an average rate of profits he rejected except under the restrictions stated by Adam Smith, which imply a "small and stationary world of trade." He thought the glib assumption of an average rate of wages, as well as of a wage-fund, had done much harm "by hiding the real rates of wages, the real causes which govern them, and the real sources from which wages proceed." The facts, which he laboriously collected, he found to be everywhere against the theory. In every country there is really "a great number of rates; and the real problem is, What are the causes which produce these different rates?" As to profits, he denies that there are any means of knowing the gains and prospects of all the investments of capital, and declares it to be a mere fiction that any capitalist surveys the whole field. Bagehot, as we saw, gave up the doctrine of a national level of wages and profits except in the peculiar case of an industrial society of the contemporary English type; Leslie denies it even for such a society. With this doctrine, that of cost of production as determining price collapses, and the principle emerges that it is not cost of production, but demand and supply, on which domestic, no less than international, values depend,—though this formula will require much interpretation before it can be used safely and with advantage. Thus Leslie extends to the whole of the national industry the partial negation of the older dogma introduced by Cairnes through the idea of non-competing groups. He does not, of course, dispute the real operation of cost of production on price in the limited area within which rates of profit and wages are determinate and known; but he maintains that its action on the large scale is too remote and uncertain to justify our treating it as regulator of price. Now, if this be so, the entire edifice which Ricardo reared on the basis of the identity of cost of production and price, with its apparent but unreal simplicity, symmetry, and completeness, disappears: and the ground is cleared for the new structure which must take its place. Leslie predicts that, if political economy, under that name, does not bend itself to the task of rearing such a structure, the office will speedily be taken out of its hands by sociology.

Leslie was a successful student of several special economic subjects—of agricultural economy, of taxation, of the distribution of the precious metals and the history of prices, and, as has been indicated, of the movements of wages. But it is in relation to the method and fundamental doctrines of the science that he did the most important, because the most opportune and needful work. And, though his course was closed too early for the interests of knowledge, and much of what he produced was merely occasional and fragmentary, his services will be found to have been greater than those of many who have left behind them more systematic, elaborate, and pretentious writings.

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[1] That service was due to F. D. Longe (*Refutation of the Wage-Fund Theory of Modern Political Economy*, 1866). Leslie's treatment of the subject was contained in an article of *Fraser's Magazine* for July, 1868, reprinted as an appendix to his *Land-Systems and Industrial Economy of Ireland, England, and Continental Countries*, 1870

Jevons.

One of the most original of the recent English writers on political economy was W. Stanley Jevons (1835–1882). The combination which he presented of a predilection and aptitude for exact statistical inquiry with sagacity and ingenuity in the interpretation of the results was such as might remind us of Petty. He tended strongly to bring economics into close relation with physical science. He made a marked impression on the public mind by his attempt to take stock of our resources in the article of coal. His idea of a relation between the recurrences of commercial crises and the period of the sun-spots gave evidence of a fertile and bold scientific imagination, though he cannot be said to have succeeded in establishing such a relation. He was author of an excellent treatise on *Money and the Mechanism of Exchange* (1875), and of various essays on currency and finance, which have been collected since his death, and contain vigorous discussions on subjects of this nature, as on bimetalism (with a decided tendency in favor of the single gold standard), and several valuable suggestions, as with respect to the most perfect system of currency, domestic and international, and in particular the extension of the paper currency in England to smaller amounts. He proposed in other writings (collected in *Methods of Social Reform*, 1883) a variety of measures, only partly economic in their character, directed especially to the elevation of the working classes, one of the most important being in relation to the conditions of the labor of married women in factories. This was one of several instances in which he repudiated the *laissez faire* principle, which indeed, in his book on *The State in Relation to Labor* (1882), he refuted in the clearest and most convincing way, without changing the position he had always maintained as an advocate of free trade. Towards the end of his career, which was prematurely terminated, he was more and more throwing off "the incubus of metaphysical ideas and expressions" which still impeded the recognition or confused the appreciation of social facts. He was, in his own words, ever more distinctly coming to the conclusion "that the only hope of attaining a true system of economics is to fling aside, once and forever, the mazy and preposterous assumptions of the Ricardian school." With respect to method, though he declares it to be his aim to "investigate inductively the intricate phenomena of trade and industry," his views had not perhaps assumed a definitive shape. The editor of some of his remains declines to undertake the determination of his exact position with respect to the historical school. The fullest indications we possess on that subject are to be found in a lecture of 1876, *On the Future of Political Economy*. He saw the importance and necessity in economics of historical investigation, a line of study which he himself was led by native bent to prosecute in some directions. But he scarcely apprehended the full meaning of what is called the historical method, which he erroneously contrasted with the "theoretical," and apparently supposed to be concerned with verifying and illustrating certain abstract doctrines resting on independent bases. Hence, whilst he declared himself in favor of "thorough reform and reconstruction," he sought to preserve the *a priori* mode of proceeding alongside of, and concurrently with, the historical. Political economy, in fact, he thought was breaking up and falling into several, probably into many, different branches of inquiry, prominent amongst which would be the "theory" as it had descended from his best predecessors, especially those of the French school, whilst another would be the "historical study," as it was followed in England by Jones, Rogers, and others, and as it had been proclaimed in general principle by his contemporary Cliffe Leslie. This was one of those eclectic views which have no permanent validity, but are useful in facilitating a transition. The two methods will doubtless for a time coexist, but the historical will inevitably supplant its rival. What Jevons meant as the "theory" he wished to treat by mathematical methods (see his *Theory of Political Economy*, 1871; 2d ed., 1879). This project had, as we have seen, been entertained and partially carried into effect by others before him, though he unduly multiplies the number of such earlier essays when, for example, he mentions Ricardo and J. S. Mill as writing mathematically, because they sometimes illustrated the meaning of their propositions by dealing with definite arithmetical quantities. Such illustrations, of which a specimen is supplied by Mill's treatment of the subject of international trade, have really nothing to do with the use of mathematics as an instrument for economic research, or even for the co-ordination of economic truths. We have already, in speaking of Cournot, explained why, as it seems to us, the application of mathematics in the higher sense to economics must necessarily fail, and we do not think that it succeeded in Jevons's hands. His conception of "final utility" is ingenious, but we cannot regard it as either "positive" or fruitful. He offers as a valuable result of mathematical investigation the theorem that in every case of exchange the quantity of each of the articles concerned multiplied by its utility is the same. But what is the unit of utility? If we cannot look for something more tangible—not to say more serviceable—than this, there is not much encouragement to pursue such researches, which will in fact never be anything more than academic playthings, and which involve the very real evil of restoring the metaphysical entities previously discarded. The reputation of Jevons as an acute and vigorous thinker, inspired with noble popular sympathies, is sufficiently established. But the attempt to represent him, in spite of himself, as a follower and continuator of Ricardo, and as one of the principal authors of the development of economic theory (meaning by "theory" the old *a priori* doctrine) can only lower him in estimation by placing his services on grounds which will not bear criticism. His name will survive in connection, not with new theoretical constructions, but with his treatment of practical problems, his fresh and lively expositions, and, as we have shown, his energetic tendency to a renovation of economic method.

Toynbee.

Arnold Toynbee (1852–1883), who left behind him a beautiful memory, filled as he was with the love of truth and an ardent and active zeal for the public good, was author of some fragmentary or unfinished pieces, which yet well deserve attention, both for their intrinsic merit and as indicating the present drift of all the highest natures, especially amongst our younger men, in the treatment of economic questions. He had a belief in the organizing power of democracy which it is not easy to share, and some strange ideas due to youthful enthusiasm, such as, for example, that Mazzini is "the true teacher of our age;" and he fluctuates considerably in his opinion of the Ricardian political economy, in one place declaring it to be a detected "intellectual imposture," whilst elsewhere, apparently under the influence of Bagehot, he speaks of it as having been in recent times "only corrected, re-stated, and put into the proper relation to the science of life," meaning apparently, by this last, general sociology. He saw, however, that our great help in the future must come, as much had already come, from the historical method, to which in his own researches he gave preponderant weight. Its true character, too, he understood better than many even of those who have commended it; for he perceived that it not only explains the action of special local or temporary conditions on economic phenomena, but seeks by comparing the stages of social development in different countries and times to "discover laws of universal application." If, as we are told, there exists at Oxford a rising group of men who occupy a position in regard to economic thought substantially identical with that of Toynbee, the fact is one of good omen for the future of the science.

It is no part of our plan to pass judgment on the works of contemporary English authors—a judgment which could not in general be final, and which would be subject to the imputation of bias in a greater degree than estimates of living writers in foreign countries. But, for the information of the student, some opinions may be expressed which scarcely any competent person would dispute. The best brief exposition of political economy, substantially in accordance with Mill's treatise, is to be found in Fawcett's *Manual* (6th ed., 1884). But those who admit in part the claims of the new school will prefer Mr. and Mrs. Marshall's *Economics of Industry* (2d ed., 1881). Better, in some respects, than either is the *Political Economy* of the American professor, Francis A. Walker (1883), whose special treatises on *Money* and on the *Wages Question* may also be recommended. Other meritorious works are J. E. T. Rogers's *Manual of Political Economy*, 1870; John Macdonnell's *Survey of Political Economy*, 1871; and John L. Shadwell's *System of Political Economy*, 1877. Prof. W. E. Hearn's *Plutology* (1864) contains one of the ablest extant treatments of the subject of production. Mr. Goschen's is the best work on the foreign exchanges (10th ed., 1879). Mr. Macleod, though his general economic scheme has met with no acceptance, is recognized as supplying much that is useful on the subject of banking. Prof. Rogers's *Six Centuries of Work and Wages* (1884) is the most trustworthy book on the economic history of England during the period with which he deals. W. Cunningham's *Growth of English Industry and Commerce*, 1882, is instructive on the mercantile system. Dr. W. Neilson Hancock has shown in a multitude of papers a most extensive and accurate knowledge of the social economy of Ireland.

On American political economy the reader will consult with advantage an article in the *Fortnightly Review* for September, 1880, by Cliffe Leslie, which was written after the publication of his collected essays. We can only mention some of the best known works (besides those of F. A. Walker) produced in the United States. Amongst them are E. Peshine Smith's *Manual of Political Economy*, 1853; Francis Bowen's *American Political Economy*, 1870; Amasa Walker's *Science of Wealth*, 1867; A. L. Perry's *Elements of Political Economy*, 1866 (the two former writers are protectionist, the two latter free-traders; Perry is a disciple of Bastiat). The principal works on American economic history are those of A. S. Bolles, entitled *Industrial History of the United States*, and *Financial History of the United States, 1774–1789*, 1879.

We cannot here overlook a work like that of Mr. Sidgwick (1883), to which we have already referred on a special point. It is impossible not to respect and admire the conscientious and penetrating criticism which he applies to the *a priori* system of economics in its most mature form. But it is open to question whether the task was wisely undertaken. It cannot be permanently our business to go on amending and limiting the Ricardian doctrines, and asking by what special interpretations of phrases or additional qualifications they may still be admitted as having a certain value. The time for a new construction has arrived; and it is to this, or at least to the study of its conditions, that competent thinkers with the due scientific preparation should now devote themselves. It is to be feared that Mr. Sidgwick's treatise, instead of, as he hopes, "eliminating unnecessary controversy," will tend to revive the *stériles contestations* and *oiseuses disputes de mots*, which Comte censured in the earlier economists. It is interesting to observe that the part of the work which is, and has been recognized as, the most valuable is that in which, shaking off the fictions of the old school, he examines independently by the light of observation and analysis the question of the industrial action of Governments.

Let us briefly consider, in conclusion, by the light of the preceding historical survey, what appear to be the steps in the direction of a renovation of economic science which are now at once practicable and urgent.

I. Economic investigation has hitherto fallen for the most part into the hands of lawyers and men of letters, not into those of a genuinely scientific class. Nor have its cultivators in general had that sound preparation in the sciences of inorganic and vital nature which is necessary whether as supplying bases of doctrine or as furnishing lessons of method. Their education has usually been of a metaphysical kind. Hence political economy has retained much of the form and spirit which belonged to it in the 17th and 18th centuries, instead of advancing with the times, and assuming a truly positive character. It is homogeneous with the school logic, with the abstract unhistorical jurisprudence, with the *a priori* ethics and politics, and other similar antiquated systems of thought; and it will be found that those who insist most strongly on the maintenance of its traditional character have derived their habitual mental pabulum from those regions of obsolete speculation. We can thus understand the attitude of true men of science towards this branch of study, which they regard with ill-disguised contempt, and to whose professors they either refuse or very reluctantly concede a place in their brotherhood.

The radical vice of this unscientific character of political economy seems to lie in the too individual and subjective aspect under which it has been treated. Wealth having been conceived as what satisfies desires, the definitely determinable qualities possessed by some objects of supplying physical energy, and improving the physiological constitution, are left out of account. Every thing is gauged by the standing of subjective notions and desires. All desires are viewed as equally legitimate, and all that satisfies our desires as equally wealth. Value being regarded as the result of a purely mental appreciation, the social value of things in the sense of their objective utility, which is often scientifically measurable, is passed over, and ratio of exchange is exclusively considered. The truth is, that at the bottom of all economic investigation must lie the idea of the destination of wealth for the maintenance and evolution of a society. And, if we overlook this, our economics will become a play of logic or a manual for the market, rather than a contribution to social science; whilst wearing an air of completeness, it will be in truth one-sided and superficial. Economic science is something far larger than the catallactics to which some have wished to reduce it. A special merit of the physiocrats seems to have lain in their vague perception of the close relation of their study to that of external nature; and, so far, we must recur to their point of view, basing our economics on physics and biology as developed in our own time. Further, the science must be cleared of all the theologico-metaphysicial elements or tendencies which still encumber and deform it. Teleology and optimism on the one hand, and the jargon of "natural liberty" and "indefeasible rights" on the other, must be finally abandoned.

Nor can we assume as universal premises, from which economic truths can be deductively derived, the convenient formulas which have been habitually employed, such as that all men desire wealth and dislike exertion. These vague propositions, which profess to anticipate and supersede social experience, and which necessarily introduce the absolute where relativity should reign, must be laid aside. The laws of wealth (to reverse a phrase of Buckle's) must be inferred from the facts of wealth, not from the postulate of human selfishness. We must bend ourselves to a serious direct study of the way in which society has actually addressed itself and now addresses itself to its own conservation and evolution through the supply of its material wants. What organs it has developed for this purpose, how they operate, how they are affected by the medium in which they act and by the co-existent organs directed to other ends, how in their turn they react on those latter, how they and their functions are progressively modified in process of time—these problems, whether statical or dynamical, are all questions of fact, as capable of being studied through observation and history as the nature and progress of human language or religion, or any other group of social phenomena. Such study will of course require a continued "reflective analysis" of the results of observation; and, whilst eliminating all premature assumptions, we shall use ascertained truths respecting human nature as guides in the inquiry and aids towards the interpretation of facts. And the employment of deliberately instituted hypotheses will be legitimate, but only as an occasional logical artifice.

II. Economics must be constantly regarded as forming only one department of the larger science of sociology, in vital connection with its other departments, and with the moral synthesis which is the crown of the whole intellectual system. We have already sufficiently explained the philosophical grounds for the conclusion that the economic phenomena of society cannot be isolated, except provisionally, from the rest,—that, in fact, all the primary social elements should be habitually regarded with respect to their mutual dependence and reciprocal actions. Especially must we keep in view the high moral issues to which the economic movement is subservient, and in the absence of which it could never in any great degree attract the interest or fix the attention either of eminent thinkers or of right-minded men. The individual point of view will have to be subordinated to the social; each agent will have to be regarded as an organ of the society to which he belongs and of the larger society of the race. The consideration of interests, as George Eliot has well said, must give place to that of functions. The old doctrine of right, which lay at the basis of the system of "natural liberty," has done its temporary work; a doctrine of duty will have to be substituted; fixing on positive grounds the nature of the social co-operation of each class and each member of the community, and the rules which must regulate its just and beneficial exercise.

Turning now from the question of the theoretic constitution of economics, and viewing the science with respect to its influence on public policy, we need not at the present day waste words in repudiating the idea that "non-government" in the economic sphere is the normal order of things. The *laissez faire* doctrine, coming down to us from the system of natural liberty, was long the great watchword of economic orthodoxy, and it had a special acceptance and persistence in England, in consequence of the political struggle for the repeal of the corn laws, which made economic discussion in this country turn almost altogether on free trade—a state of things which was continued by the effort to procure a modification of the protective policy of foreign nations. But it has now for some time lost the sacrosanct character with which it was formerly invested. This is a result not so much of scientific thought as of the pressure of practical needs—a cause which has modified the successive forms of economic opinion more than theorists are willing to acknowledge. Social exigencies will force the hands of statesmen, whatever their attachment to abstract formulas; and politicians have practically turned their backs on *laissez faire*. The state has with excellent effect proceeded a considerable way in the direction of controlling, for ends of social equity or public utility, the operations of individual interest. The economists themselves have for the most part been converted on the question; amongst theorists Mr. Herbert Spencer finds himself almost a *vox clamantis in deserto* in protesting against what he calls the "new slavery" of Governmental interference. He will protest in vain, so far as he seeks to rehabilitate the old absolute doctrine of the economic passivity of the state. But it is certainly possible that even by virtue of the force of the reaction against that doctrine there may be an excessive or precipitate tendency in the opposite direction. With the course of production or exchange considered in itself there will probably be in England little disposition to meddle. But the dangers and inconveniences which arise from the unsettled condition of the world of labor will doubtless from time to time here, as elsewhere, prompt to premature attempts at regulation. Apart, however, from the removal of evils which threaten the public peace, and from temporary palliations to ease off social pressure, the right policy of the state in this sphere will for the present be one of abstention. It is indeed certain that industrial society will not permanently remain without a systematic organization. The mere conflict of private interests will never produce a well-ordered commonwealth of labor. *Freiheit ist keine Lösung.* Freedom is for society, as for the individual, the necessary condition precedent of the solution of practical problems, both as allowing natural forces to develop themselves and as exhibiting their spontaneous tendencies; but it is not in itself the solution. Whilst, however, an organization of the industrial world may with certainty be expected to arise in process of time, it would be a great error to attempt to improvise one. We are now in a period of transition. Our ruling powers have still an equivocal character; they are not in real harmony with industrial life, and are in all respects imperfectly imbued with the modern spirit. Besides, the conditions of the new order are not yet sufficiently understood. The institutions of the future must be founded on sentiments and habits, and these must be the slow growth of thought and experience. The solution, indeed, must be at all times largely a moral one; it is the spiritual rather than the temporal power that is the natural agency for redressing or mitigating most of the evils associated with industrial life.[1] In fact, if there is a tendency—and we may admit that such a tendency is real or imminent—to push the state towards an extension of the normal limits of its action for the maintenance of social equity, this is doubtless in some measure due to the fact that the growing dissidence on religious questions in the most advanced communities has weakened the authority of the churches, and deprived their influence of social universality. What is now most urgent is not legislative interference on any large scale with the industrial relations, but the formation, in both the higher and lower regions of the industrial world, of profound convictions as to social duties, and some more effective mode than at present exists of diffusing, maintaining, and applying these convictions. . This is a subject into which we cannot enter here. But it may at least be said that the only parties in contemporary public life which seem rightly to conceive or adequately to appreciate the necessities of the situation are those that aim, on the one hand, at the restoration of the old spiritual power, or, on the other, at the formation of a new one. And this leads to the conclusion that there is one sort of governmental interference which the advocates of *laissez faire* have not always discountenanced, and which yet, more than any other, tends to prevent the gradual and peaceful development of a new industrial and social system,—namely, the interference with spiritual liberty by setting up official types of philosophical doctrine, and imposing restrictions on the expression and discussion of opinions.

It will be seen that our principal conclusion respecting economic action harmonizes with that relating to the theoretic study of economic phenomena. For, as we held that the latter could not be successfully pursued except as a duly subordinated branch of the wider science of sociology, so in practical human affairs we believe that no partial synthesis is possible, but that an economic reorganization of society implies a universal renovation, intellectual and moral no less than material. The industrial reformation for which western Europe groans and travails, and the advent of which is indicated by so many symptoms (though it will come only as the fruit of faithful and sustained effort), will be no isolated fact, but will form one part of an applied art of life, modifying our whole environment, affecting our whole culture, and regulating our whole conduct—in a word, consciously directing all our resources to the conservation and evolution of humanity.

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[1] The neglect of this consideration, and the consequent undue exaltation of state action, which, though quite legitimate, is altogether insufficient, appears to us the principal danger to which the contemporary German school of economists is exposed.

The reader is referred for fuller information to the following works on the history of political economy, all of which have been more or less, and some very largely, used in the preparation of the foregoing outline.

General Histories.—*Histoire de l'Économie Politique en Europe depuis les anciens jusqu' à nos jours*, by Jerôme Adolphe Blanqui (1837–38); of which there is an English translation by Emily J. Leonard (1880). *Histoire de l'Économie Politique*, by Alban de Villeneuve-Bargemont (Brussels, 1839; Paris, 1841); written from the Catholic point of view. *View of the Progress of Political Economy in Europe since the 16th Century*, by Travers Twiss, D.C.L. (1847). *Die geschichtliche Entwickelung der National-Oekonomik und ihrer Literatur*, by Julius Kautz (2d ed. 1860); a valuable work marked by philosophical breadth, and exhibiting the results of extensive research, but too declamatory in style. *Kritische Geschichte der Nationalökonomie und der Socialismus*, by Eugen K. Dühring (1871; 3d ed. 1879); characterized by its author's usual sagacity, but also by his usual perverseness and depreciation of meritorious writers in his own field. *Guida allo studio dell' Economia Politica*, by Luigi Cossa (1876 and 1878; Eng. trans. 1880). *Geschichte der Nationalökonomik*, by H. Eisenhart (1881); a vigorous and original sketch. And, lastly, a brief but excellent history by H. von Scheel in the *Handbuch der politischen Oekonomie* (really a great encyclopædia of economic knowledge in all its extent and applications), edited by Gustav Schönberg (1882). To these histories proper must be added *The Literature of Political Economy*, by J. R. M'Culloch (1845), a book which might with advantage be re-edited, supplemented where imperfect, and continued to our own time. Some of the biographical and critical notices by Eugène Daire and others in the *Collection des principaux Économistes* will also be found useful, as well as the articles in the *Dictionnaire de l'Économie Politique* of Coquelin and Guillaumin (1852–53), which is justly described by Jevons as "on the whole the best work of reference in the literature of the science."

Special Histories.—*Italy.—Storia della Economia Pubblica in Italia, ossia Epilogo critico degli Economisti Italiani*, by Count Giuseppe Pecchio (1829), intended as an appendix to Baron Custodi's collection of the *Scrittori classici Italiani di Economia Politica*, 50 vols., comprising the writings of Italian economists from 1582 to 1804. There is a French translation of Pecchio's work by Leonard Gallois (1830). The book is not without value, though often superficial and rhetorical.

Spain.—Storia della Economia Politica in España (1863), by M. Colmeiro; rather a history of economy than of economics—of policies and institutions rather than of theories and literary works.

Germany.—Geschichte der National-ökonomik in Deutschland (1874), by Wilhelm Roscher; a vast repertory of learning on its subject, with occasional side-glances at other economic literatures. *Die neuere National-ökonomie in ihren Hauptrichtungen*, by Moritz Meyer (3d ed., 1882); a useful handbook dealing almost exclusively with recent German speculation and policy.

England.—Zur Geschichte der Englischen Volkswirthschaftslehre, by W. Roscher (1851–52).

The reader is also advised to consult the articles of the present work which relate directly to the several principal writers on political economy. (J. K. I.)

POLK, James Knox (1795–1849), eleventh president of the United States of America, was of Scoto-Irish descent, his ancestors, whose name was Pollok, having emigrated from Ireland in the 18th century. He was the eldest of ten children, and was born 2d November, 1795, in Mecklenburg county, North Carolina, from which his father, who was a farmer, removed in 1806 to the valley of the Duck river, Tennessee.

At an early age he was placed in a merchant's office, but as he showed a disinclination for business his father at last permitted him to begin preparatory studies for the university. In 1815 he entered the university of North Carolina, where in 1818 he graduated with the highest honors. Called to the bar in 1820, he speedily made for himself a high reputation, and in 1823, he entered the State legislature. In August, 1825, he was chosen to represent his district in Congress, to which he was re-elected every succeeding two years until 1839. As a strong supporter of Democratic opinions he identified himself with every important discussion, and, though he was not a brilliant speaker, his solid abilities, extraordinary energy, and indomitable will soon gave him a place in the front rank of politicians. In 1835 he was chosen speaker of the House of Representatives, to which he was re-elected in 1837, and in 1839 he was elected governor of Tennessee. In 1844 he was the Democratic candidate for the presidentship, and was chosen over Clay by a majority of sixty-five electoral votes. The election in great measure turned on the annexation of Texas, which was effected before his inauguration. One of the earliest questions with which his administration had to deal was the boundary of Oregon, which, although he had previously declared the title of the United States to Oregon to be "clear and undisputed," was finally fixed at the parallel of 49° instead of 54° 40′. Following the annexation of Texas came the Mexican war, resulting in the treaty of Guadalupe Hidalgo, 2d February, 1848, by which New Mexico and California were ceded to the United States. Other important measures of his administration were the admission of Iowa and Wisconsin to the Union, the adoption of a low tariff in 1846, the organization of the department of the interior, and the adoption of the method of collecting Government revenues by specie without the aid of the banks. Polk retired from office 4th March, 1849, and died in Nashville, 15th June of the same year.

Life of the Hon. James Knox Polk, with a Compendium of his Speeches, 1844; Chase, *History of the Polk Administration*, 1850.

POLLACK (*Gadus pollachius*), a species of cod-fish, abundant on rocky coasts of northern Europe, and extending as far south as the western parts of the Mediterranean, where, however, it is much scarcer and does not attain to the same size as in its real northern home. In Scotland and some parts of Ireland it is called *Lythe*. It is distinguished from other species of the genus *Gadus* by its long pointed snout, which is twice as long as the eye, with projecting lower jaw, and without a barbel at the chin. The three dorsal fins are composed of respectively 12, 18 or 20, and from 17 to 19 rays, and the two anal fins of 31 and 19 or 20. A black spot above the base of the pectoral fin is another distinguishing mark. Although pollack are well-flavored fish, and smaller individuals (from 12 to 16 inches) excellent eating, they do not form any considerable article of trade, and are not preserved, the majority being consumed by the captors. Specimens of twelve pounds are common, but the species is said to attain 24 pounds in weight.

POLLAN (*Coregonus pollan*), a species of the Salmonoid genus *Coregonus* which has been found in the large and deep loughs of Ireland only. A full account of the fish by its first describer, W. Thompson, may be found in his *Natural History of Ireland*, vol. iv. p. 168.

POLLIO, Caius Asinius (76 B.C.–4 A.D.), a Roman orator, poet and historian, who played a conspicuous part in the troubled history of his time, was born in 76 B.C. In his twenty-second year (54 B.C.) he impeached unsuccessfully C. Cato, who in his tribunate (56) had acted as the tool of the triumvirs. In the civil war between Cæsar and Pompey, Pollio sided with Cæsar, and after the successful campaigns against the remnants of the Pompeian party in Africa and Spain he was raised to the prætorship, and received the command of the war in Spain against Sextus Pompeius. At the time of Cæsar's assassination (March 15, 44) Pollio was in Spain. He was defeated by Sextus Pompeius and fled for his life. But by Lepidus's influence a peace was patched up and Sextus left Spain, while Pollio remained with three legions under him. During the war between Mark Antony and the senate, Pollio, in a letter to Cicero, declared himself on the side of the senate, but found pretexts for waiting to cast in his lot with the victor. In fact no sooner had Octavian become reconciled to Antony and Lepidus, and compelled the senate to rescind the decrees against them, than Pollio joined Lepidus with two legions. Antony, Lepidus, and Octavian now formed the triumvirate (43), and Pollio was nominated consul for the year 40 B.C. Meantime he was entrusted by Antony with the administration of Gallia Transpadana, and in superintending the distribution of the Mantuan territory amongst the veterans he used his influence to save from confiscation the property of the poet Virgil. When L. Antonius, brother of Mark Antony, revolted against Octavian and was besieged in Perusia (41–40), he entreated Pollio to hasten to his relief. Pollio advanced hesitatingly, but was fain to take refuge in Ravenna when Octavian marched to meet him. After the fall of Perusia Octavian and Antony were reconciled for a time by the peace of Brundisium, which Pollio helped to negotiate. He was now consul (40); Virgil's famous fourth eclogue is addressed to him in his consulship. Next year Pollio was sent by Antony against the Parthini, an Illyrian people who adhered to Brutus. He was successful, took the town of Salonæ, and celebrated a triumph in the same year. The eighth eclogue of Virgil is addressed to Pollio while engaged in this campaign. From the spoils of the war he constructed the first public library at Rome.[1] Thenceforward Pollio withdrew from active life and devoted himself to literature. When Octavian invited him to join in the war against Antony which ended in the battle of Actium, Pollio declined on the score of his former friendship with Antony. He seems to have maintained to a certain degree an attitude of independence if not of opposition towards Augustus. He lived to a green old age, and died in his villa at Tusculum in 4 A.D.

Pollio was a distinguished orator; his speeches showed ingenuity and care, but were marred by an affected archaism which rendered them somewhat crabbed and harsh. He wrote tragedies also, which Virgil declared to be worthy of Sophocles, and a prose history of the civil wars of his time from the first triumvirate (60 B.C.) down to the death of Cicero (43 B.C.) or perhaps to the battle of Philippi (42 B.C.) or even later. This history, in the composition of which Pollio received assistance from the grammarian Ateius, was used as an authority by Plutarch and Appian. As a literary critic Pollio was very severe. He censured Sallust and Cicero and professed to detect in Livy's style certain provincialisms of his native Padua; he attacked the *Commentaries* of Julius Cæsar, accusing their author of carelessness and credulity if not of deliberate falsification. Horace addressed one of his odes (ii. 1) to Pollio on the subject of his history. Pollio was the first Roman author who recited his writings to an audience of his friends, a practice which afterwards grew very common at Rome. All his writings are lost except a few fragments of his speeches (collected by Meyer, *Orat. Rom. Frag.*), and three letters addressed Cicero (Cic., *Ad Fam.*, x. 31–33).

PÖLLNITZ, Karl Ludwig, Freiherr von (1692–1775), known as a writer of memoirs, was born on the 25th February, 1692. His father, G. Bernhard von Pöllnitz, was a major-general and minister of state in the electorate of Brandenburg. Pöllnitz was a man of restless and adventurous disposition, and after squandering his fortune travelled from court to court, his pleasant manners generally securing for him a kind reception. He was made reader to Frederick the Great, and afterwards the director of a theatre; but before accepting these appointments he had served as a soldier in Austria, the States of the Church, and Spain. He was repeatedly converted to Catholicism and re-converted to the Reformed faith; but he died a Catholic on the 23d June, 1775.

The most famous work attributed to him is *La Saxe galante*, which contains an account of the private life of Augustus of Saxony; but it has been doubted whether he was the author of this book. His contemporaries expressed much admiration for the lively style of his *Lettres et mémoires, avec nouveaux mémoires de sa vie et la relation de ses premieres voyages*, and general interest was excited by his *État abrégé de la cour de Saxe sous le règne d' Auguste III., roi de Pologne*. He was probably the author of the *Histoire secrète de la duchesse d'Hanovre, épouse de George I., roi de la Grande Bretagne*. After his death Brunn issued *Mémoires de Pöllnitz pour servir à l'histoire des quatre derniers souverains de la maison de Brandebourg, royale de Prusse*.

POLLOK, Robert (1798–1827), was the author of *The Course of Time*, a poem that has passed through many editions, and is still a favorite in serious households in Scotland. The son of a small farmer, he was born in 1798 at Moorhouse, in the parish of Eaglesham in Renfrewshire, was originally destined for the plough, but trained himself for the university, took his degree at Glasgow, and studied for the ministry of the United Secession Church. Along with the very general ambition to wag his head in a pulpit he had a specific literary ambition; he published *Tales of the Covenanters* while he was a divinity student, and planned and completed a poem on the spiritual life and destiny of man. This was the *Course of Time*. The unfortunate poet died within six months of its publication, at the age of twenty-nine. Excessive study had quickened a tendency to consumption. The poem was published in March, 1827, and at once became popular. It is written in blank verse, in ten books, in the poetic diction of the 18th century, but with abundance of enthusiasm, impassioned elevation of feeling, and copious force of words and images. The poet's view of life was strongly Calvinistic.

POLLOKSHAWS, a burgh of barony in Renfrewshire, Scotland, situated near the White Cart, on the Glasgow and Kilmarnock Railway, 2½ miles south by west of Glasgow, of which it is now reckoned a suburb, connected by tramway. The streets are irregular, but contain many good houses and shops. The principal buildings are the town hall, the mechanics' institute, and the public library and reading-room. The staple industries are cotton-spinning, hand and power-loom weaving of silk and cotton fabrics, dyeing, bleaching, and calico-printing. There are also paper works, potteries, and large engineering works. The town was created a burgh of barony by royal charter in 1813, and is governed by a provost, a baillie, and six councillors. Population in 1871, 8921; in 1881, 9363.

POLLUX. See Castor and Pollux.

POLLUX, Julius, of Naucratis in Egypt, a Greek sophist of the 2d century. His education was begun by his father, a man of literary culture, and was continued by one Hadrian, but he is said neither to have attained to the excellences nor fallen into the defects of his master. He taught at Athens, where, according to Philostratus, he was appointed to the professorship by the emperor Commodus on account of his melodious voice. He died at the age of fifty-eight, leaving a son behind him. Suidas gives a list of his rhetorical works, none of which have survived. Philostratus (*Vit. Soph.*, ii. 12) recognizes his natural abilities, but speaks of his rhetoric in very moderate terms. He was ridiculed by Athenodorus, a contemporary teacher at Athens. It is a disputed point whether or not he is the butt of Lucian's scathing satire in the *Lexiphanes* and *Teacher of Rhetoric*. In the *Teacher of Rhetoric* Lucian lashes a vile and ignorant person who gains a reputation as an orator by sheer effrontery; the application of this—probably grossly exaggerated—portrait to Pollux derives some color from the remark of Philostratus that the speeches of Pollux were more remarkable for boldness than art. The *Lexiphanes*, a satire upon the use of obscure and obsolete words, may conceivably have been directed against Pollux as the author of the *Onomasticon*. This work, which we still possess, is a Greek dictionary in ten books dedicated to Commodus, and arranged not alphabetically but according to subject matter. Though mainly a dictionary of synonyms and phrases, it supplies much rare and valuable information on many points of classical antiquity. It also contains numerous fragments of writers now lost.

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[1] The library was in the Atrium Libertatis, which was also erected by Pollio (Isidor., *Orig.*, vi. 5; Sueton., *Aug.*, 29; Ovid, *Trist.*, iii. 1, 71). The situation of this Atrium is uncertain. There was an older Atrium Libertatis near the Forum (Cic. *Ad Att.*, iv. 16, 8), but we are precluded from identifying it with that of Pollio by the language of Isidore and Suetonius, who imply that Pollio built a new Atrium. Perhaps Pollio's Atrium was connected with the temple of Liberty on the Aventine (Livy, xxiv. 16); this would be strongly confirmed by Martial (xii. 3, 6), if we could be sure that his "domus alta Remi" referred to the Aventine. Mr A. W. Verrall (*Studies in Horace*, p. 113) has made it probable that Dion Cassius (xlix. 43) confused the Pollian with the Octavian library, and that accordingly 33 B.C. is the date of the dedication of the former library and not of the latter, which we know from Plutarch (*Marc.*, 30) to have been dedicated not earlier than 23 B.C., the date of Marcellus's death. But Mr. Verrall's conjecture that "in the great reconstructions of Augustus" the Pollian library was absorbed in the Octavian seems negatived by Ovid, *Trist.*, iii. 1, 69–72, where "atria" certainly refers to the Pollian library, and "templa—vicino juncta theatro," probably refers to the Octavian library, which was in the Porticus Octaviæ, adjoining the twin temples of Jupiter and Juno, and close to the theatre of Marcellus (see Burn, *Rome and the Campagna*, p. 306 *sq.*). Pliny (*N. H.*, xxxvi. 24) also refers to "Pollionis Asini monumenta" as being distinct from the Porticus Octaviæ. Moreover, there is no evidence that the two libraries were even near each other; if the Pollian was on the Aventine, they were separated by nearly the whole breadth of the city.

The first book treats of the gods and their worship, kings, speed and slowness; dyeing, traders and artisans, fertility and barrenness, times and seasons, houses, ships, war, horses, agriculture, the parts of the plough and the wagon, bees. Book ii. treats of the ages and names of man, the parts of his body, his mind and soul, etc.; book iii. of kinship, marriage, citizenship, friendship, love, the relation of master and slave, mines, journeying, rivers, health, sickness, wealth, poverty, etc.; book iv. of the sciences and arts; book v. of the chase, animals, compound words, love and hate, blame, fair greetings, inscriptions, etc.; book vi. of feasts, wine, food, the talkative man, the flatterer, the passionate man, crimes, words compounded with ὁμο, συν, etc., gifts, laughter and weeping, etc.; book vii. of trades; book viii. of law and justice, magistrates, popular assemblies, etc.; book ix. of cities, coins, games, synonyms of likeness and unlikeness, etc., compounds in ευ; book x. of vessels, instruments, and tools. The chief editions of Pollux's *Onomasticon* are those of Aldus (Venice, 1502); J. H. Lederlin and Tib. Hemsterhuis (Amsterdam, 1706); W. Dindorf (Leipsic, 1824), containing the notes of previous commentators; Im. Bekker (Berlin, 1846), containing the Greek text only.

POLO. This game, which is a species of "hockey on horseback," is of Eastern origin, and seems to have been a favorite pastime in Persia, Tartary, and the frontiers of India from prehistoric times. Every district has a different name for the game, and the rules under which it is played, although substantially identical, vary considerably on minor points. Thus in Little Tibet, Ladakh, and the adjacent districts the ground used is in the form of a parallelogram some hundred yards long with a goal at each end about 50 feet wide. Amongst the Manipuris, a semi-independent tribe on the northeast frontier of India, by whom the game is known as "kunjai," the ground is about 20 yards by 50 yards and the whole of each end forms goal. In other places the goals are about 400 yards apart, and the ground is 120 yards wide at each end, decreasing in width towards the centre.

In some of the early matches in the United Kingdom the ground was about 400 yards long and 200 yards wide, the width of the goal being from 30 to 35 yards. Under the present rules of the Hurlingham Club, which is now the principal authority on the game, it is provided that the goals shall be "not less than 250 yards apart and that each goal shall be 8 yards wide." The English name of the game is perhaps derived from "pulu," which is the Tibetan for a ball, and the pastime itself reached India from Persia through Afghanistan. It speedily gained favor with the officers of British cavalry regiments quartered in India, and was introduced into the United Kingdom in 1871 by the 10th Hussars. As far as can be ascertained the first match played on English soil took place at Aldershot in the spring of that year. This, however, is not absolutely certain, as no records seem to have been preserved of the early contests.

Under the rules of the game as now played the opposing parties may consist of from three to six players a side, the number in all matches for cups or prizes being limited to four. Each of the players is mounted on a pony which must not exceed fourteen hands and which must be free from any vice. As the description of the game as "hockey on horseback" would imply, the object of the pastime is to force a ball by means of a stick, with which each player is furnished, through the goal of the opposing side. The size of the ball is 3 inches in diameter, and the sticks are 4 feet long with a cross piece at one end for the purpose of striking the ball. At the commencement of a game each side takes up its position behind the goal posts. A player on each side is appointed as goal-keeper. On a flag being dropped to notify the commencement of the game, the other players gallop towards the centre of the ground at full speed, their object being to reach the ball first and drive it in the direction of the opposite goal. When a ball is hit out of bounds it is thrown into play again by one of the umpires, of whom there is one appointed for each side before the commencement of a match. When a ball is hit beyond the goal without passing through it the side defending goal is entitled to a "hit off," which must be made from the goal line. It is allowable in the course of play to impede an adversary and hinder his stroke by hooking his stick, but this must not be done either under or over his pony. Whilst it is permissible for a player to interpose his pony before his antagonist so as to prevent the latter reaching the ball, it is expressly forbidden to cross another player in possession of the ball except at such a distance as to avoid all possibility of collision. Should a player break his stick or have it broken he must ride to the appointed place where the sticks are kept and take one, and on no account is one to be brought to him. If he drops his stick he must dismount and pick it up, and is not allowed to hit the ball whilst dismounted. If a player is in front of a player of his own side who hits the ball, and has not two—or in case of matches of four a side, one—of the opposing side between him and the hostile goal, and has not come through the "bully," he is "off side." He does not then come "on his side" until the ball has been hit or hit at by the opposing side, or until the player on his own side who made the hit passes him. As long as he is "off side" he may not in any way impede a player of the opposite side. In all matches the duration of play is 1 hour 10 minutes, with an interval of 5 minutes after each 20 minutes play.

Owing to the expense of maintaining a specially trained stud of ponies and a prepared ground for the pastime, the pursuit of the game of polo has always been confined to the wealthier classes in England. Its chief supporters are the younger members of the aristocracy and the officers of British cavalry regiments.

POLO, MARCO (*c.* 1254–1324), the Venetian, the most famous perhaps of all travellers. His history needs to be introduced by some account of the preceding generation of his family, and of the state of the world which rendered their and his extensive travels possible.

Under CHINA, in the introductory portion (vol. v. 545 *sq.*) we have briefly indicated the circumstances which in the last half of the 13th century and first half of the 14th threw Asia open to Western travellers to a degree unknown before and since. We first hear of the Polo family in the year 1260. The vast wave of Tartar conquest, set in motion by Jenghiz Khan, and continuing to advance for some years after his death, had swept away all political barriers from the China Sea to the western frontier of Russia. This huge extent of empire continued for a time to own a supreme chief in the Great Khan, the head of the house of Jenghiz, whose headquarters were in the Mongolian steppe. Practically indeed the empire soon began to split up into several great monarchies under the descendants of his four sons, in order of age Juji, Jaga tai, Oghotai, and Tuli. At the date we have named the supreme khanate had recently devolved upon Kublai, son of Tuli, and, after the founder, the ablest of his house. In the beginning of his reign Kublai carried out the transfer of the seat of rule from Karakorum on the northern verge of the Mongolian plains to the populous and civilized regions that had been conquered in the further East, a transfer which eventually converted the Tartar khan into a Chinese emperor.

Barka, the son of Juji, and the first of the house of Jenghiz to turn Moslem, reigned on the steppes of the Volga, where a standing camp, which eventually became a great city under the name of Sarai, had been established by his brother and predecessor Batu.

Hulagu, a young brother of Kublai, after taking Baghdad, and putting the caliph Mosta'sim to death, had become practically independent ruler of Persia, Babylonia, Mesopotamia, and Armenia, though he and his sons and his sons' sons continued to the end of the century to stamp the name of the Great Khan upon their coins, and to use the Chinese seal of state which he conferred.

The house of Jagatai had settled upon the pastures of the Ili and in the valley of the Jaxartes, and ruled also the populous cities of Samarkand and Bokhara.

Kaidu, grandson of Oghotai, who had been the immediate successor of Jenghiz, refused to recognize the transfer of supreme authority to his cousins, and through the long life of Kublai was a thorn in the side of the latter. His immediate authority was exercised in what we should now call Chinese Turkestan and Southern Central Siberia.

Northern China had been conquered by Jenghiz and his successors from the Tartar dynasty called *Kin* or "Golden," who had held it about a century. But southern China still remained in the hands of the native dynasty, whose capital was the great city now known as Hang-chow-foo. Their dominion was still substantially intact, but its subjugation was a task to which Kublai soon turned his attention, and it became the most prominent transaction of his reign.

In India the most powerful sovereign was the Turk sultan of Delhi; but, though both Sind and Bengal owned his supremacy, no part of peninsular India had yet been invaded. The Dravidian kingdoms of the south were still untouched by foreign conquest, and the accumulated gold of ages lay in their temples and treasuries an easy prey for the coming Moslem.

In the Indo-Chinese peninsula and the Eastern Islands a variety of kingdoms and dynasties were expanding and contracting, of which we have but dim and shifting glimpses. Their advance in wealth and art, far beyond what the present state of those regions would suggest, is attested by the vast and magnificent mediæval remains of architecture which are found at intervals over both the Indo-Chinese continental countries and the islands, as at Pagán in Burmah, at Ayuthia in Siam, at Ongkor and many other places in Camboja, at Borobodor and Branbanan in Java. All these remains are deeply marked by Hindu influence.

Venetian genealogies and traditions of uncertain value trace the Polo family to Sebennico in Dalmatia, and before the end of the 11th century names of its members are found in the Great Council of the republic. But the ascertained line of the traveller begins only with his grandfather. Andrea Polo of S. Felice was the father of three sons, Marco, Nicolo, and Maffeo, of whom the second was the father of the subject of this article. They were presumably "noble," *i. e.*, belonging to the families who had seats in the Great Council, and were enrolled in the Libro d'Oro; for we know that Marco the traveller is officially so styled (*nobilis vir*). The three brothers were engaged in commerce; the elder Marco, resident apparently in Constantinople and in the Crimea, does not ente into the history.

In 1260 we find Nicolo and Maffeo at Constantinopl How long they had been absent from Venice we d not know. Nicolo was a married man, and had le his wife there. In the year named the two brother went on a speculation to the Crimea, whence a su cession of chances and openings carried them to th court of Barka Khan at Sarai, and further north, an eventually across the steppes to Bokhara. Here the fell in with certain envoys who had been on a missio from the Great Khan Kublai to his brother Hulag in Persia, and by them were persuaded to make th journey to Cathay in their company. And thus th first European travellers of whom we have an knowledge reached China. Kublai, when they reache his court, was either at CAMBALUC (*q.v.*) *i.e.*, Peking which he had just rebuilt on a vast scale, or at hi beautiful summer seat at Shangtu in the country nort of the great wall ("In Xanadu did Cubla Khan," etc. It was the first time that the khan, a man full o energy and intelligence, had fallen in with Europea gentlemen. He was delighted with the Venetia brothers, listened eagerly to all that they had to te of the Latin world, and decided to send them back a his envoys to the pope, with letters requesting th despatch of a large body of educated men to instruc his people in Christianity and in the liberal arts. Th motive of the khan's request was doubtless much th same that some years back influenced the black kin of Uganda on Lake Nyanza to make a similar reque through the traveller Stanley. With Kublai, as wit his predecessors, religion was chiefly a political engin The khan must be obeyed; how man should worshi God was no matter to him. But Kublai was the fir of his house to rise above the essential barbarism o the Mongols, and he had been able enough to discer that the Christian Church could afford the aid h desired in taming his countrymen. It was only whe Rome had failed lamentably to meet his advances tha he fell back upon the lamas and their trumpery a after a fashion, civilizing instruments.

The brothers arrived at Acre in April, 1269. The learned that Clement IV. had died the year befor and no new pope had yet been chosen. So they we home to Venice, where they found that Nicolo's wi was dead, but had left a son Marco, now a fine lad o fifteen.

The papal interregnum was the longest that ha been known, at least since the dark ages. After th Polos had spent two years at home there was still n pope; and the brothers resolved on starting again fo the East, taking young Mark with them. At Acr they took counsel with an eminent churchman, Tedald archdeacon of Liége, and took from him letters t authenticate the causes that had hindered their mission. They had not yet left Ayas on the Cilicia coast (then one of the chief points for the arrival an departure of the land-trade of Asia), when news overtook them that a pope had been elected in the perso of their friend Archdeacon Tedaldo. They hastene back to Acre, and at last were able to execute Kublai' commission and to obtain a papal reply. But, instea of the hundred teachers asked for by the Great Khan the new pope (styled Gregory X.) could supply bu two Dominicans; and these lost heart and turne back, when they had barely taken the first step o their journey.

The second start from Acre must have taken plac about November, 1271; and from a careful consideration of the indications and succession of chapters i Marco Polo's book, it would seem that the party proceeded from Ayas to Sivas, and then by Mardin Mosul, and Baghdad to Hormuz at the mouth of th Persian Gulf (see ORMUS), with the purpose of going on to China by sea; but that, some obstacle having interfered which compelled them to abandon this plan they returned northward through Persia. Traversing

Kerman and Khorasan they went on to Balkh and Badakhshan, in which last country—an Oriental Switzerland, as it has been called—they were long detained by the illness of young Marco. In a passage touching on the charming climate of the hills of Badakhshan, Marco breaks into an enthusiasm which he rarely betrays, but which is easily understood by those who have known what it is, with fever in the blood, to escape to the exhilarating air and fragrant pine-groves of the Himálaya. They then ascended the upper Oxus through Wakhán to the plateau of Pamír (a name first heard in Marco's book). Those regions, so attractive to geographers, were never described again by any European traveller till the spirited expedition in 1838 of that excellent officer the late Lieutenant John Wood of the Indian navy, whose narrative abounds in the happiest incidental illustration of Marco Polo's chapters. Crossing the Pamír highlands, the travellers' descended upon Kashgar, whence they proceeded by Yarkand to Khotan. These are regions which remained almost absolutely closed to our knowledge till within the last twenty years, when the temporary overthrow of the Chinese power, and the enterprise of travellers like the late Mr. Johnson and Mr. Robert Shaw, followed by the missions of Sir Douglas Forsyth and his companions, and of Mr. Ney Elias, again made them known.

From Khotan they passed on to the vicinity of Lake Lop (or Lob), reached still more recently, for the first time since Marco Polo's journey, by the indefatigable Russian officer Prejevalsky, in 1871. Thence the great desert of Gobi was crossed to Tangut, as the region at the extreme northwest of China, both within and without the Wall, was then called.

In his account of the passage of the Gobi, or desert of Lop, as he calls it, Polo gives some description of the terrors with which the suggestions of solitude and desolation have peopled such tracts in most parts of the world, a description which reproduces with singular identity that of the Chinese pilgrim HWEN T'SANG (*q.v.*), in passing the same desert in the contrary direction six hundred years before.

The Venetians, in their further journey, were met and welcomed by the Great Khan's people, and at last reached his presence at Shangtu, in the spring of 1275. Kublai received them with great cordiality, and took kindly to young Mark, by this time about one and twenty years of age. The "young bachelor," as the book calls him, applied himself diligently to the acquisition of the divers languages and written characters chiefly in use among the multifarious nationalities ncluded in the khan's court and administration; and Kublai, seeing that he was both clever and discreet, oon began to employ him in the public service. M. Pauthier, his most recent French editor, has found n the Chinese annals a record that in the year 1277 a ertain Polo was nominated as a second-class commisioner or agent attached to the imperial council, a assage which we may without scruple apply to the oung Venetian.

His first public mission was one which carried him hrough the provinces of Shansi, Shensi, and Szechuen, nd the wild country on the coast of Tibet, to the remote province of Yunnan, called by the Mongols *Karájang*, and into northern Burmah (Mien). Marco, uring his stay at court, had observed the khan's elight in hearing of strange countries, of their maners, marvels, and oddities, and had heard his frank xpressions of disgust at the stupidity of envoys and commissioners who could tell of nothing but their official business. And he took care to store his memory r his note-book with all curious facts that were likely o interest Kublai, and these, on his return to court, e related with vivacity. This first journey led him hrough a country which twenty years ago was an lmost absolute *terra incognita*,—though within that me we have learned much regarding it through the ourneys of Cooper, Garnier, Richthofen, Gill, Baber, and others. In this region there existed, and there still exists, in the deep valleys of the great rivers, and in the alpine regions which border them, a vast ethnological garden, as it were, of tribes of very various origin, and in every stage of semi-civilization or barbarism; and these afforded many strange products and eccentric traits of manners to entertain the emperor.

Marco rose rapidly in favor, and was often again employed on distant missions, as well as in domestic administration; but we are able to gather but few details of his employment. At one time we know that he held for three years the government of the great city of Yangchow; on another occasion we find him visiting Karakorum on the north of the Gobi, the former residence of the Great Khans; again in Champa, or southern Cochin-China; and, once more, on a mission to the southern states of India. We are not informed whether his father and uncle shared in such employments, though they are specially mentioned as having rendered material service to the khan, in forwarding the capture of the city of Siang-yang-foo (on the Han river) during the war against southern China, by the construction of powerful artillery engines—a story, however, perplexed by chronological difficulties, which here we must pass over.

In any case the elder Polos were gathering wealth, which they longed to carry back to their home in the lagoons, and after their long exile they began to dread what might follow old Kublai's death. The khan, however, was deaf to all suggestions of departure; and but for a happy chance we should have lost our mediæval Herodotus.

Arghun, khan of Persia, the grandson of Kublai's brother Hulagu, lost in 1286 his favorite wife, Bolgana (*Bulughán* or "Sable") by name. Her dying injunction was that her place should be filled only by a lady of her own Mongol tribe. Ambassadors were despatched to the court of Khánbáligh to obtain such a bride. The message was courteously received, and the choice fell on the lady Cocachin (Kukáchím), a maiden of seventeen, "moult bele dame et avenant." The overland road from Peking to Tabriz was not only of portentous length for so delicate a charge, but was then imperilled by war; so the envoys of Arghun proposed to return by sea. Having made acquaintance with the Venetians, and eager to profit by their experience, especially by that of Marco, who had just returned from his mission to India, they begged the khan as a favor to send the Franks in their company. He consented with reluctance, but fitted out the party nobly for the voyage, charging them with friendly messages to the potentates of Christendom, including the king of England. They appear to have sailed from the port of Chwan-chow (or CHINCHEW, *q.v.*) in Fuhkien, which was then the great haven of foreign trade, and was known to Western strangers as Zaitún, in the beginning of 1292. The voyage was an ill-starred one, involving long detention on the coast of Sumatra, and in the south of India; and two years or more passed before they arrived at their destination in Persia. Two out of the three envoys, and a vast proportion of their suite perished by the way; but the three hardier Venetians survived all perils, and so did the young lady, who had come to look on them with filial regard. It proved that Arghun Khan had been dead even before they quitted China; his brother reigned in his stead; and his son Ghazan succeeded to the lady's hand. She took leave of the kindly Venetians, not without tears; they went on to Tabriz, and after a long delay there departed for Venice, which they seem to have reached about the end of 1295.

The first biographer of Marco Polo was the famous geographical collector John Baptist Ramusio, who wrote more than two centuries after the traveller's death. Facts and dates sometimes contradict his statements, but his story is told with great life and picturesqueness, and we need not hesitate to accept, at least as a genuine tradition, a romantic story, too long for repetition here, of the arrival of the Polos at their family mansion in the parish of St. John Chrysostom, of their appearance at its door in worn and outlandish garb, of the scornful denial of their identity, and of the shrewd stratagem by which they secured acknowledgment from the society of Venice.

Some years pass ere we hear more of Marco Polo; and it is then in a militant capacity.

Jealousies, always too characteristic of Italian communities, were in the case of Venice and Genoa sharpened by direct commercial rivalry, and had been growing in bitterness throughout the 13th century. In 1298 the Genoese made preparations on a great scale to strike a blow at their rivals on their own ground, and a powerful fleet of galleys, under Lamba Doria as admiral, made straight for the Adriatic. Venice, on hearing of the Genoese armament, hastily equipped a fleet still more numerous, and placed it under the command of Andrea Dandolo. The crew of a Venetian galley at this time amounted, all told, to 250 men, under a *comito* or master, but besides this officer each galley carried a *sopracomito* or gentleman commander, who was usually a noble. On one of the galleys of Dandolo's fleet went Marco Polo in this last capacity.

The hostile fleets met before the island of Curzola on the 6th September, and engaged next morning. The battle ended in a complete victory to Genoa, the details of which may still be read, inscribed on the façade of the church of St. Matthew in that city. Sixty-six Venetian galleys were burnt in the Bay of Curzola, and eighteen were carried to Genoa, with 7000 prisoners, one of whom was Marco Polo. The captivity was of less than a year's duration; for by the mediation of Milan peace was made, on honorable terms for both republics, by July, 1299; and Marco Polo was probably restored to his family during that or the following month.

But his captivity was memorable as being the means of bringing about the record of his remarkable experiences in the East. Up to this time he had doubtless often related his stories of Cathay among his friends; and from these stories indeed, and the frequent employment in them (as it would seem) of a numerical expression unfamiliar in those days, he had acquired the nickname of *Marco Millioni*. Yet it would seem that he had committed nothing to writing.

The narratives not only of Marco Polo but of several other famous mediæval travellers (*e. g.*, Ibn Batuta, Friar Odoric, Nicolo Conti) seem to have been extorted from them by a kind of pressure, and committed to paper by other hands. This indicates indeed how little the literary ambition which besets so many modern travellers weighed with the class in those days. It is also perhaps an example of that intense dislike to the use of pen and ink which still prevails among ordinary respectable folk on the shores of the Mediterranean.

But, in the prison of Genoa, Marco Polo fell in with a certain person of writing propensities, Rusticiano or Rustichello of Pisa, who also was a captive of the Genoese. His name is known otherwise to literary antiquaries as that of a respectable kind of literary hack, who abridged and recast several of the French romances of the Arthurian cycle which were then in fashion. He it was, apparently, who persuaded Marco Polo to defer no longer the committal to paper of his wonderful experiences. In any case it was he who wrote down these experiences at Marco's dictation; and he is the man, therefore, to whom we owe the existence of this record, and possibly the preservation even of the traveller's name and memory.

We learn but little of Marco Polo's personal or family history after this captivity; but we know that at his death he left a wife, Donata by name (perhaps of the family of Loredano, but this is uncertain), and three daughters, Fantina and Bellela married, the former to Marco Bragadino, and Moreta then a spinster, but married at a later date to Ranuzzo Dolfino One last glimpse of the traveller is gathered from hi will, which is treasured in the library of St. Mark's On the 9th January, 1324, the traveller, now in hi seventieth year, and sinking day by day under bodily infirmity, sent for a neighboring priest and notary t make his testament. We do not know the exact tim of his death, but it fell almost certainly within the yea 1324, for we know from a scanty series of documents commencing in June, 1325, that he had at the latte date been some time dead. He was buried in accordance with his will, in the church of St. Lorenzo, wher the family burying-place was marked by a sarcophagus erected by his filial care for his father Nicolo, which existed till near the end of the 16th century. On th renewal of the church in 1592 this seems to have bee cast aside and lost.

The copious archives of Venice have yielded up few traces of our traveller. Besides his own will jus alluded to, there are in the library the wills of hi uncle Marco and of his younger brother Maffeo; a fe legal documents connected with the house propert in St. John Chrysostom, and other papers of simila character; and two or three entries in the record o the Maggior Consiglio. We have mentioned the sobriquet of Marco Millioni which he got from his youn townsmen. Ramusio tells us that he had himself note the use of this name in the public books of the commonwealth, and this statement has been verified of lat years in one of those entries in the books of the Grea Council (dated 10th April, 1305), which records as on of the securities in a certain case the "Nobilis vi *Marchus Paulo* MILIOÑ." It is alleged that long afte the traveller's death there was always in the Venetia masques one individual who assumed the character o Marco Millioni, and told Munchausen-like stories t divert the vulgar. Such, if this be true, was the hono of our great man in his own country. One curiou parchment among those preserved is the record of th judgment of the court of requests (Curia Petitionum upon a suit brought by the "Nobilis Vir Marcus Polo" against Paulo Girardo, who had been an agent of his to recover the value of a certain quantity of musk fo which Girardo had not accounted. Another curiou document brought to light within the last few years i a catalogue of certain curiosities and valuables whic were collected in the house of the unhappy Marin Faliero, and this catalogue comprises several object that Marco Polo had given to one of the Faliero family Among these are two which would have been of matchless interest had they survived, viz.—"Unum anulum con inscriptione que dicit Cuibile Can Marco Polo, e unum torques cum multis animalibus Tartarorum sculptis que res donum dedit predictus Marcus quidan (cuidam) Faletrorum."

The most tangible record of Polo's memory in Venic is a portion of the Ca' Polo—the mansion (there i every reason to believe) where the three travellers, afte their absence of a quarter century, were denied entrance. The court in which it stands was known i Ramusio's time as the *Corte del Millioni*, and now i called Corte Sabbionera. That which remains of th ancient edifice is a passage with a decorated archwa of Italo-Byzantine character pertaining to the 13th century. With this exception, what was probably th actual site of the mansion is now occupied by th Malibran theatre.

No genuine portrait of Marco Polo exists. Ther is a medallion portrait on the wall of the Sala dell Scudo in the ducal palace, which has become a kin of type; but it is a work of imagination no older tha 1761. The oldest professed portrait is one in the gallery of Monsignor Badia at Rome, which is inscribed *Marcus Polus Venetus Totius Orbis et Indie Peregrato* *Primus*. It is a good picture, but evidently of th 16th century at earliest, and the figure is of the character of that time. The Europeans at Canton hav attached the name of Marco Polo to a figure in a Buddhist temple there containing a gallery of "Arhans" or Buddhist saints, and popularly known as the "temple of the five hundred gods." There is a copy of this at Venice, which the Venetian municipality obtained on the occasion of the Geographical Congress there in 1881. But the whole notion was a groundless fancy.

The book indited by Rusticiano the Pisan, which has preserved Marco Polo's fame, consists essentially of two parts. The first, or prologue, as it is termed, is the only part unfortunately which consists of actual personal narrative. It relates in a most interesting, though too brief, fashion the circumstances which led the two elder Polos to the khan's court, with those of their second journey accompanied by Marco, and of the return to the West by the Indian seas and Persia. The second and staple part of the book consists of a long series of chapters of very unequal length and unsystematic structure, descriptive of the different states and provinces of Asia, with occasional notices of their sights and products, of curious manners and remarkable events, and especially regarding the emperor Kublai, his court, wars, and administration. A series of chapters near the close treats in a wordy and monotonous manner of sundry wars that took place between various branches of the house of Jenghiz in the latter half of the 13th century. This last series is either omitted or greatly curtailed in all the MS. copies and versions except one.

It was long a doubtful question in what language the work was originally written. That this had been some dialect of Italian was a natural presumption, and a contemporary statement could be alleged in its favor. But there is now no doubt that the original was French. This was first indicated by Count Baldelli-Boni, who published an elaborate edition of two of the Italian texts at Florence in 1827, and who found in the oldest of these indisputable signs that it was a translation from the French. The argument has since been followed up by others; and a manuscript in rude and peculiar French, belonging to the National Library of Paris, which was printed by the Société de Géographie in 1824, has been demonstrated (as we need not hesitate to say) to be either the original or a very close transcript of the original dictation. A variety of its characteristics are strikingly indicative of the unrevised product of dictation, and are such as would necessarily have disappeared either in a translation or in a revised copy. Many illustrations could be adduced of the fact that the use of French was not a circumstance of a surprising or unusual nature; for the language had at that time, in some points of view, even a wider diffusion than at present, and examples of its literary employment by writers who were not Frenchmen are very numerous. It is superfluous to allege instances here, when we observe that Rusticiano himself, the scribe of the narrative, was a compiler of French romances.

Some eighty MSS. of the book are known, and their texts exhibit considerable differences. These fall under four principal types. Of these type i. is found completely only in that old French codex which has been mentioned. Type ii. is shown by several valuable MSS. in purer French, the best of which formed the basis of the edition prepared by the late M. Pauthier in 1865. It exhibits a text pruned and revised from the rude original, but without any exactness, though perhaps under some general direction by Marco Polo himself; for an inscription prefixed to one of the MSS. records the presentation of a copy by the traveller himself to the Seigneur Thibault de Cepoy, a distinguished Frenchman known to history, at Venice in the year 1306. Type iii. is that of a Latin version prepared in Marco Polo's lifetime, though without any sign of his cognizance, by Francesco Pipino, a Dominican of Bologna, and translated from an Italian copy. In this, condensation and curtailment are carried a good deal further than in type ii. Some of the forms under which this type appears curiously illustrate the effects of absence of effective publication, not only before the invention of the press, but in its early days. Thus the Latin version published by Grynæus at Basel in the *Novus Orbis* (1532) is different in its language from Pipino's, and yet is clearly traceable to that as its foundation. In fact it is a retranslation into Latin from some version of Pipino (Marsden thinks the Portuguese printed one of 1502). It introduces also changes of its own, and is quite worthless as a text; and it is curious that Andreas Müller, who in the 17th century took much trouble with editing Polo according to his lights, should have unfortunately chosen as his text this fifth-hand version. It may be added that the French editions published in the middle of the 16th century were translations from Grynæus's Latin. Hence they complete this curious and vicious circle of translation—French, Italian, Pipino's Latin, Portuguese, Grynæus's Latin, French.

The fourth type of text deviates largely from those already mentioned; its history and true character are involved in obscurity. It is only represented by the Italian version prepared for the press by G. B. Ramusio, with most interesting preliminary dissertations, and published at Venice two years after his death, in the second volume of the *Navigationi e Viaggi*. Its peculiarities are great. Ramusio seems to imply that he made some use of Pipino's Latin, and various passages confirm this. But many new circumstances, and anecdotes occurring in no other copy, are introduced; many names assume a new shape; the whole style is more copious and literary in character than that of any other version. Whilst a few of the changes and interpolations seem to carry us further from the truth, others contain facts of Asiatic nature or history, as well as of Polo's alleged experiences, which it is extremely difficult to ascribe to any hand but the traveller's own.

We recognize to a certain extent tampering with the text, as in cases where the proper names used by Polo have been identified, and more modern forms substituted. In some other cases the editorial spirit has been more meddlesome and has gone astray. Thus the age of young Marco has been altered to correspond with a date which is itself erroneous. Ormus is described as an island, contrary to the old texts, and to the facts of its position in Polo's time. In speaking of the oil-springs of Caucasus the phrase "camel-loads" has been substituted for "ship-loads," in ignorance that the site was Baku on the Caspian.

But on the other hand there are a number of new circumstances certainly genuine, which can hardly be ascribed to any one but Polo himself. We will quote one only. This is the account which Ramusio's version gives of the oppressions exercised by Kublai's Mohammedan minister Ahmed, telling how the Cathayans rose against him and murdered him, with the addition that Messer Marco was on the spot when all this happened. Not only is the whole story in substantial accordance with the Chinese annals, even to the name of the chief conspirator (*Vanchu* in Ramusio, *Wang-cheu* in the Chinese records), but the annals also tell of the courageous frankness of "Polo, assessor of the privy council," in opening Kublai's eyes to the iniquities of his agent.

To sum up, we can hardly doubt that we have, imbedded in the text of this most interesting edition of Ramusio's, the supplementary recollections of the traveller, noted down at a later period of his life, but perplexed by translation and retranslation and editorial mistakes. The most important desideratum still remaining in reference to Polo's book is the recovery of the original from which Ramusio derived the passages peculiar to his edition.

That Marco Polo has been so universally recognized as the prince of mediæval travellers is due rather to the width of his experience, the vast compass of his journeys, and the romantic nature of his personal history than to transcendent superiority of character or capacity. Enthusiastic biographers, beginning with Ramusio, have placed him on the same platform with Columbus. But he has left no trace of the genius and lofty enthusiasm, the ardent and justified previsions, which mark the great admiral as one of the lights of the human race. It is a juster praise that the spur which his book eventually gave to geographical studies, and the beacons which it hung out at the eastern extremities of the earth, helped to guide the aims, though hardly to kindle the fire of the greater son of the rival republic. His work was at least a link in the providential chain which at last dragged the New World to light.

But Polo also was the first traveller to trace a route across the whole longitude of Asia, naming and describing kingdom after kingdom, which he had seen with his own eyes; the first to speak of the new and brilliant court which had been established at Peking; the first to reveal China in all its wealth and vastness, and to tell us of the nations on its borders, with all their eccentricities of manners and worship; the first to tell more of Tibit than its name, to speak of Burmah, of Laos, of Siam, of Cochin-China, of Japan, of Java, of Sumatra, and of other islands of the Great Archipelago, that museum of beauty and marvels, of Nicobar and Andaman Islands with their naked savages, of Ceylon and its sacred peak, of India, not as a dream-land of fables, but as a country seen and partially explored; the first in mediæval times to give any distinct account of the secluded Christian empire of Abyssinia, and of the semi-Christian island of Socotra, and to speak, however dimly, of Zanzibar, and of the vast and distant Madagascar; whilst he carries us also to the remotely opposite region of Siberia and the Arctic shores, to speak of dog-sledges, white bears, and reindeer-riding Tunguses. That all this rich catalogue of discoveries (as they may fitly be called) should belong to the revelation of one man and o-book is ample ground enough to justify a very high place in the roll of fame.

Indeed it is remarkable in how large a proportion of the Old World modern travellers and explorers have been but developing what Marco Polo indicated in outline,—it might be said, without serious hyperbole, only travelling in his footsteps, most certainly illustrating his geographical notices. At the moment when these lines are written a British mission is starting to survey for political reasons a tract upon the Oxus; Marco Polo traversed this tract. For twenty years Russian and English explorers have been trying to solve the problem of the Pamir watershed; Marco Polo explored it. Till within the last quarter century the cities of eastern Turkestan, such as Kashgar, Yarkand, and Khotan, were known only from the compilation of Oriental fragments; Marco had visited them all. Within a shorter period dense darkness hung over the tracts between western China and Upper Burmah; these also had been traversed by Marco Polo. France is now scattering the brands of war in Tongking, in Fuhkien, and in Madagascar; all these were within Marco's Polo's knowledge and find mention in his book. And how vast an area has he described from personal knowledge which remains outside of the fields that we have indicated! Readers of the book would welcome a little more of egotistical detail. Impersonality is carried to excess; and we are often driven to discern only by indirect and doubtful induction whether he is speaking of places from personal knowledge or from hearsay. In truth, though there are delightful exceptions, and though nearly every part of the book suggests interesting questions, a desperate meagreness and baldness does affect considerable parts of the narrative. In fact his work reminds us sometimes of his own description of Khorasan—"On chevauche par beaus plains et belles costieres, là ou il a moult beaus herbages et bonne pasture et frais assez . . . et aucune fois y treuve l'en un desert de soixante milles ou de mains, esquel desers ne treuve l'en point d'eaue; mais la convient porter o lui!"

The diffusion of the book was hardly so rapid as has been sometimes alleged. It is true that we know from Gilles Mallet's catalogue of the books collected in the Louvre by Charles V., dating *c.* 1370–75, that no less than five copies of Marco Polo's work were then in the collection; but on the other hand the number spread over Europe of MSS. and early printed editions of Mandeville, with his lying wonders, indicates a much greater popularity. Dante, who lived twenty-three years after the book was dictated, and who touches so many things in the seen and unseen worlds, never alludes to Polo, nor, we believe, to anything that can be connected with him, nor can any trace of Polo be discovered in the book of his contemporary Marino Sanudo the elder, though this worthy is well acquainted with the work, later by some years, of Hayton the Armenian, and though many of the subjects on which he writes in his own book (*De Secretis Fidelium Crucis*[1]) challenge a reference to Polo's experiences. Perhaps indeed the most notable circumstance bearing in the same direction is the fact that the author of Mandeville, whoever he really was, and who plundered right and left, never plunders Polo, a thing only to be accounted for by his being ignorant of Polo's existence. The only literary work we know of belonging to the 14th century which shows a thorough acquaintance with Polo's book is the poetical romance of *Baudouin de Sebourg*, which borrows themes from it largely.

Marco Polo contributed so vast an amount of new facts to the knowledge of the earth's surface, that one might have have expected his book to have a sudden effect upon geography. But no such result occurred for a long time. Doubtless several causes contributed to this, of which the unreal character attributed to the book as a collection of romantic marvels rather than of geographical and historical facts, may have been one,—a view that the diffusion of Mandeville's fictions, far outdoing Polo's facts in marvel, perhaps tended to corroborate, whilst supplanting the latter in popularity. But the essential causes were the imperfect nature of publication; the traditional character of the prevailing geography, which hampered the propagation of true statements; and the entire absence of scientific principle in what did pass for geography, so that there was no organ competent to the assimilation of so huge a mass of new knowledge.

The late Sir Francis Palgrave wrote a book called *The Merchant and the Friar*, in which it is feigned that Marco Polo comes to England, and becomes acquainted with Roger Bacon. Had Roger Bacon indeed known either the traveller or his book, we cannot doubt, from the good use he makes, in his *Opus Majus*, of William of Rubruk, that he would have turned the facts to good account.

But the world with which the map makers of the 13th and 14th centuries dealt was, in its outline, that handed down by traditions of the craft, as sanctioned by some fathers of the church, such as Orosius and Isidore, and sprinkled with a combination of classical and mediæval legends. Almost universally the earth's surface fills a circular disk, rounded by the ocean,—a fashion that already was ridiculed by Herodotus (iv. 36), as it was in a later generation by Aristotle (*Meteorol.*, ii. 5). This was the most persistent and the most obstructive dogma of the false geography. The central point of the circle is occupied by Jerusalem, because it was found written in Ezekiel: "Hæc dicit Dominus Deus, Ista est Jerusalem, in medio gentium posui eam, et in circuitu ejus terras,"—supposed to be corroborated by the Psalmist's expression, regarded as prophetic of our Lord's passion—"Deus autem Rex noster ante sæcula operatus est salutem in medio terræ" (Ps. lxxiv. 12). Paradise occupied the extreme east, because it was found in Genesis that the Lord planted a garden eastward in Eden. Gog and Magog were set in the far north or northeast because it was again said in Ezekiel; "Ecce ego super te Gog principem capitis Mosoch et Thubal . . . et ascendere te faciam de lateribus aquilonis." This last legend of Gog and Magog, shut up by a mountain-barrier, plays a prominent part in the romantic history of Alexander, which had such enormous currency in those ages, and attracted especial attention in the 13th century, owing to the general identification of the Tartar hordes with these impure nations whom the hero had shut up. It is not wonderful that the Tartar irruption into the West, heard of at first with as much astonishment as it would produce now, was connected with this old belief.

The loose and scanty nomenclature of the cosmography was mainly borrowed from Pliny and Mela, through such fathers as we have named; whilst vacant spaces were occupied by Amazons, Arimaspians, and the realm of Prester John. A favorite representation of the inhabited earth was a great T within an O (see Map).

Such schemes of the world had no place for the new knowledge. The first genuine attempt at a geographical compilation absolutely free from the traditional *idola* seems to be that in the *Portulano Mediceo* at Florence. In this some slight use seems to be made of Polo. But a far more important work is one of the next generation, the celebrated Catalan map of 1375 in the Paris library. This also is an honest endeavor on a large scale to represent the known world on the basis of collected facts, casting aside all theories, pseudo-scientific and pseudo-theological; and a very remarkable work it is. In this work Marco Polo's influence on maps is perhaps seen to the greatest advantage. As regards Central and Further Asia, and partially as regards India, his book is the basis of the map. His names are often much perverted, and it is not always easy to understand the view that the compiler took of his itineraries. Still we have Cathay admirably placed in the true position of China, as a great empire filling the southeast of Asia. The trans-Gangetic peninsula is absent, but that of India proper is, for the first time in the history of geography, represented with a fair approximation to correct form and position. We really seem to see in this map something like the idea of Asia that the traveller himself would have presented, had he bequeathed us a map.

In the following age we find more frequent indications that Polo's book was diffused and read. And now that the spirit of discovery was beginning to stir, the work was regarded in a juster light as a book of facts, and not as a mere *Romman du Grant Kaan*. But the age produced new supplies of information in greater abundance than the knowledge of geographers was prepared to digest or co-ordinate; and, owing partly to this, and partly to his unhappy reversion to the fancy of a circular disk, the map of Fra Mauro (1459), one of the greatest map-making enterprises in history, and the result of immense labor in the collection of facts and the endeavor to combine them, really gives a much less accurate idea of Asia than the *Carta Catalana*.

When M. Libri, in his *Hist. des Sciences Mathématiques*, speaks of Columbus as "jealous of Polo's laurels," he speaks rashly. In fact Columbus knew of Polo's revelations only at second-hand, from the letters of the Florentine Paolo Toscanelli and the like; we cannot find that he ever refers to Polo by name. Though, to the day of his death, Columbus was full of imaginations about Zipangu (Japan) and the land of the Great Khan, as being in immediate proximity to his discoveries, these were but accidents of his great theory. It was his intimate conviction of the absolute smallness of the earth, of the vast extension of Asia eastward, and of the consequent narrowness of the western ocean on which his life's project was based.

When, soon after the discovery of the New World, attempts were made to combine the new and old knowledge, e results were unhappy. The earliest of such combina- tried to realize the ideas of Columbus regarding the ntity of his discoveries with the Great Khan's domin- s; but even after America had vindicated its indepen- t existence, and the new knowledge of the Portuguese l introduced China where the Catalan map had pre- ted Cathay, the latter country, with the whole of Polo's menclature, was shunted to the north, forming a separate stem. Henceforward the influence of Polo's work on ps was simply injurious; and when to his names was ded a sprinkling of Ptolemy's as was usual throughout 16th century, the result was a hotch-potch conveying approximation to any representation of facts.

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[1] Printed by Bongars in the collection called *Gesta dei per Francos*, 1611.

Gradually the contributions of Ptolemy and Polo are d more sparingly, but in Sansom's map (1659) a new ment of confusion appears in numerous features derived m the "Nubian Geographer," *i. e.* Edrisi.

It is needless to follow the matter further. With the in- sed knowledge of northern Asia from the Russian side, d of China from the maps of Martini, followed by the r Jesuit surveys, and with the real science brought to r on Asiatic geography by such men as De l'Isle and Anville, mere traditional nomenclature gradually disap- red; and the task which Polo has provided for the graphers of later days has been chiefly that of determin- g the true localities which his book describes under ob- olete or corrupted names.

Before concluding, a word or two seems necessary on the ubject of the alleged introduction of important inventions nto Europe by Marco Polo. Assertions or surmises of this ind have been made in regard to the mariner's compass, o gunpowder, and to printing. Though the old assertions s to the first two are still occasionally repeated in books f popular character, no one who has paid any attention o the subject now believes Marco can have had anything o do with their introduction. But there is no doubt that he resemblance of early European block-books to those of hina is in some respects so striking that it seems clearly o indicate the derivation of the art from that country. here is, however, not the slightest reason for connecting his introduction with the name of Polo. His fame has so vershadowed later travellers that the fact has been gener- lly overlooked that for some years in the 14th century ot only were missions of the Roman church established n the chief cities of eastern China, but a regular over- and trade was carried on between Italy and China, by ay of Tana (Azof), Astrakhan, Otrar, Kamul (Hami), and an-chow. Many a traveller other than Marco Polo might ave brought home the block-books, and some might ave witnessed the process of making them. This is the s to be ascribed to Polo, because he so curiously omits to peak of the process of printing, when in describing the lock-printed paper-money of China, his subject seems ab- olutely to challenge a description of the art. (H. Y.)

POLOTSK, a district town of the government of itebsk, at the confluence of the Polota with the wina (Düna), 5 miles from the Smolensk and Riga ailway, is one of the oldest towns of Russia. The ntinuous wars, however, of which, owing to its posi- on on the line of communication between central Rus- a and the west, it was for many centuries the scene, ave allowed almost nothing of its remarkable antiqui- es to remain. The "upper castle" which stood at e confluence of the rivers and had a stone-wall with ven towers, is now in ruins, as also is the "lower stle," formerly enclosed with strong walls and con- cted with the upper by a bridge. The numerous onasteries and convents also have disappeared. The thedral of St. Sophia in the upper castle, built in e 12th century, and successively used as a place of orship by the Greek, the Catholic, and the "United" hurches, fell to ruins in the 18th century, when the United" bishop Grebnicki substituted a modern ructure. The town is now of trifling importance, d the population (12,200 in 1880, against 13,800 in 65) is decreasing. Upwards of two-thirds of the habitants are Jews; the remainder have belonged ostly to the Greek Church since 1839, when they ere compelled to abandon the Union. Flax, linseed, rn, and timber are the leading articles of the com- erce of the town.

Polotesk or Poltesk is mentioned in 862 as one of the wns given by Rurik to his men, together with Byelo- ero and Rostoff. In 980 it had a prince of its own, Rog- lod, whose daughter is the subject of many legends. It remained an independent principality until the 12th century, resisting the repeated attacks of the princes of Kieff; those of Pskoff, Lithuania, and the Livonian knights, however, proved more powerful, and it fell under Lithuanian rule in the following century. About 1385 its independence was destroyed by the Lithuanian prince Witowt. It was five times besieged by Moscow in 1500–18, and was taken by John the Terrible in 1563. Recaptured by Stephen Batory sixteen years later, it became Polish by the treaty of 1582. It was then a populous city, which, enjoying the privileges of "Magdeburg law" from 1498, carried on an active commerce, and covered a large area. Pestilences and conflagrations were its ruin; the plague of 1566 wrought great havoc among its inhabitants, and that of 1600 destroyed 15,000. The castles, the town, and its walls were burned in 1607 and 1642. The Russians continued their attacks, burning and plundering the town, and twice taking possession of it for a few years, in 1633 and 1705. It was not definitively annexed, however, to Russia until 1772, after the first dismemberment of Poland. In 1812 its inhabitants resisted the French invasion, and the town was partially destroyed.

POLTAVA, a government of southwestern Russia, bounded by Tchernigoff on the N., Kharkoff on the E., Ekaterinoslaff and Kherson on the S., and Kieff on the W., and having an area of 19,265 square miles. Its surface is an undulating plain from 500 to 600 feet above sea-level, with a few elevations reaching 670 feet in the north, and gently sloping to the southwest, where its range is between 300 and 400 feet. Owing to the excavations of the rivers, their banks, especially those on the right, have the aspect of hilly tracts, while low plains stretch to the left. Low-lying districts with some marshes and sandy tracts are met with in the broad valley of the Dnieper, which skirts the province on the southwest. Almost the whole of the surface is covered with Tertiary deposits; chalk appears in the northeast, at the bottom of deeper ravines. The government touches the granitic region of the Dnieper only in the south, below Krementchug. Limestone with dolerite veins occurs in the isolated hill of Isatchek, which rises above the marshes of the Sula. The whole is covered with a layer, 20 to 60 feet thick, of boulder clay, which, again, is often covered with a thick sheet of loess. Sandstone (sometimes suitable for grindstones) and limestone are quarried, and a few layers of gypsum and peat bog are also known within the government. The soil is on the whole very fertile, with the exception of some sandy tracts. Poltava is watered by the numerous tributaries of the Dnieper, which flows along its border, navigable throughout. Deep sand beds intersected with numberless ravines and old arms of the river stretch along the left bank, where accordingly the settlements are but few. It is joined by the Sula, the Psiol, the Vorskla, the Orel, the Trubezh, and several other tributaries, none of them navigable, although their courses vary from 150 to 270 miles in length. Even those which used to be navigated within the historical period, such as Trubezh and Supoy, are now drying up, while the others are being partially transformed into marshes. Only 5 per cent. of the total area is under wood; timber, wooden wares, and pitch are imported.

The population in 1881 reached 2,418,870, of whom 217,800 lived in towns. The great majority are Little Russians, there being only 20,000 Great Russians, less than 1000 White Russians, some 2000 Poles, and 1500 Germans. In 1865 the Jews were estimated at 40,000. Agriculture is the chief pursuit, there being 7,451,000 acres (60 per cent. of the total area) of arable land, and the average yield of the years 1870–77 being 6,302,000 quarters [50,416,000 bu.] of corn and 703,200 quarters [5,625,600 bu.] of potatoes. The crops chiefly grown are wheat, rye, and oats; the sunflower is largely cultivated, especially for oil, and the culture of tobacco, always important, has recently made a very great advance, now yielding about 200,000 cwts. Kitchen gardening, the culture of the plum, and the preparation of preserved fruits, are also important branches of industry. At Lubory, where an apothecaries' garden is maintained by the crown, the collection and cultivation of medicinal plants is also a specialty. The main source of wealth in Poltava always has been, and still is, its cattle-breeding. In 1881 there were 209,000 horses, 882,000 cattle, 1,820,000 sheep (only 520,000 of these, as against 878,000 in 1862, being of finer breeds), 405,000 pigs, and 7000 goats. Black and gray sheepskins are largely exported, as also is wool. Some of the wealthier landowners and many peasants now rear finer breeds of horses.

The aggregate value of the manufactures in 1879 was £1,112,100 [$5,404,806], employing in their production 3755 hands; distilleries hold the leading place, (£717,500) [$3,487,050], after which come flour mills (£136,600) [$663,876], tobacco works (£79,700) [$387,342], machine-making (£35,700) [$173,502], tanneries (£27,700) [$134,622], saw-mills (£20,000) [$97,200], and sugar-works (£10,900) [$52,974]. Wool is exported in a raw state, and the woollen manufactures amounted only to £5750 [$27,945]. In the villages and towns several domestic trades are carried on, such as the preparation of sheepskins, plain woollen cloth, leather, boots, and pottery.

The fair of Poltava is of great importance for the whole woollen trade of Russia; leather, cattle, horses, coarse woollen cloth, skins, and various domestic wares are also exchanged for manufactures imported from Great Russia. The value of merchandise brought to the fair reaches and sometimes exceeds 25,000,000 [$19,250,000 silver roubles] roubles. Several other fairs, the aggregate returns for which reach more than one-half of the above, are held at Romny (tobacco), Krementchug (timber, corn, tallow, and salt), and Kobelyaki (sheepskins). Corn is exported to a considerable extent to the west and to Odessa, as also saltpetre, spirits of wine, wool, tallow, skins, and plain woollen cloth. The navigation on the Dnieper is interfered with by want of water, and becomes active only in the south. The chief traffic is by railway.

The government is divided into fifteen districts, the chief towns of which are—Poltava (41,050 inhabitants), Gadyatch (9250), Khorol (5175), Kobelyaki (13,150), Konstantinograd (4320), Krementchug (46,620 with Krukoff), Lokhvitsa (9320), Lubny (9820), Mirgorod (7750), Pereyaslaff (13,350), Piryatin (5400), Priluki (13,100), Romny (12,310), Zolotonosha (7180), and Zyenkoff (8360). Glinsk (3250) and Gradijsk (7850) have also municipal institutions, while several villages and towns (Sorotchintsy, Borispol, Smyeloye, Grun, Ryeshetilovka, etc.) have from 6500 to 8000 inhabitants.

History.—At the dawn of Russian history the region now occupied by Poltava was inhabited by the Syeveryanes. As early as 988 the Russians erected several towns on the Sula and Trubezh for their protection against the Petchenegs and Polovtsy, who held the southeastern steppes. Population extended, and the towns Pereyaslaff, Lubny, Lukomy, Priluki, Piryatin, Romny, etc., begin to be mentioned in the 11th and 12th centuries. The Mongol invasion destroyed most of them, and for two centuries afterwards they totally disappear from Russian annals. About 1331 Godimin annexed the so-called "Syeversk towns" to Lithuania, and on the recognition of the union of Lithuania with Poland they were included in the united kingdom along with the remainder of Little Russia. In 1476 a separate principality of Kieff under Polish rule and Polish institutions was formed out of Little Russia, and remained so until the rising of Bogdan Khmyelnitzkii in 1654. By the Andrusoff treaty, the left bank of the Dnieper being ceded to Russia, Poltava became part of the dominions of the Zaporogian hetman, and was divided into "regiments," six of which (Poltava, Pereyaslaff, Priluki, Gadyatch, Lubny, and Mirgorod) lay within the limits of the present government. They lost their independence in 1764, and serfdom was introduced in 1783, the Poltava region becoming part of the governments of Kieff and Ekaterinoslaff. The present government was instituted in 1802.

POLTAVA, capital of the above government, stands on the right bank of the Vorskla, 88 miles by rail to the west-southwest of Kharkoff. The town is built on a plateau which descends by steep slopes nearly on all sides; the buildings are separated by large yards and gardens. Several suburbs, inhabited by Cossacks, whose houses are buried amid gardens, and a German colony, surround the town. Water is scarce, and has to be brought a long distance, from the marshy Vorskla. The oldest buildings are the Krestovozdvijenskiy monastery, erected in 1650, and a wooden church visited by Peter I. after the battle of Poltava. There are two lyceums for boys and girls, a "realschule," a military school for cadets, a theological seminary, and two girls' colleges, besides Russian, German, and Jewish primary schools. The manufactures are insignificant (£58,000 [$281,880] in 1879); the principal are tobacco works (£27,500) [$133,650] and a tannery (£14,400) [$69,984]. The trade derives its importance from the four fairs that are held at Poltava. The chief of these, in July (noticed above), is visited by 30,000 to 40,000 people. In 1881 the population was 41,050.

Poltava is mentioned in Russian annals in 1174, under the name of Ltava, but does not again appear in history until 1430, when, together with Glinsk, it was given by Gedymin to the Tartar prince Leksada. Under Bogdan Khmyelnitzkii it was the chief town of the Poltava "regiment." Peter I. defeated Charles XII. in the immediate neighborhood on June 27, 1709.

POLYÆNUS, a Macedonian, lived at Rome as a rhetorician and pleader in the 2d century. When the Parthian War (162–165 A.D.) broke out, Polyænus, too old to share in the campaign, dedicated to the emperors Marcus Antonius and Lucius Verus a work, still extant, called *Strategica* or *Strategemata*, an historical collection of stratagems and maxims of strategy written in Greek and strung together in the form of anecdotes. It is not strictly confined to warlike stratagems, but includes also examples of wisdom, courage, and cunning drawn from civil and political life. The work is uncritically and negligently written, but is nevertheless important on account of the extracts it has preserved from histories now lost. It is divided into eight books, and originally contained nine hundred anecdotes, of which eight hundred and thirty-three are extant. Polyænus intended to write a history of the Parthian War, but there is no evidence that he did so. His works on Macedonia, on Thebes, and on tactics (if indeed this be not identical with the *Strategica*) are lost.

His *Strategics* seem to have been highly esteemed by the Roman emperors and to have been handed down by them as a sort of heirloom. From Rome it passed to Constantinople; at the end of the 9th century it was diligently studied by Leo VI., who himself wrote a work on tactics; and in the middle of the 10th century Constantine Porphyrogenitus mentioned it as one of the most valuable books in the imperial library. It was used by Strobæus, Suidas, and the anonymous author of the work *περὶ ἀπίστων* (*Mythographi Græci*, ed. Westermann, p. 323). It is arranged as follows: bks. i., ii., iii., stratagems occurring in Greek history, from the mythical times of Dionysus and Hercules onward; bk. iv., strategems of the Macedonian kings and successors of Alexander the Great; bk. v., stratagems occuring in the history of Sicily and the Greek islands and colonies; bk. vi., stratagems of whole peoples (Carthaginians, Lacedæmonians, Argives, etc.), together with some of individuals (Philopœmen, Pyrrhus, Hannibal, etc.); bk. vii., stratagems of the barbarians (Medes, Persians, Egyptians, Thracians, Scythians, Celts); bk. viii., stratagems of Romans and women. This distribution is not, however, observed very strictly. Of the negligence or haste with which the work was written there are many instances: *e.g.*, he confounds Dionysius the elder and Dionysius the younger, Mithradates satrap of Artaxerxes and Mithradates the Great, Scipio the elder and Scipio the younger; he mixes up the stratagems of Cæsar and Pompey; he brings into immediate connection events which were totally distinct; he narrates some events twice over, with variations according to the different authors from whom he draws. Though he usually abridges, he occasionally amplifies arbitrarily the narratives of his authorities. He never mentions his authorities, but amongst authors still extant he used Herodotus, Thucydides, Xenophon, Polybius, Diodorus, Plutarch, Frontinus, and Suetonius; amongst authors of whom only fragments now remain he drew upon Ctesias, Ephorus, Timæus, Phylarchus, and perhaps Aristagoras, Dinon, Heraclides, Megasthenes, and Nicolaus Damascenus. His style is clear, but monotonous and inelegant. He heaps up participles and falls alternately into the opposite faults of accumulating and totally omitting conjunctions. A glaring instance of these faults is to be found in bk. iii., 9, 33. In the forms of his words he generally follows Attic usage.

His work was first printed in a Latin translation by Justus Vulteius (Basel, 1549); the Greek text was first edited by Casaubon (Leyden, 1589), but mainly from a very inferior MS. Korais in his edition (Paris, 1809) corrected the text in many places. The best edition is that of Wölfflin (Teubner, 1860), whose preface may be consulted with advantage.

POLYANTHUS. See PRIMROSE.

POLYBIUS, the historian, was a native of Megalopolis in Arcadia, the youngest of Greek cities (Paus. viii. 9), but one which played an honorable part in the last days of Greek freedom as a staunch member of the Achæan league. Polybius's father Lycortas was the intimate friend of Philopœmen, himself also a citizen of Megalopolis, and on the death of the latter, in 182 B.C., succeeded him as leader of the league. The date of Polybius's birth can only be fixed approximately. He tells us himself that in 181 he had not yet reached the age (? 30 years, Polyb., xxix. 9) at which an Achæan was legally capable of holding office (xxiv. 6). We learn from Cicero (*Ad Fam.*, v. 12) that he outlived the Numantine war, which ended in 132, and from Lucian (*Macrob.*, 22) that he died at the age of eighty-two. We may therefore follow the majority of authorities in placing his birth between 214 and 204 B.C. Little is known of his early life. As the son of Lycortas he was naturally brought into close contact with the leading men of the Achæan league. With the foremost of them, Philopœmen, he seems to have been on intimate terms. Plutarch (*εἰ πρεσβ.*, 12) describes him as sitting at the feet of the great Achæan soldier, of whom Polybius himself always writes in terms of affectionate admiration; and after Philopœman's tragic death in Messenia (182) he was entrusted with the honorable duty of conveying home the urn in which his ashes had been deposited (Plut., *Phil.*, 11). The next year (181) witnessed what seems to have been his first entry into political life. Together with his father Lycortas and the younger Aratus, he was appointed, in spite of his youth, a member of the embassy which was to visit Ptolemy Epiphanes, king of Egypt,—a mission, however, which the sudden death of Ptolemy brought to a premature end, (xxv. 7). The next twelve years of his life are a blank, but in 169 he reappears as a trusted adviser of the Achæans at a difficult crisis in the history of the league. In 171 war had broken out between Rome and the Macedonian king Perseus, and the Achæan statesmen were divided as to the policy to be pursued: to side with Macedon would have been suicidal; Lycortas himself was in favor of neutrality, but there were good reasons for fearing that the Roman senate would regard neutrality as indicating a secret leaning towards Macedon, and indeed both Lycortas and Polybius himself had already incurred suspicion at Rome on this ground. Polybius therefore declared for an open alliance with Rome, and his views were adopted. It was decided to send an Achæan force to cooperate with the Roman general. Polybius was selected to command the cavalry, and was at once despatched to the Roman camp to announce the decision of the league (xxviii. 10 *sq.*). The Roman consul declined the proffered assistance, but Polybius accompanied him throughout the campaign, and thus gained his first insight into the military system of Rome. On his return home he was able to render an important service to his countrymen by checking the unauthorized attempt of a Roman officer to raise troops in Achaia (xxviii. 13). In the next year (168) both Lycortas and Polybius were on the point of starting at the head of 1200 Achæans to take service in Egypt against the Syrians, when an intimation from the Roman commander that armed interference was undesirable put a stop to the expedition (xxix. 23). The success of Rome in the war with Perseus was now assured, and it is possible that the readiness of Lycortas and Polybius to serve abroad was partly due to a belief that the fate of Macedon must soon be shared by Achaia. If this was so, the belief was but too well founded. The final defeat of Perseus was rapidly followed by the arrival in Achaia of Roman commissioners charged with the duty of securely establishing Roman interests there. As a result of their proceedings 1000 of the principal Achæans were arrested and carried off to Italy. Polybius was among the number, but, while his companions were condemned to a tedious incarceration in the country towns of Italy, he obtained permission to reside in Rome. This privilege he owed to the influence of Æmilius Paullus, and his two sons Scipio and Fabius (xxxii. 9), who seem to have made his acquaintance in Macedonia. At any rate Polybius was received into Æmilius's house, and became the instructor of his sons (Appian, *Pun.*, 132). Between Scipio, the future conqueror of Carthage, and himself a friendship soon sprung up which ripened into a lifelong intimacy. To the last Scipio so constantly relied upon the advice and counsel of Polybius that it could be said by the countrymen of the latter that Scipio never failed when he followed the advice of his friend (Pausan., viii. 30). To Polybius himself his friendship with Scipio was not merely the chief pleasure of his life but of inestimable service to him throughout his career. It protected him from interference, opened to him the highest circles of Roman society, and enabled him to acquire a personal influence with the leading men, which stood him in good stead when he afterwards came forward to mediate between his countrymen and Rome. It placed within his reach opportunities for a close study of Rome and the Romans such as had fallen to no historian before him, and secured him the requisite leisure for using them, while Scipio's liberality more than once supplied him with the means of conducting difficult and costly historical investigations (Pliny, *N. H.*, v. 9). In 151, after seventeen years of banishment, the few surviving exiles were allowed to return to Greece. But the stay of Polybius in Achaia was brief. The estimation in which he was held at Rome is clearly shown by the anxiety of the consul Mamilius (149) to take him as his adviser on his expedition against Carthage. Polybius started to join him, but broke off his journey at Corcyra on learning that the Carthaginians were inclined to yield and that war was unlikely (xxxvi. 3). But when, in 147, Scipio himself took command in Africa, Polybius hastened to join him, and was an eye-witness of the siege and destruction of Carthage (Appian, *Pun.*, 132). During his absence in Africa, the Achæans had made a desperate and ill-advised attempt to assert for the last time their independence of Rome,—a passionate outbreak which Polybius had dreaded, and which his presence might have prevented. As it was he returned in 146 to find Corinth in ruins, the fairest cities of Achaia at the mercy of the Roman soldiery, and the famous Achæan league shattered to pieces (Pol. ap. Strabo, p. 381). But there was still work to be done that he alone could do. All the influence he possessed was freely spent in endeavoring to shield his countrymen from the worst consequences of their rashness. The excesses of the soldiery were checked, and at his special intercession the statues of Aratus and Philopœmen were preserved (xxxix. 14). An even more difficult task was that entrusted to him by the Roman authorities themselves, of persuading the Achæans to acquiesce in the new régime imposed upon them by their conquerors, and of setting the new machinery in working order. With this work, which he accomplished so as to earn the heartfelt gratitude of his countrymen (xxxix. 16), his public career seems to have closed. The rest of his life was, so far as we know, devoted to the great history which is the lasting monument of his fame. He died at the age of eighty-two of a fall from his horse (Lucian, *Macrob.*, 22).

Of the forty books which made up the history of Polybius, the first five alone have come down to us in a complete form; of the rest we have only more or less copious fragments. But as to the general plan and scope of the work there is no room for doubt, thanks mainly to the clearness with which they are explained by Polybius himself. The task which he set himself was that of making plain, for the instruction of his own and future generations, how and why it was that "all the known regions of the civilized world had fallen under the sway of Rome" (iii. 1). This empire of Rome, unprecedented in its extent and still more so in the rapidity with which it had been acquired, was the standing wonder of the age, and "who," he exclaims (i.1), "is so poor-spirited or indolent as not to wish to know by what means, and thanks to what sort of constitution, the Romans subdued the world in something less than fifty-three years?" These fifty-three years are those between 220 (the point at which the work of Aratus ended) and 168 B. C., and extend therefore from the outbreak of the Hannibalic war to the defeat of Perseus at Pydna. To this period then the main portion of his history is devoted from the third to the thirtieth book inclusive. But for clearness' sake he prefixes in books i. and ii. such a preliminary sketch of the earlier history of Rome, of the first Punic War, and of the contemporary events in Greece and Asia, as will enable his readers more fully to understand what follows. This seems to have been his original plan, but at the opening of book iii., written apparently after 146, he explains that he thought it desirable to add some account of the manner in which the Romans exercised the power they had won, of their temperament and policy, and of the final catastrophe which destroyed Carthage and forever broke up the Achæan league (iii. 4, 5). To this appendix, giving the history from 168–146, the last ten books are devoted.

Whatever fault may be found with Polybius, there can be no question that he had formed a high conception of the task before him, and of the manner in which it should be executed. He lays repeated stress on two qualities as distinguishing his history from the ordinary run of historical compositions. The first of these, its synoptic character, was partly necessitated by the nature of the period with which he was dealing. The interests, fortunes, and doings of all the various states fringing the basin of the Mediterranean had become so inextricably interwoven that it was no longer possible to deal with each of them in isolation. The historian must deal with this complex web of affairs as a whole, if he would be able either to understand or to explain it properly. Polybius therefore claims for his history that it will take a comprehensive view of the whole course of events in the civilized world, within the limits of the period with which it deals (i. 4). In doing so he marks a new point of departure in historical writing, "for we have undertaken," he says, "to record, not the affairs of this or that people, like those who have preceded us, but all the affairs of the known world at a certain time." In other words he aims at placing before his readers at each stage a complete survey of the field of action from Spain in the West to Syria and Egypt in the East. This synoptic method proceeds from a true appreciation of what is now called the unity of history, and to Polybius must be given the credit of having first firmly grasped and clearly enforced a lesson which the events of his own time were especially well calculated to teach. Posterity too has every reason to be grateful, for, though, as will be seen later, this synoptic method frequently interferes with the symmetry and continuity of his narrative, yet it has given us such a picture of the 2d and 3d centuries before Christ as no series of special narratives could have supplied.

The second quality upon which Polybius insists as distinguishing his history from all others is its "pragmatic" character. It deals, that is, with events and with their causes, and aims at an accurate record and explanation of ascertained facts. This "pragmatic method" (ix. 2) has a double value. First of all it makes history intelligible by explaining the how and the why; and, secondly, it is only when so written that history can perform its true function of instructing and guiding those who study it. For the great use of history according to Polybius is to contribute to the right conduct of human life (i. 35), by supplying a storehouse of experience for the assistance of those who will use it. But this it can only do if the historian bears in mind the true nature of his task. Above all things he must not content himself with merely writing a pleasant tale. He must remember that the historian should not write as the dramatist does to charm or excite his audience for the moment but to edify and instruct all serious students in the future (ii. 56). He will therefore aim simply at exhibiting events in their true light, setting forth "the why and the how" in each case not confusing causes and occasions, or dragging in old wives' fables, prodigies, and marvels (ii. 16; iii. 48). He will omit nothing which can help to explain the events he is dealing with: the genius and temperament of particular peoples, their political and military systems, the characters of the leading men, the geographical features of the country, must all be taken into account. To this conception of the aim and methods of history Polybius is on the whole consistently faithful in practice. It is true that his anxiety to instruct leads often to a rather wearisome iteration of his favorite maxims, and that his digressions, such as that on the military art, are occasionally provokingly long and didactic. But his comments and reflections are for the most part sound and instructive (*e. g.*, those on the lessons to be learnt from the revolt of the mercenaries in Africa, i. 65; from the Celtic raids in Italy, ii. 35., and on the Roman character), while among his digressions are included such invaluable chapters as those on the Roman constitution (book vi), the graphic description of Cisalpine Gaul (book ii), and the account of the rise and constitution of the Achæan league (ii. 38 *sq.*). To his anxiety again to trace back events to their first causes we owe, not only the careful inquiry (book iii.) into the origin of the Second Punic War, but the sketch of early Roman history in book i., and of the early treaties between Rome and Carthage in iii. 22 *sq.* Among the many defects which he censures in previous historians, not the least serious in his eyes are their inattention to the political and geographical surroundings of the history (ii. 16; iii. 36), and their neglect duly to set forth the causes of events (iii. 6).

Polybius is equally explicit as regards the personal qualifications necessary for a good historian, and in this respect, too, his practice is in close agreement with his theory. He has a profound distrust of closet students and a profound belief in the value of a personal knowledge of affairs. Without such experience a writer will, he says, be guilty of endless blunders and omissions and will inevitably distort the true relations and importance of events. History, he asserts, will not be satisfactorily written until either men of affairs undertake to write it, not as a piece of bye-work but as an honorable and necessary task, or until intending historians realize that some actual experience of affairs is indispensable (xii. 28). Such experience would have saved accomplished and fluent Greek writers like Timæus from many of their blunders (xii. 25a), but the shortcomings of Roman soldiers and senators like Q. Fabius Pictor show that it is not enough by itself. Equally indispensable is careful, painstaking research. All available evidence must be collected, thoroughly sifted, soberly weighed, and, lastly, the historian must be animated by a sincere love of truth and a calm impartiality. What follows where any or all of these conditions and qualifications are absent Polybius illustrates abundantly in his frequent and scathing criticisms on previous writers. In the case of Timæus, against whom he seems to cherish a peculiar animosity, nearly all that remains of book xii. is devoted to an exposition of his shortcomings. Q. Fabius Pictor and Philinus are charged both with ignorance of important facts and with partiality (i. 14; iii. 9), while in the second book Phylarchus's account of the war between the Achæan league and Cleomenes of Sparta is mercilessly dissected.

It is not possible here to discuss the question whether Polybius has been just to his predecessors; it is more important to consider how far he himself comes up to the standard by which he has tried others. In his personal acquaintance with affairs, in the variety of his experience and in his opportunities for forming a correct judgment on events he is without a rival among ancient historians. A great part of the period of which he treats fell within his own lifetime (iv. 2). He may just have remembered the battle of Cynoscephalæ (197). He must have been sixteen or seventeen years old at least when the power of Antiochus was broken at Magnesia (189), while of the events from 168–146 he was, as he tells us (iii. 4), not only an eyewitness but a prominent actor in them all. As the son of Lycortas he lived from his early youth in immediate contact with the foremost statesmen of the Peloponnesus, while between 181 and 168 he was himself actively engaged in the military and political affairs of the Achæan league. The period of his exile in Rome served to add largely to his stores of experience; he was able to study at close quarters the working of the Roman constitution and the peculiarities of the Roman temperament; he made the acquaintance of Roman senators and became the intimate friend of the greatest Roman of the day. Lastly, he was able to survey with his own eyes the field on which the great struggle between Rome and Hannibal was fought out. He left Rome only to witness the crowning triumph of Roman arms in Africa and to gain a practical acquaintance with Roman methods of government by assisting in the settlement of his own beloved Achaia. When, in 146, his public life closed, he completed his preparation of himself for his great work by laborious investigations of archives and monuments and by a careful personal examination of historical sites and scenes. If to all this we add that he was deeply read in the learning of his day (Ælian, *Tact.* i., *ἀνὴρ πολυμαθής*), above all in the writings of earlier historians, we must confess that, as at once scholar, statesman, soldier, and man of the world he was above all others fitted to write the history of the age of transition in which he lived.

Of Polybius's anxiety to get at the truth no better proof can be given than his conscientious investigation of original documents and monuments and his careful study of geography and topography—both of them points in which his predecessors, as well as his successor Livy, conspicuously failed. Polybius is careful constantly to remind us that he writes for those who are φιλομαθεῖς, lovers of knowledge, with whom truth is the first consideration. He closely studied the bronze tablets in Rome on which were inscribed the early treaties concluded between Romans and Carthaginians (see for these *Rhein. Mus.*, 32, 614; iii. 22-26). He quotes the actual language of the treaty which ended the first Punic war (i. 62), and of that between Hannibal and Philip of Macedon (vii. 9). In xvi. 15 he refers to a document which he had personally inspected in the archives at Rhodes, and in iii. 33 to the monument on the Lacinian promontory recording the number of Hannibal's forces. According to Dionysius, i. 17, he got his date for the foundation of Rome from a tablet in the pontifical archives. As instances of his careful attention to geography and topography we have not only the fact of his widely extended travels, from the African coast and the Pillars of Hercules in the west to the Euxine and the coasts of Asia Minor in the east, but also the geographical and topographical studies scattered throughout his history, such as the description of Sicily (i. 42), of Cisalpine Gaul (ii. 14) and of the Euxine (iv. 10), the discussion of Hannibal's route over the Alps and the graphic picture of the scene of the battle of Lake Trasimene. Lastly, to judge from its extant fragments, book xxxiv. seems to have been actually a treatise on geography in general.

Next to the duty of original research, Polybius ranks that of impartiality. Some amount of bias in favor of one's own country may, he thinks, be pardoned as natural (xvi. 14), but it must not be gratified at the expense of truth. It is unpardonable, he says, for the historian to set anything whatever above the truth. And on the whole Polybius must be allowed here again to have practiced what he preached. It is true that his own sympathies and antipathies are not entirely concealed. His affection for and pride in Arcadia appear in more than one passage (iv. 20, 21), as also does his dislike of the Æolians (ii. 45; iv. 3, 16). His treatment of Aratus and Philopœmen, the heroes of the Achæan league, and of Cleomenes of Sparta, its most constant enemy, is perhaps open to severer criticism—it is at any rate certain that Cleomenes does not receive full justice at his hands. Similarly his views of Rome and the Romans may have been influenced by his firm belief in the necessity of accepting the Roman supremacy as inevitable and by his intimacy with Scipio, the head of the great patrician house of the Cornelii. He has evidently a deep admiration for the great republic, for her well-balanced constitution, for her military system and for the character of her citizens. He shares too the dislike of the Roman aristocracy for such men of the people as Flaminius (ii. 21) and Varro (iii. 116). But just as his patriotism does not blind him to the faults and follies of his countrymen (xxxviii. 4, 5, 6), so he does not scruple to criticise Rome. He notices the incipient degeneracy of Rome after 146 (xviii. 35). He endeavors to hold the balance evenly between Rome and Carthage; he strongly condemns the Roman occupation of Sardinia as a breach of faith (iii. 28, 31); and he does full justice to the splendid generalship of Hannibal. Moreover, whether his liking for Rome was excessive or not, there can be no doubt that he has sketched the Roman character in a masterly fashion. Their ambition, their invincible confidence in themselves, their dogged courage, which made them more dangerous the harder they were pressed, and their devotion to the state are all clearly brought out. Nor does he show less appreciation of their practical sagacity, their readiness to learn from other peoples, their quickness in adapting their tactics both in war and diplomacy to changing circumstances, and their mastery of the art of ruling.

His interest in the study of character and his skill in its delineation are everywhere noticeable. He believes, indeed, in an overruling Fortune, which guides the course of events. It is Fortune which has fashioned anew the face of the world in his own time (iv. 2), which has brought the whole civilized world into subjection to Rome (i. 4), and the Roman empire itself is the most marvellous of her works (viii. 4). But under Fortune not only political and geographical conditions but the characters and temperaments of nations and individuals play their part. Fortune selects the best instruments for her purposes. The Romans had been fitted by their previous struggles for the conquest of the world (i. 63); they were chosen to punish the treachery of Philip of Macedon (xv. 4); and the greatest of them, Scipio himself, Polybius regards as the especial favorite of Fortune (xxxii. 15; x. 5).

The praise which the matter of Polybius's history deserves cannot be extended to its form, and in this respect he contrasts sharply with Livy, whose consummate skill as a narrator has given him a popularity which has been denied to Polybius. Some of the most serious defects which spoil Polybius's history as a work of art are due to an over-rigid adherence to those views of the nature of the task before him which have been described above. His laudable desire to be comprehensive and to present a picture of the whole political situation at each important moment is fatal to the continuity of his narrative. The reader is hurried hither and thither from one part of the field to another in a manner at once wearisome and confusing. Thus the thrilling story of the Second Punic War is broken in upon by digressions on the contemporary affairs in Greece and in Asia. More serious, however, than this excessive love of synchronism is Polybius's almost pedantic anxiety to edify and to instruct. For grace and elegance of composition and for the artistic presentation of events he has a hardly concealed contempt. Hence a general and almost studied carelessness of effect, which mars his whole work. On the other hand, he is never weary of preaching. His favorite theories of the nature and aims of history, of the distinction between the universal and special histories, of the duties of an historian, sound as most of them are in themselves, are enforced again and again at undue length and with wearisome iteration. No opportunity is lost of pointing out the lesson to be learnt from the events described, and more than once the reader is irritated and the effect of a graphic picture is spoilt by obtrusive moralizing. Nor, lastly, is Polybius's style itself such as to compensate for these defects. It is indeed, often impressive from the evident earnestness and sincerity of the writer and from his sense of the gravity of his subject and is unspoilt by rhetoric or conceit. It has about it the ring of reality; the language is sometimes pithy and vigorous, and now and then we meet with apt metaphors, such as those borrowed from boxing (i. 57), from cock-fighting (i. 58), from draughts (i. 84). But in spite of these redeeming features, the prevailing baldness of Polybius's style excludes him from the first rank among classical writers, and it impossible to quarrel with the verdict pronounced by Dionysius of Halicarnassus, who places him among those authors of later times who neglected the graces of style, and who paid for their neglect by leaving behind them works "which no one was patient enough to read through to the end" (περὶ συνθές. ὀνομάτων, 4.)

It is to the value and variety of his matter, to his critical insight, breadth of view, and wide research, and not least to the surpassing importance and interest of the period with which he deals, that Polybius owes his place among the writers of history. What is known as to the fortunes of his histories, and the reputation they enjoyed, fully bears out this conclusion. The silence respecting him maintained by Quintilian and by Lucian may reasonably be taken to imply their agreement with Dionysius as to his merits as a master of style. On the other hand Cicero (*De Off.*, iii. 32) describes him as "bonus auctor in primis"; in the *De Republica* (ii. 14) he praises highly his accuracy in matters of chronology, "nemo in exquirendis temporibus diligentior"; and Cicero's younger contemporary, Marcus Brutus, was a devoted student of Polybius, and was engaged on the eve of the battle of Pharsalia in compiling an epitome of his histories (Suidas, *s. v.;* Plutarch, *Brut.*, 4). Livy, however, notwithstanding the extent to which he used his writings (see LIVY), speaks of him in such qualified terms as to suggest the idea that his strong artistic sensibilities had been wounded by Polybius's literary defects. He has nothing better to say of him than that he is "by no means contemptible" (xxx. 45), and "not an untrustworthy author" (xxxiii. 10). Posidonius and Strabo, both of them Stoics like Polybius himself, are said to have written continuations of his history (Suidas, *s. v.;* Strabo, p. 515). Arrian in the early part of the 2d and Ælian in the 3d century both speak of him with respect, though with reference mainly to his excellence as an authority on the art of war. In addition to his *Histories* Polybius was the author of the following smaller works: a life of Philopœmen (Polyb., x. 24), a history of the Numantine War (Cic., *Ad Fam.*, v. 12), a treatise on tactics (Polyb., ix. 20; Arrian, *Tactica;* Ælian, *Tact.*, i.). The geographical treatise, referred to by Geminus, is possibly identical with the thirty-fourth book of the *Histories* (Schweigh., *Præf.*, p. 184.)

The complete books (i.-v.) of the *Histories* were first printed in a Latin translation by Nicholas Perotti in 1473. The date of the first Greek edition, that by Obsopæus, is 1530. For a full account of these and of later editions, as well as of the extant MSS., see Schweighäuser's Preface to his edition of Polybus. Our knowledge of the contents of the fragmentary books is derived partly from quotations in ancient writers, but mainly from two collections of excerpts; one, probably the work of a late Byzantine compiler, was first printed at Basel in 1549 and contains extracts from books vi.-xviii. (περὶ πρεσβειῶν, περὶ ἀρετῆς καὶ κακίας); the other consists of two fragments from the "select passages" from Greek historians compiled by the directions of Constantine

Porphyrogenitus in the 10th century. To these must be added the Vatican excerpts edited by Cardinal Mai in the present century.

The following are the more important modern editions of Polybius: Ernesti (3 vols., 1763–64); Schweighäuser (8 vols., 1793, and Oxford, 1823); Bekker (2 vols., 1844); L. Dindorf (4 vols., 1866–68, 2d ed., Teubner, 1882); Hultsch (4 vols., 1867–71). For the literature of the subject, see Englemann, *Biblioth. Script. Class.: Script. Græci* (*pp.* 646–650, 8th ed., Leipsic, 1880). (F. A. P.)

POLYCARP. The importance of Polycarp, bishop of Smyrna, for the earliest period of church history arises from his historical position. He was on the one hand a disciple of John and other apostles and disciples of Jesus; on the other hand he was the teacher of Irenæus, the first of the catholic fathers.[1] In his letter to Florinus, Irenæus (ap. Euseb., *H. E.*, v. 20) says:

> "I saw you when I was yet, as a boy, in Lower Asia with Polycarp. . . . I could even now point out the place where the blessed Polycarp sat and spoke, and describe his going out and coming in, his manner of life, his personal appearance, the addresses he delivered to the multitude, how he spoke of his intercourse with John and with the others who had seen the Lord, and how he recalled their words. And everything that he had heard from them about the Lord, about His miracles and His teaching, Polycarp told us, as one who had received it from those who had seen the Word of Life with their own eyes, and all this in complete harmony with the Scriptures. To this I then listened, through the mercy of God vouchsafed to me, with all eagerness, and wrote it not on paper, but in my heart, and still by the grace of God I ever bring it into fresh remembrance."

These are priceless words, for they establish a chain of tradition (Jesus, John, Polycarp, Irenæus) which is without a parallel in history. It is all the more to be regretted that Irenæus in his great work[2] has said so little of Polycarp, and that neither Polycrates of Ephesus[3] nor Tertullian[4] mentions anything of importance.

The sources for the life and activity of Polycarp are as follows: (1) a few notices of Irenæus; (2) the epistle of Polycarp to the church at Philippi; (3) the epistle of Ignatius to Polycarp; (4) the epistle of the church at Smyrna to the church at Philomelium, giving an account of the martyrdom of Polycarp. Since these authorities have all been called in question, and some of them entirely rejected, by recent criticism, it is necessary to say a few words about each of them.

1. Of the statements of Irenæus, those contained in the letter to Victor and in the large work have passed unchallenged. The letter to Florinus, however, which places Polycarp in unequivocal connection with the apostle John, has been discredited, because it is alleged, John never was in Asia Minor. But this denial of John's residence in Asia Minor is itself a piece of critical arbitrariness, and to assert that the epistle to Florinus is spurious is a desperate resource. The only argument which can be adduced against it with any sort of plausibility is the fact that in his great work Irenæus does not satisfy the expectations which the letter to Florinus is apt to raise in a modern reader. It is certainly the case that he tells us very little about Polycarp and still less about John. But statements from the mouth of Polycarp of the very kind which the letter to Florinus would lead us to expect are not altogether wanting in the great work of Irenæus (see iii. 3, 4; ii. 22, 5; v. 30, 1)[5]; and that they are so few is accounted for by the plan and object of the treatise. The facts mentioned by Irenæus, therefore, cannot be set aside, although the assertion that Polycarp was appointed bishop of the church at Smyrna by the apostles (iii. 3, 4) is probably a deduction from the catholic theory of the origin of the episcopate. If it was once understood that Polycarp had seen apostles, the necessary inference for the time of Irenæus was that he had received his office from the hands of the apostles.

2. Under the name of Polycarp we possess in a Latin translation, a complete letter to the church at Philippi, which was first published by Faber Stapulensis in 1498. Of the Greek original, which was first edited by Halloix in 1633, unfortunately only three-fourths has been preserved.[6] Since Irenæus (iii. 3, 4) expressly mentions and commends a letter of Polycarp to the church of Philippi, since Eusebius (*H. E.*, iii. 36) was acquainted with the epistle as we have it and makes extracts from it, and since Jerome (*De Vir. Ill.*, xvii.) testifies that in his time it was publicly read in the Asiatic churches, the external evidence in its favor is as strong as could be desired. But the internal evidence is also very strong. The occasion of the letter was a case of embezzlement, the guilty individual being a presbyter at Philippi. It shows a fine combination of mildness with severity; the language is simple but powerful; and, while there is undoubtedly a lack of original ideas, the author shows remarkable skill in weaving together pregnant sentences and impressive warnings selected from the apostolic epistles and the first epistle of Clement. There is no trace of any tendency beyond the immediate purpose of maintaining the true Christian life in the church, and warning it against covetousness and against an unbrotherly spirit. In these circumstances it would certainly never have occurred to any one to doubt the genuineness of the epistle, or to suppose that it had been interpolated, but for the fact that in several passages reference is made to Ignatius and his epistles. In point of fact the historical situation which is presupposed by the epistle is this, that Ignatius, on his last journey to Rome, has just passed through Philippi, and that his letters are circulating in the churches. Hence all those scholars who hold the seven Ignatian epistles to be spurious are compelled to regard the epistle of Polycarp as also a forgery,[7] or at least as having been largely interpolated.[8] The interpolation hypothesis, however breaks down in view of the fact that the first epistle of Clement is quoted even in those passages which are alleged to be interpolated; and besides it is inconsistent with the very obvious arrangement and unity of the composition. On the other hand the assumption that the whole work is a forgery is untenable —(1) because in that case we should expect that its tone and language and tendency would be in keeping with the Ignatian epistles, which is very far from being the fact, and (2) because we must assume that Irenæus himself had been deceived by a forged epistle of Polycarp, or else that he had read the genuine epistle, but in the course of the 3d century it had been supplanted by a spurious substitute. Either of these suppositions is extremely improbable, and, since internal marks of forgery are altogether absent, we must rather reverse the argument and say that the epistle of Polycarp is a very important piece of evidence for the historical existence of a bishop of Antioch named Ignatius, for his journey to martyrdom at Rome, and for the fact that on this journey he wrote several letters. In these circumstances it is very desirable that we should be able to fix the exact date of Polycarp's epistle. This unfortunately is impossible, owing to the colorless character of the writing. Still it is noteworthy that there is not a single trace of the time of Trajan, that on the contrary an expression in the seventh chapter seems to presuppose the activity of Marcion.[9] In that case the letter cannot have been written before 140 A.D. The Ignatian epistles and the history of Ignatius furnish no argument to the contrary, for the idea that Ignatius was martyred under Trajan cannot be traced higher than the 3d century,[10] while the chronological indications in the Ignatian epistles themselves point to a later period. The epistle of Polycarp is of more importance for the Ignatian problem than for Polycarp himself. It conveys no distinct impression of his individuality, beyond the fact that the writer of this letter lived wholly in the ideas of the older generation and of the apostles, and would admit no addition to their teaching. That, however, is a feature which harmonizes admirably so far as it goes with the description which Irenæus gives of Polycarp in the letter to Florinus. On account of its dependence on older epistles, the epistle of Polycarp is of great value for the history of the canon. For the constitutional history of the church also it contains valuable materials; but for the history of dogma it is of little use.

3. The epistle of Ignatius to Polycarp is an important document, whether it is genuine or not. It belongs at any rate to the 2d century, so that even if it were spurious it would at least show what conception of the bishop's character was then prevalent. Polycarp appears in the letter as a man of a passive disposition, with too little energy and decision for the vehement Ignatius. The admonitions which

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[1] Iren., iii. 3, 4.

[2] The lost writings of Irenæus may have contained fuller information; see the close of the *Martyrium Polycarpi* in the Cod. Mosq., and the letter of Irenæus to Victor in Eusebius (*H. E.*, v. 24).

[3] Euseb., *H. E.*, v. 24, 4.

[4] *De Præscr. Hær.* 32.

[5] *Cf.* "Presbyterorum reliquiæ ab Irenæo servatæ," in the *Patr. App. Opp.*, ed. Gebhardt, Harnack, Zahn, vol. i. 2, p. 105 *sq.*

[6] All the Greek MSS. are derived from a single archetype, in which the epistle of Barnabas followed that of Polycarp, but a sheet of four leaves had been torn out, so that the end of Polycarp's epistle and the beginning of that of Barnabas are missing.

[7] So, for example, Lipsius, Hilgenfeld and others.

[8] So Dallæus, first of all, then Bunsen and Ritschl (*Entstehung der altkathol. Kirche*, 2d ed., p. 584 *sq.*).

[9] Compare vii. 1 with Iren. iii. 3, 4.

[10] See Harnack, *Die Zeit des Ignatius*, 1878.

Ignatius thinks fit to bestow on Polycarp (c. 1–6) are surprising, when we remember that they are addressed to an old and venerable man. But Ignatius was writing under the consciousness of impending martyrdom, and evidently felt, with all his affected modesty, that this gave him a right to censure the churches and bishops of Asia. To pronounce the epistle spurious on account of its tone is hazardous, because it is difficult to imagine how it could have entered the head of a forger to subject the honored Polycarp to such treatment at the hands of Ignatius.

4. The most valuable source for the history of Polycarp is the letter of the church in Smyrna about his martyrdom. Eusebius has preserved the greater part of this epistle in his *Church History* (iv. 15); but we possess it entire with various concluding observations in several Greek manuscripts, and also in a Latin translation.[1] The epistle gives a minute description of the persecution in Smyrna, of the last days of Polycarp, and of his trial and martyrdom; and, as it contains many instructive details, and professes to have been written not long after the events to which it refers, it has always been regarded as one of the most precious remains of the 2d century. Certain recent critics, however, have questioned the authenticity of the narrative. Lipsius[2] brings the date of the epistle down to about 260, although he admits many of its statements as trustworthy. Keim[3] endeavors to show in a long dissertation that it could not possibly have been written shortly after the death of Polycarp, but that, although based on good information, it was not composed till the middle of the 3d century. But Keim's own investigation is sufficient to convince every unprejudiced mind that the genuineness of the epistle will bear the closest scrutiny, for the arguments he advances are of no value.[4] The only positions which Keim (following in the wake of others[5]) makes good are that a few slight interpolations[6] have been inserted in the epistle, and that it was written, not a few days, but perhaps a year or two after the death of Polycarp. The statement in the epistle that Polycarp suffered martyrdom under the proconsulate of Quadratus has quite recently given rise to a voluminous literature. Eusebius in his *Chronicle* gives 166 A.D. as the year of Polycarp's death, and until the year 1867 this statement was never questioned. In that year appeared Waddington's "Mémoire sur la chronologie de la vie du rhéteur Ælius Aristide" (*Mém. de l'Institut. imp. de France*, 1867, xxvi.), in which it was shown from a most acute combination of circumstances that Quadratus was proconsul of Asia in 155–6, and that consequently Polycarp was martyred on the 23d of February, 155.[7] Since the date of Polycarp's death is of great importance for the chronology of many other events, and since it is an unusual thing in the history of criticism for the date of any occurrence to be thus put eleven years farther back, Waddington's arguments have been examined by a great number of critics. Renan,[8] Aube,[9] Hilgenfeld,[10] Gebhardt,[11] Lipsius,[12] Harnack,[13] Zahn,[14] Egli,[15] and others have declared themselves satisfied, although some scholars regarded 156 as also a possible date. On the other hand Keim,[16] Wieseler,[17] and Uhlhorn,[18] join issue with Waddington and adhere to the date of Eusebius. The arguments on which they rely do not appear to the present writer to be convincing, and it may be asserted with great probability that the martyrdom of Polycarp took place on the 23d of February 155.[19]. Besides these we have no other sources for the life of Polycarp. The *Vita S. Polycarpi auctore Pionio* (published by Duchesne, Paris, 1881, and Funk, *Apost. Patr. Opp.*, vol. ii. p. 315 *sq.*) is worthless.[20]

The chief facts to be gathered about the life of Polycarp from the above sources are these. He must have been born before the year 69, for on the day of his death he declared that he had served the Lord for eighty-six years (*Martyrium*, ix.). He became a Christian in his earliest youth, and was an associate of the apostle John and other disciples of Jesus who had come from Palestine to Asia Minor. What he heard from them he kept in life-long remembrance, and in his manhood and old age he used to gather the young people round him, and repeat to them what he had learned from those who had seen Christ in the flesh. Amongst these youthful hearers was Irenæus, who has recorded much of what he thus learned (for example, an encounter between John and Cerinthus in the bath, a statement about the age of Jesus, etc.). Especially when heresy began to raise its head, the aged Polycarp never ceased to appeal to the pure doctrine of the apostles. He lived to see the rise of the Marcionite and Valentinian sects, and vigorously opposed them. Irenæus tells us that on one occasion Marcion "endeavored to establish relations with him" (Iren., iii. 3, 4), and accosted him with the words *ἐπιγινώσκεις ἡμᾶς*; there is no doubt that Marcion wished to be on friendly terms with so influential a man; but Polycarp displayed the same uncompromising attitude which his master John had shown to Cerinthus, and answered *ἐπιγινώσκω σε τὸν πρωτότοκον τοῦ Σατανᾶ*. These stern words are again applied to Marcion in the epistle to the Philippians; for it is undoubtedly Marcion who is referred to in the following passage (c. vii.): "He who falsifies the sayings of the Lord after his own pleasure, and affirms that there is no resurrection [of the flesh] and no judgment, is the first-born of Satan." The steady progress of the heretical movement, in spite of all opposition, was a cause of deep sorrow to Polycarp, so that in the last years of his life (Iren. ap. Euseb., v. 20) the words were constantly on his lips, "Oh, good God, to what times hast thou spared me, that I must suffer such things." He never allowed himself to engage in discussion with heretics, but as far as possible avoided their presence. Even in early life he had become the head of the church of Smyrna, where he was held in the highest respect. The congregation looked up to him as an apostolic and prophetic teacher (*Mart.*, xvi.), and consequently as combining in himself all the spiritual gifts which God had conferred on Christendom. In his old age the members of the congregation vied with each other in providing for his support (*ibid.*, xiii.). How great his reputation was is best shown by the fury of the heathen and the Jews in his martrydom. He was arrested amidst shouts of "This is the teacher of Asia; this is the father of the Christians; this is the destroyer of our gods; this is the man who has taught so many no longer to sacrifice and no longer to pray to the gods" (*ibid.*, xii.). When sentence was pronounced against him, every creature of the Jewish and heathen rabble hastened to add something to the pile of wood on which he was to be burned (*ibid.*, xiii.). They refused to deliver up his bones to the Christians for burial, for, said the Jews to the mob, "The Christians will now forsake the Crucified, and worship Polycarp" (*ibid.*, xvii.). The sacrifice of Polycarp immediately quenched the fury of the multitude, and the persecution ceased. All these facts prove the great influence which the bishop had in the city. But his reputation extended far beyond the limits of his own diocese. His letter to the church at Philippi shows us how fully his apostolic spirit, his wisdom and justice, must have been recognized even in Macedonia; otherwise he could not have ventured to interfere in the purely internal affairs of the Philippian church. Ignatius, the bishop of Antioch, begins his letter to him with the words (c. 1) —*'Αποδεχόμενός σου τὴν ἐν θεῷ γνώμην, ἡδρασμένην ὡς ἐπὶ πέτραν ἀκίνητον, ὑπερδοξάζω, καταξιωθεὶς τοῦ προσώπου σου τοῦ ἀμώμου, οὗ ὀναίμην ἐν θεῷ*, and, in spite of his patronizing tone, evidently writes with deep respect. But even the church at Rome were to have an opportunity of making the acquaintance of the venerable bishop. It is one of the most interesting and important incidents in the church history of the 2d century that Polycarp, in the year before his death (when he was above ninety years of age) undertook the journey to Rome in order to visit the bishop Anicetus.[1] Irenæus, to whom we are indebted for this information (*Hær.* iii. 3. 4; *Ep. ad Victorem*, in Eusebius, *H. E.*, v. 24, 16–17), gives as the reason for the journey that differences existed between Asia and Rome, or between Polycarp and Anicetus, "with regard to certain things," and especially about the time of the Easter festival, which it was desirable to remove. He might easily have told us what these "certain things" were, and given us fuller details of the negotiations between the two great bishops; for in all probability he was himself in Rome at the time (*Mart.*, Epilog. Mosq.). But unfortunately all he says is that, with regard to the "certain things," the two bishops speedily came to an understanding, while, as to the time of Easter, each adhered to his own custom without breaking off communication with the other. We learn further that Anicetus, as a mark of special honor, allowed Polycarp to celebrate the Eucharist in the church (the Eucharist must therefore have still been celebrated at Rome in the Greek tongue), that many Marcionites and Valentinians were converted by Polycarp in Rome (so that his visit must have lasted for a considerable time), and that Polycarp took leave of Anicetus in peace. On his return to Smyrna he enjoyed only about six months of uninterrupted activity. Then, on the occasion of the festive games, there arose, as in so many other instances, an outburst of popular feeling against the Christians, in which Polycarp was to die a martyr's death. From the letter of the church of Smyrna we see with what magnanimity and manliness and true Christian spirit the gray-haired bishop conducted himself. It leaves the most vivid impression of a man of dignity and noble demeanor, and at the same time of humble disposition and compassionate love. Every action he does, every word he speaks, in the prosecution and during the trial is noble and great; even that quiet irony which we detect in his answer to Marcion does not forsake him (*Mart.*, ix. 2). The proconsul was anxious to save him, and tried to induce him to recant, but he remained steadfast. He was delivered up to the populace, and his body was burned. The Christians present believed that they saw a dove soaring aloft from the burning pile, and it was reported that an odor issued from it like that of costly incense (*ibid.*, xvi. 15). Such legends do not require years for their formation, but only a few hours. By his death Polycarp shielded his congregation from further persecution. (A. HA.)

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[1] See Zahn, "Epp. Ignat. et Polyc.," in *Patr. App. Opp.*, vol. ii.; Von Gebhardt in the *Ztschr. f. d. histor. Theol.*, 1875, p. 356 *sq.*; Harnack, *Zeit des Ignatius*, 1878.

[2] *Ztschr. f. wissensch. Theol.*, 1874, p. 200 *sq.*

[3] *Aus dem Urchristenthum*, p. 90 *sq.*

[4] He lays stress especially on the miraculous elements and the ideal of martyrdom held up in the letters.

[5] See Schürer, *Ztschr. f. d. histor. Theol.*, 1870, p. 203.

[6] Amongst these we ought probably to include the expression, ἡ καθολικὴ ἐκκλησία (Inscr., c. xvi. 19), καθολικός being here used in the sense of "orthodox."

[7] He died on a "great Sabbath"—another expression which has given rise to much discussion—by which is meant the Sabbath after Easter. In 155 this fell on the 23d February, and this agrees with what the church of Smyrna says about the day of its bishop's death: πρὸ ἑπτὰ καλενδῶν Μαρτιων.

[8] *Antechrist*, 1873, p. 207. [9] *Hist. des persec.*, 1875, p. 325 *sq.*

[10] *Ztschr. f. wiss. Theol.*, 1874, p. 305 *sq.*

[11] *Ztschr. f. d. hist. Theol.*, 1875, p. 356 *sq.*

[12] *Ztschr. f. wiss. Theol.*, 1874, p. 188: *Jahrbb. f. prot. Theol.*, 1883, p. 525 *sq.* [13] *Ztschr f. Kirchengesch.*, 1876, p. 305.

[14] "Epp. Ignat. et Polyc.," as cited above.

[15] *Ztschr. f. wiss. Theol.*, 1882, p. 227 *sq.*, 1884, p. 216 *sq.*

[16] *Aus dem Urchristenthum*, p. 90 *sq.*

[17] *Die Christenverfolgungen der Caesaren*, 1878, p. 34 *sq.*

[18] *Realencyk. f. prot. Theol.*, 2d ed., xii. p. 105.

[19] See Salmon in the *Academy*, 21st July 1883, p. 46 *sq.*

[20] See Harnack in the *Theol. Lit. Zeitung*, 1882, No. 12; Zahn, in the *Götting. Gel. Anz.*, 1882, Heft 10.

POLYCLETUS. Two Greek sculptors bore this name. For an account of the works of the elder, a native of Sicyon, see vol. ii. p. 312, and Figs. 6, 7. With him is sometimes confounded his younger kinsman and namesake, properly known as Polycletus the Argive. For the most part this younger Polycletus confined himself to statues of athletes who had won prizes at Olympia. In recent excavations there two bases of statues by him have been found, but no remains of his work. From the fact of his having executed a statue of Zeus Philios, *i.e.*, a combination of Zeus and Dionysus, for the town of Megalopolis, which was founded in 371 B.C., we may assign him to about that date.

POLYCRATES, a celebrated Greek tyrant of Samos, was the son of Æaces. After distinguishing himself by his liberality towards his poorer fellow-citizens he took advantage of a festival to Hera in order to make himself master of Samos (537 or 536 B.C.).[2] Allied with Amasis, king of Egypt, he prospered greatly, so that his fame went forth through all Greece and Ionia. He had 100 ships and 1000 bowmen. He made war indiscriminately on friend and foe, declaring with grim humor that he gratified his friends more by returning to them their own than by not taking it at all. Many islands fell before him and many cities on the mainland. Amongst the former was Rhenea, which he attached by a chain to the neighboring island of Delos, and dedicated to the Delian Apollo. When the Lesbians would have succored Miletus, he conquered and captured them in a sea-fight and employed them to dig a moat round the walls of his fortress. According to Herodotus, he was the first within historical times who aimed at the sovereignty of the seas, and his ambitious schemes embraced not only the Greek islands but also Ionia. In magnificence none of the Greek tyrants save those of Syracuse could compare with him. His great public works were executed, according to Aristotle, for the purpose of employing his subjects and diverting their thoughts from the recovery of their freedom.[3] He imported Spartan and Molossian hounds, goats from Naxos and Scyros, sheep from Attica and Miletus. The splendor of his palace is attested by the design which many centuries later the emperor Caligula formed of rebuilding it. Foreign artists worked for him at high wages; from Athens he brought Democedes, the greatest physician of the age, at a salary of two talents. Polycrates was also a patron of letters: he collected a library and lived on terms of intimate friendship with the poet Anacreon, whose verses were full of references to his patron. The philosopher Pythagoras, however, quitted Samos in order to escape his tyranny. The good fortune of Polycrates is the subject of a famous story. Amasis, moved with fear at the exceeding great prosperity of his friend, reminded him that God is jealous, and that the man who is uplifted very high must needs fall very low. Therefore he besought him, if he would avert the jealous wrath of heaven, to cast from him that which he valued most. Polycrates hearkened to him and flung into the sea an emerald signet set in gold, the work of the Samian artist Theodorus. But a few days after the signet was found in the belly of a large fish which a fisherman had presented to the king. When Amasis heard of this he knew that Polycrates was doomed, and renounced his alliance. Amasis died before his forebodings were fulfilled. When the Persians under King Cambyses were preparing to invade Egypt, Polycrates anxious to conciliate the growing power of Persia, sent forty ships to their help (525 B.C.). But the squadron was largely manned by malcontents whom Polycrates had hoped thus to get rid of; hardly had it reached the island of Carpathus when the crews mutinied and turned the ships's heads back to Samos. They defeated the tyrant in an action at sea, but were themselves overthrown in a land battle and compelled to flee the island. Having taken refuge in Sparta, they prevailed on the Spartans to make war on Polycrates. A powerful Spartan armament laid siege to Samos, but was fain to retire after forty days without effecting its

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[1] Anicetus was bishop from 154 (156) to 166 (167) (see Lipsius, *Chron. d. Röm Bischöfe*, § 263). Those critics who reject Waddington's view as to the date of Polycarp's death use this as their principal argument, that according to it there is no room for Polycarp's journey to Rome. It is certainly remarkable that the journey can just be brought under Waddington's calculations and no more; but, since after all it can be brought under them, no conclusive argument can be drawn from this circumstance. A voyage to Rome at a favorable season of the year was not a very formidable affair, and that Polycarp was still comparatively vigorous is shown by his conduct during the persecution (*Mart.*, v. *sq.*).

[2] Eusebius gives the date as 1484 (year of Abraham) = Olymp. 61,4 = October, 533 to October, 532. But codex N of the Armenian version of Eusebius has Abrah. 1480 = Olymp. 60,4 = Oct., 537 to Oct., 536. The former date, accepted by Clinton, would leave only ten years for the tyranny of Polycrates, which seems too little.

[3] Herodotus, our chief authority for the life of Polycrates, mentions three great engineering and architectural works for which Samos was remarkable: (1) a tunnel, about 1400 yards long, dug through a mountain, and serving to bring water to the capital; (2) a great mole or breakwater round the harbor; (3) a great temple (the temple of Hera, patron goddess of Samos), said by Herodotus to be the largest he had ever seen. But we cannot say what share Polycrates had in these works; certainly the temple of Hera seems to have been begun before his time.

object. Not very long afterwards Orœtes, the Persian satrap of Sardes, by working on the avarice and ambition of Polycrates, lured him to Magnesia and put him to a shameful death (522 B.C.).

The name of Polycrates was also borne by an Athenian rhetorician of some repute, who flourished early in the 4th century B.C. He taught at Athens, and afterwards in Cyprus. He composed declamations on paradoxical themes—an *Encomium on Clytemnestra*, an *Accusation of Socrates*, an *Encomium on Busiris* (a mythical king of Egypt, notorious for his inhumanity); also declamations on mice, pots, and counters. His *Encomium on Busiris* was sharply criticised by his younger contemporary Isocrates, in a work still extant, and Dionysius of Halicarnassus characterizes his style as frigid, vulgar, and inelegant. Nevertheless his works are said to have been studied by Demosthenes. See Jebb's *Attic Orators*, ii. p. 94; Cope on Aristotle's *Rhetoric*, ii. c. 24.

POLYGLOTT. A polyglott is a book which contains side by side versions of the same text in several different languages; and the most important polyglotts are editions of the Bible, or its parts, in which the Hebrew and Greek originals are exhibited along with the great historical versions, which are of value for the history of the text and its interpretation. The first enterprise of this kind is the famous *Hexapla* of Origen; but here only Hebrew and Greek were employed (though the versions of Aquila, Symmachus, and Theodotion were shown as well as the Septuagint), so that the work was rather diglott than polyglott in the usual sense. After the invention of printing and the revival of philological studies, polyglotts became a favorite means of advancing the knowledge of Eastern languages (for which no good helps were available) as well as the study of Scripture. The series began with the *Complutensian* (Alcala, 1514–17), already spoken of in the article on its promoter Cardinal Jimenes or Ximenes; next came the *Antwerp Polyglott* (1569–72, in 8 vols. folio) of which the principal editor was Arias Montanus aided by Guido Fabricius Boderianus, Raphelengius, Masius, Lucas of Bruges, and others. This work was under the patronage of Philip II. of Spain; it added a new language to those of the *Complutensian* by including the Syriac New Testament; and, while the earlier polyglott had only the Targum of Onkelos on the Pentateuch, the Antwerp Bible had also the Targum on the Prophets, and on Esther, Job, Psalms, and the Salomonic writings. Next came Le Jay's *Paris Polyglott* (1645), which embraces the first prints of the Syriac Old Testament (edited by Gabriel Sionita, a Maronite, but the book of Ruth by Abraham Ecchelensis, also a Maronite) and of the Samaritan Pentateuch and version (by Morinus, *q.v.*). It has also an Arabic version, or rather a series of various Arabic versions. Le Jay's work is a splendid piece of typography, but its success was marred by the appearance of the cheaper and more comprehensive *London Polyglott*. Le Jay was ruined, and a great part of the impression went to the trunkmakers. The last great polyglott is Walton's (London, 1657), which is much less beautiful than Le Jay's, but more complete in various ways, including among other things the Syriac of Esther and several apocryphal books for which it is wanting in the Paris Bible, Persian versions of the Pentateuch and Gospels, the Psalms and New Testament in Ethiopic. Walton was aided by able scholars, and used much new manuscript material. His prolegomena, too, and collections of various readings mark an important advance in Biblical criticism. It was in connection with this polyglott that E. Castle produced his famous *Heptaglott Lexicon* (London, 2 vols. folio, 1669), an astounding monument of industry and erudition even when allowance is made for the fact that for the Arabic he had the great MS. lexicon compiled and left to the university of Cambridge by the almost forgotten W. Bedwell. The later polyglotts are of little scientific importance, the best recent text having been confined to a single language; but every Biblical student still uses Walton and, if he can get it, Le Jay. Of the numerous polyglotts on parts of the Bible it may suffice to mention the Genoa psalter of 1516, edited by Giustiniani, bishop of Nebbio. It is in Hebrew, Latin, Greek, Chaldee, and Arabic, and is interesting from the character of the Chaldee text, from being the first specimen of Western printing in the Arabic character, and from a curious note on Columbus and the discovery of America on the margin of Psalm xix.

POLYGNOTUS, a Greek painter. For a description of his work see vol. ii. p. 313. It may here be added that an approximate date for his paintings at Delphi is obtained from the fact that one of them was inscribed with an epigram written by the poet Simonides, who died 467 B.C. As Simonides appears to have resided in Sicily during the last ten years of his life, the epigram was probably composed previous to 477 B.C. This series of mural paintings at Delphi, embracing about one hundred and forty-six figures, seems to have occupied two opposite walls of an oblong building known as the Lesche. The figures, hardly under life size, were disposed in two or sometimes three rows, the one higher up than the other, with apparently but very slight indications of the fact that the figures of the upper rows were to be understood as standing at a more remote distance. The several rows would run continuously like sculptured friezes, and indeed this manner of composition is best illustrated by the friezes at Vienna recently found at Gjölbaxhi in Lycia, some of which present subjects and motives identical with those treated by Polygnotus.

POLYHISTOR, Cornelius Alexander, a Milesian and disciple of Crates,[1] who through the fortune of war became the slave and afterwards the freedman of Cornelius Lentulus (Suidas). He received the Roman citizenship from Sulla (Servius on *Æn.* x. 388), and wrote an enormous number of books on historical and geographical subjects, of which more than a hundred and fifty fragments have been collected (Müller, *Fr. Hist. Gr.*, iii. 206 *sq.*). His account of the doctrines of Pythagoras has been largely drawn from by Diogenes Laertius, but the most interesting of the fragments refer to the history of the Jews, for which Alexander drew on historical and poetical works of Jewish and Samaritan Hellenists. What has been preserved on this subject, mainly by Eusebius in the *Præparatio Evangelica*, is sufficient to throw a good deal of light, not particularly favorable, on the intellectual activity of the Hellenists of the 2d century B.C.

See J. Freudenthal, *Hellenistische Studien*, i. ii. (Breslau, 1875), in which the subject of the sources of Polyhistor is fully discussed.

POLYNESIA. In the last edition of the *Encyclopædia Britannica* Polynesia was used to denote all the intertropical islands of the Pacific Ocean eastward of the Philippine Islands to the north and the new Hebrides to the south of the equator. The New Hebrides and other islands west of that group were included under the term Australasia. Of late years these islands (sometimes also including Fiji) have been known as Melanesia, while the western islands of the North Pacific have been known as Micronesia. Thus Polynesia has been restricted to the central and eastern islands inhabited by the brown or Sawaiori race, becoming an ethnographic rather than a geographical term. Articles dealing with the western islands north and south of the equator will be found under Micronesia and Melanesia. The present article is intended to give a comprehensive view of all the islands of the Pacific, their physical characteristics, natural productions, and the races of men found upon them. The name Polynesia is therefore here employed in a wide signification and solely as a geo-

Plate III.

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[1] From the scholiast on Apoll. Rh., i. 925, it would appear that Polyhistor was a Milesian only by education, for here the Carian Chersonese is named as his birthplace. The dates seem to show that he was not a personal disciple of Crates.

graphical term. The western boundary of this region runs from the great barrier reef of Australia eastward of New Guinea and the Philippine Islands. All the intertropical islands of the Pacific eastward of this imaginary line are included, and also a few others which extend outside the tropic of Capricorn to nearly 30° S. lat. Any other divisions for geographical purposes, except those of groups of islands, appear to be unnatural and uncalled for. For ethnographical purposes special terms are used for the three different classes of people found in this wide area.

If we exclude NEW CALEDONIA (*q.v.*), which is of older formation than the rest, all the islands of Polynesia are either of volcanic or of coral formation. Some are purely coral, either in the shape of low atolls or of elevated plateaus. In a few atolls there are remnants of earlier volcanic rocks; and most of the volcanic islands are more or less fringed with coral reefs. But, notwithstanding this mixture, the islands must be divided broadly into those which are volcanic and those which are of coral formation. The coral islands must again be subdivided into (1) atolls, or low islands which usually have a lagoon within them, and (2) elevated table-lands.

The volcanic islands, with the exception of the Hawaiian archipelago, are all south of the equator. In plate III. the great volcanic ridge is indicated by two lines which, commencing in 150° E., run in a south-easterly direction to about 140° W. long. With the exception of two curves, one in the lower line south of the New Hebrides, and one in the upper line at its eastern extremity, these are parallel, and are 10° apart. Within these two lines lie all the volcanic islands of Polynesia, except two isolated groups, viz., the Marquesas and the Haiwaiian Islands. On this ridge there are no atolls. The upper boundary line sharply divides the volcanic ridge from the atoll valley. This valley is indicated by a third line running for more than 50° of longitude parallel with the other two, at 20° distance from that bounding the northern extremity of the volcanic ridge. Eastward of 155° W. long. this line bends towards the south to exclude the isolated volcanic centre of the Marquesas Islands; then, curving around the Tuamotu archipelago, it joins the central line. Within the area thus enclosed lie all the atolls or low coral lagoon islands of Polynesia, and there are no volcanic islands within this region except in three or four instances, where are found the remnants of former islands which have sunk, but have not been quite submerged. This is the region of subsidence—stretching across fully 100° of longitude, and covering generally about 20° of latitude.

Within the volcanic region there are a few coral islands, but these are all more or less elevated. Since their formation they have participated in the upward movement of the ridge on which they are situated. They are indicated on the map by dotted lines. Two of the groups are within the lines marking the volcanic ridge; and one, the Loyalty group, lies close to the lower line.

The Volcanic Islands.—Most of the volcanic islands of Polynesia are high in proportion to their size. The tapering peaks, or truncated cones, which form their backbone present a picturesque appearance to the voyager as he approaches them. In some there are precipitous spurs jutting into the sea, while in others the land slopes gently from the central peak to the shore. Where there are these gentle slopes, and wherever there is any low land near the shore, there also will be found a coral reef fringing the coast at a smaller or greater distance, according to the steepness of the land under the water. Where the trend downwards is very gradual, the edge of the reef will sometimes be one, two, or even three miles to seaward. It has been thought that the absence of extensive reefs in some islands of the New Hebrides is due to "subterranean heat." But the steepness of the slope of the islands under water is doubtless the reason why the reefs are
small. As the reef-building coral polypes
and work below a certain depth—about 20
120 feet—we easily see that the distance of
edge of the reef must be according to the s
island beneath the water. Opposite to the
leys, where there is a stream flowing out to
is usually found a break in the reef. This i
caused either by the fresh water, or by the
which it contains, injuring the coral polype
venting them from effectively carrying on
in these spots. The conviction of the prese
that it is the sediment contained in the water—
during heavy rains and consequent fresh
prevents the growth of the coral, rather tha
action of fresh water upon the polypes. W
are streams of considerable size, and especi
they are subject to floods, there are gene
openings into the reef, and stretches of d
forming natural harbors sufficient for the a
tion of even large vessels. There are a
locked harbors, but most are thus formed by
the reef.

In a few spots active volcanoes are st
These are in the neighborhood of New B
New Ireland, in the Solomon, New Heb
Tonga archipelagoes. In most of the isla
have been no recent eruptions; but now and
inhabitants of islands where volcanic action
rently long ceased have been startled by a
break. Over the whole region earthquakes
quent occurrence. Most of the craters in t
of Samoa have immense trees growing in t
there is only one crater in the entire gro
shows signs of even a comparatively recent
or concerning which there is a tradition a
people of one. Yet in 1867, after an almos
ous succession of earthquakes during a who
there was a submarine eruption between tw
islands. This lasted only a few days. A fe
afterwards the writer was on board H.M.S. "
when soundings were taken on the spot. A
found the summit of which was 90 fatho
while all around the sea was 120 fathoms dee
the outpourings of this submarine volcano du
a few days raised a mound in the bed of
180 feet in height.

The soil in the volcanic islands is generally
tile. The climate is hot and moist in most
consequently the vegetation is wonderfully ri
islands are densely clothed with the most l
verdure from the sea-beach to the summit
mountains. While in a few islands, especi
comparatively barren ones (barren is only a c
tive term as applied to any of the volcanic
there is sometimes grand and bold scenery,
of them the jagged and precipitous rocks are
ered up and rounded off with the rich vegetat
they lose much of their grandeur. The atm
is so laden with moisture that ferns, club-mos
even small shrubs grow upon the faces of the
rocks. Mainly on this account the scenery ca
be said to be grand; but nearly all these isla
truly beautiful. There is a freshness about th
tation all the year round which is rarely seen i
portions of the world. The cocoa-nut palm
which are usually abundant on the low lands n
sea, always give a charm to the islands as th
approached. In addition to several species of
beautiful ferns, dracænas, crotons, and other
foliage plants abound. Pines are found on so
the western islands. For flowers none of the
compare with the hedgerows and meadows of
land. There are, it is true, many most beautif
sweet-scented flowers, but they are not usually
in great profusion.

Fruits are abundant. Some of the indigenous
are good, and many of the best productions of
tropical countries have been introduced and flo

Oranges are very plentiful in many islands; also pine-apples, guavas, custard apples, and bananas. The mango has been introduced into some islands, and flourishes well. Most of these fruits have been introduced by missionaries. One of the fruits most abundantly used, both in a ripe state and cooked when unripe as a vegetable, is the Chinese banana, *Musa Cavendishii*. The first plant of this carried to the islands was in a case of plants given by the duke of Devonshire to the missionary John Williams when he returned from England to the Pacific shortly before he was killed on Erromanga. During the long voyage all the plants in the case died except this banana. When it reached Samoa it was carefully cultivated by one of the missionaries and a stock of it was propagated. From the single plant all the Chinese bananas in Polynesia have sprung, and, that particular kind being greatly prized both by natives and foreign settlers, it is now grown largely wherever missionaries or traders have gone, and must produce annually hundreds of tons of nutritious fruit.

The natives live chiefly upon vegetable food. In most of the volcanic islands the taro (*Colocasia esculenta*) is the most important food-producer. Next to this comes the yam (*Dioscorea sativa*). Probably next in importance to this are the plantains and bananas, then the bread-fruit (*Artocarpus incisa*) and arrowroot (*Tacca pinnatifida*). The bread-fruit is more or less plentiful in most of the volcanic islands, and during one season of the year the natives very largely subsist upon it. It is not, however, by any means so nutritious as the taro or the yam. This vegetable is often spoken of in Britain as if it were a rich fruit, but one would as soon eat a raw potato as a raw bread-fruit. It has been over-estimated by many writers who have visited the Pacific. The present writer has noticed that the Samoans suffered in condition, that sickness among children was very common and the rate of mortality high during the bread-fruit season. Although the raw cocoa-nut is not eaten to any considerable extent by the natives of volcanic islands, this must not be omitted in an enumeration of the principal articles of their food supply, for it enters into the composition of most of their made dishes in the form of expressed juice or oil; the soft half-grown kernel is used as a kind of dessert, and the liquid from it, when the kernel is only half developed, is one of their principal beverages. The *Ava*, or *Kava*, a narcotic drink largely used, is made from the root of a pepper (*Piper methysticum*).

In some islands the cocoa-nut is the chief article of commerce. The fully-grown kernel is cut into slices, dried in the sun, and sold as "copra," from which much of the palm oil of commerce is expressed. On many islands cotton is largely grown, and on a few, especially in the Hawaiian archipelago, sugar cultivation has made considerable progress. Many other vegetable products might be utilized if there were a demand for them. The candle-nut (*Aleurites triloba*) is abundant everywhere near the coast. Coffee has not been grown to any considerable extent. Wild ginger and wild nutmegs are abundant on some of the islands. In some places indigo has been introduced, and has spread so much as to become a nuisance. All the islands have numerous valuable fibre-producing plants belonging to the *Urticeæ* and *Malvaceæ*. But the probability is that, on these hot, moist, and fertile islands, cocoa-nuts, cotton, or sugar will always be the most profitable crops to cultivate for exportation.

The indigenous fauna of Polynesia is poor in mammals but rich in birds. Mammals are represented by rats and bats, the latter including the flying foxes (*Pteropus*). Some say pigs are indigenous, but they were doubtless introduced by early navigators. Horses and cattle have been introduced. They degenerate very rapidly, unless they are continually improved by newly-imported stock. Sheep and goats are introduced into some islands, but sheep do not usually thrive. Dogs are plentiful, being kept by most of the natives, who are naturally fond of domestic animals; but they degenerate greatly. Pigeons and doves, especially the fruit-eating pigeons (*Carpophaga*) and doves of the genus *Ptilonopus*, are abundant. The *Carpophaga* furnish a very important article of food in some of the islands. Some of the species of *Ptilonopus* are exceedingly beautiful. Megapodes are found in a few of the western islands; the kagu (*Rhinochetus jubatus*) has its home on New Caledonia; and in Samoa the *Didunculus strigirostris* has its habitat. This bird is remarkable as being the nearest relative of the extinct dodo. Some time ago it was rarely found, and was becoming extinct. It fed and nested on the ground, and was destroyed by cats and rats after they were introduced. Of late it has changed its habits: it now feeds, nests, and roosts upon trees, and is, in consequence, increasing in numbers. Certain non-venomous snakes are found in many of the islands. Insect life is abundant, and some of the butterflies are very beautiful.

The lagoons formed by the coral reefs around the islands invariably abound in fish, many of them most gorgeous in their coloring,—vying in this respect with the parrots of Australia. Fish form a very important part of the food supply.

One of the most wonderful creatures in the marine fauna of Polynesia is the palolo (*Palola viridis*), an annelid which appears upon the surface of the ocean, near the edge of the coral reef, at certain seasons of the year. The Palolo are from 9 to 18 inches long, and about ⅛th of an inch thick. They are eaten by the natives, and are esteemed a great delicacy. They live in the interstices of the coral reef, and are confined to a few localities. About 3 o'clock on the morning following the third quartering of the October moon they invariably appear upon the surface of the water; generally they are in such quantities that they may be taken up by the handful. Soon after the sun rises they begin to break, and by 9 o'clock A. M. they have broken to pieces and disappeared. The morning following the third quarter of the November moon they again appear in the same manner, but usually in smaller quantities. After that they are not again seen until October of the next year. They appear thus to deposit their ova, which is done by the breaking to pieces of the female worms; the males also break in the same manner, the ova being fertilized while floating in the water. Thus the parents are destroyed in propagating their species. The eggs gradually sink down to the reef where they are hatched. The young palolo then live about the reef until the next year, when they repeat the process. Year by year these creatures appear according to lunar time. Yet, in the long run, they keep solar time. This they do by keeping two cycles, one of three years and one of twenty-nine years. In the short cycle there are two intervals of twelve lunations each, and one of thirteen lunations. These thirty-seven lunations bring lunar time somewhat near to solar time. But in the course of twenty-nine years there will be sufficient difference to require the addition of another lunation; the twenty-ninth year is therefore one of thirteen instead of twelve lunations. In this way they do not change their season during an entire century. So certain has been their appearance that in Samoa they have given their name to the spring season, which is vaepalolo, or the time of palolo.[1]

The Atolls.—The atolls differ in almost every respect from the islands of volcanic origin. Little that is said of one class would be true of the other. These coral islands are all low, generally not more than 10 or 12 feet above high-water mark. They are simply sand-banks formed by the accumulation of débris washed on to the reefs during strong winds. Hence they are usually in the shape of a narrow band, varying from a few yards to one-third of a mile across, near the outer edge of the reef, with a lagoon in the centre. In some of the smaller atolls the circle of land is almost or entirely complete, but in most of those of larger dimensions there are breaks to leeward, and the sea washes freely over the reef into the lagoon. Where the circle of land is complete the sea-water gains access to the central lagoon through the reef underneath the islands.

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[1] For fuller details, see article by the present writer in *Proc. Zool. Soc. of Lond.*, 1875, p. 496.

In some it bubbles up at the rise of the tide in the midst of the lagoons, forming immense natural fountains. This has been observed producing a specially fine effect at Nui in the Ellice group. Some of these atolls are not more than 3 or 4 miles in their greatest length. Others are many miles long. They are not all circular, but are of all conceivable shapes.[1]

Two of the atolls known to the present writer are remarkable. The lagoons in them are of fresh water. One of these is Lakena, in the Ellice group, the other Olosenga, or Quiros Island, in 11° 2′ S. lat. and 171° W. long. Both are small circular islands, and in both the lagoon is shut off from the sea. Olosenga is less than 4 miles in diameter, the lagoon occupying over 3 miles, leaving a ring of land around it less than half a mile across. In some places the lagoon is at least 6 fathoms deep. This bulk of fresh water cannot, therefore, be the result of drainage. There is much to favor the opinion that both this island and Lakena are situated over the craters of former volcanoes, and that there is submarine connection between them and some of the larger islands situated on the volcanic ridge from which the body of fresh water must come. Olosenga is about 200 miles distant from Samoa. In that group mountain streams sometimes fall into chasms and totally disappear underground. In this way subterranean lakes may be formed in some of the cavities which we may suppose volcanic eruptions to leave. It is not difficult to suppose that there would be subterranean connection between these lakes and an isolated crater 200 miles distant. If so, as the crater participated in the subsidence of the region on the edge of which it is situated, the water would rise in it until, if the supply were sufficient, it there found an outlet. This appears to be what occurs at Olosenga. The lake has never been properly examined and sounded. It is, however, of considerable depth in the centre, where the water is said sometimes to bubble up as if from a great spring, and at low tide it is seen to percolate through the sand on the outer or sea side of the land.

The vegetation of the atolls is extremely poor, not more than about fifty species of plants being found in the Tokelau, Ellice, and Gilbert groups, in all of which groups collections have been made. All the species consist of littoral plants found in the volcanic islands. Most of them have their seeds enveloped in thick husks, which specially fit them for being carried by currents. Doubtless it is in this way that the atolls have received their flora. The cocoa-nut is abundant on most of these islands. This most useful palm will grow on any sandbank in the tropics, and it is benefited by having its roots in soil saturated with sea water. Unlike the natives of volcanic islands, those dwelling on the atolls eat the raw kernel of the nut in large quantities. Indeed that, with fish and the fruit of a screw-pine (*Pandanus*), constitutes the main food supply on some atolls. The people make the pulp of the pandanus into a kind of cake, in appearance much like a quantity of old dates. In some atolls a somewhat elaborate system of cultivation has been adopted, by means of which a coarse kind of taro, banana, the bread-fruit, etc., are grown. These low islands suffer much from drought, and the natural soil is nothing but sand. The people, therefore, form wide trenches by removing the sand until they get within about 2 to 3 feet of the sea-level. Into the trenches they put all the vegetable refuse and manure they can obtain, and, as there is more moisture at this level, those excavated gardens are comparatively fertile. Under the influence of a Christian civilization, which is growing, and by the introduction of new food-producing plants, the condition of the natives is improving; but they still suffer much at times from long-continued seasons of drought.

The fauna of the atolls consists mainly of a few birds, some lizards, and insects. Fish abound about the reefs, and most of the natives are deep-sea fishermen. In the Ellice Islands the people domesticate frigate-birds. Large numbers of these pets may be seen about the villages. As the birds are accustomed to visit different islands when the wind is favorable, the people send by them small presents (fish-hooks, etc.) to their friends. Christian missionaries also occasionally use them as letter-carriers for communicating with one another.

Elevated Coral Islands.—There are comparatively few of the elevated coral islands in Polynesia, but they are so distinct from both the atolls and the volcanic islands that they need a separate description. They all lie within or near the lines marking off the volcanic ridge upon the map. South of the volcanic ridge there are many coral reefs forming shoals. The elevated coral islands doubtless were once such reefs. Lying within the area of volcanic action, they have participated in the upward movement, and have been raised from shoals to become islands. Some have evidently been lifted by successive stages and apparently by sudden movements. This is clearly seen in the Loyalty Islands. On approaching them one sees high coral cliffs, in appearance much like the chalk cliffs of England, except that they are often some distance inland and not close on the shore. The Island of Marè may be taken as a good type of the class. Here, between the shore and the coral cliffs, there is a tract of level land varying from a few yards to perhaps one-fourth of a mile or more across. On this level tract the people mainly dwell. At the back of this there rises a perpendicular wall of coral, in some places as much as a hundred feet high. The cliff is water-worn, and has in it large caverns, showing that for a long period it was the coast-line. Still farther inland there are two similar though smaller cliffs, indicating that there were three distinct upheavals. These must have been at very long intervals. At present the island is fringed with a coral reef, and if it were now to be lifted from fifty to one hundred feet the present coast-line would form another cliff, while the present coral reef would form another low plot similar to that upon which the people now dwell.

These islands are old enough to have a considerable depth of vegetable soil upon them. The low land between the coast and the first cliff is well stocked with cocoa-nut and other trees. None of the islands can be compared with the volcanic islands for fertility, all having a less rich soil and being much drier; still they are fairly fertile. They suffer sometimes from drought, but are much less seriously affected in this way than the atolls.

The flora of the elevated coral islands is less rich than that of the volcanic islands, but much richer than that of the atolls. The island of Niuè may be taken as a fair specimen of this class. Its flora probably contains between 400 and 500 species, nearly all being such as are found on adjacent volcanic islands. The fauna is also much richer than that of the atolls, but poorer than that of the volcanic islands. Birds are numerous. While most of the species are identical with those found in neighboring volcanic islands, there are some interesting local variations well illustrating the modifications which take place from isolation under changed surroundings. In some instances the differences are so great that local forms have been classed not only as varieties but as distinct species.

Climate.—The climate of the islands varies considerably, as may be naturally expected when the wide area covered is remembered, and the vast difference there is between the islands themselves. Some, especially the elevated coral islands, are very healthy for tropical regions. Speaking generally, the average reading of the thermometer over a large extent of Polynesia is about 80° Fahr. It very seldom sinks lower than 60°, and, owing to the small size of most of the islands, and the prevalence of trade-winds during the greater portion of the year, the heat is always moderated, and rarely becomes intense. Yet, owing to the constant heat and to the humidity of the atmosphere, the climate in the mountainous islands is trying to the European constitution. But in this respect there is a great difference even between groups which, looked at superficially, appear to be similar, and which lie within almost the same parallels of latitude. All the islands eastward from and including Fiji are much more healthy than are those to the west. In the eastern section fever and ague are of rare occurrence; in the western section European missionaries do not find it expedient to remain for long periods on the islands owing to the weakening effects of frequent attacks of these diseases. The most remarkable thing is that natives of the eastern section suffer even more than Europeans when they go to live in the western islands, the mortality among them being very great. Numerous attempts have been made to evangelize the New Hebrides through the agency of natives of the Samoan, Cook, and Society groups; but, owing to the great mortality among the agents, their efforts have failed. Yet these people have lived there under conditions very similar to those they were accustomed to at home, the heat being about the same, and the food similar, as well as the general mode of life. The causes of the difference are as yet unknown. Possibly the explanation will be found in differences of natural drainage. It has often occurred to the present writer, though only as an unverified theory, that the bases of these western islands are, like that of New Caledonia, of older formation, and that the islands are only superficially volcanic. If so this may account for their unhealthiness as compared with the purely volcanic islands within the same parallels of latitude. In comparison with most tropical countries there is little dysentery in Polynesia; but this also is more common in the west than in the east.

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[1] On the formation of atolls and of coral reefs generally, see CORALS, vol. vi. 334, and PACIFIC, vol. xviii. p. 132.

The elevated coral islands are always much more healthy than are those of volcanic formation in their immediate neighborhood. They are drier, being always well drained, have much less dense vegetation, and receive the benefit of the trade-winds which blow right across them. They, however, sometimes suffer from drought such as is unknown on the volcanic islands. The atolls may be called—if the term can be applied to tiny islets scattered over the expanse of ocean—the deserts of the Pacific. The soil being almost entirely sand, and the vegetation affording little shade, the heat and glare, especially of those lying close to the equator, are exceedingly trying to European visitors. Being so low—only a few feet above the ocean—there is nothing to attract the clouds, and the rainfall is small. The islands are therefore subject to frequent droughts, which are sometimes of months' duration; and at such times even the fronds of the cocoa-nut palm get a shrivelled appearance, and the trees cease to bear fruit. Sometimes the people suffer greatly during these long-continued droughts, many being starved to death. At best their food supply is confined to cocoa-nuts, pandanus, fruit, and fish, but in times of drought they are forced to chew the roots of shrubs.

Hurricanes.—A great portion of southern Polynesia is subject to destructive cyclones. The tract over which they pass may be said to be, generally, that of the volcanic chain indicated by the lines on the map, although the northern edge of this region is not so subject to cyclones as the southern portion. A line drawn parallel to the lines of the map, through the middle of the New Hebrides group, and extending south of Fiji, will well represent the centre of the cyclone tract. The hurricane season is from December to April. Some islands are visited by a more or less destructive cyclone nearly every year; Samoa lies on the upper edge of the tract, and gets one, on an average, about every seven or eight years. Although these cyclones are not usually so severe as those which visit the seas of eastern Asia, they are often exceedingly destructive, sweeping almost everything down in their course. They last only a few hours. Heavy seas are raised in the line of progress, and vessels are generally exposed to greater danger when lying at anchor at the ports than when in the open sea. The cyclones are always accompanied by considerable electric disturbances, especially when they are passing away.

Diseases.—Apart from the fever, ague, and dysentery already alluded to, there is comparatively little disease in any portion of Polynesia. The principal purely native diseases are such as affect the skin. A form of elephantiasis prevails more or less on all the damp mountainous islands. Many Europeans are subject to it, especially those who are much exposed to the sun by day and the dews by night. In some of the atolls where the people have little good vegetable food and eat a great quantity of fish, much of it often in a state unfit for food, skin diseases are even more common than in the mountainous islands. There are reputed cases of leprosy in the Gilbert Islands, and that disease is well known to be one of the scourges of the Hawaiian archipelago. Several European diseases have been introduced into the islands,—those which are epidemic usually, at the first visitation, working great havoc among the natives. Many in Europe and America appear to attribute the great mortality which occurs among native races, when an epidemic is introduced among them, to weakness and want of stamina in their constitution; but a more probable explanation is found in the fact that, on the introduction of measles or smallpox, all the inhabitants of an island are suitable subjects, that the population of entire villages are prostrated at once, that there are no doctors or nurses, none even to feed the sick or to give them drink, and not even the most ordinary care is taken by the sufferers themselves to lessen the danger.[1] In some islands, especially the Hawaiian group, syphilis, first imported by Captain Cook's expedition, has wrought great havoc. It spread very rapidly, because, at that time, there was almost promiscuous intercourse between the sexes; and this has been one of the chief causes of the physical deterioration and of the rapid decrease of the natives of Hawaii. The disease has been introduced into other islands in later times through the visits of European and American sailors; but, owing to the influence of Christian teaching, which has in many cases gone first and has produced a change for the better in the relations of the sexes, it has not generally spread.

Races.—There are three different kinds of people inhabiting the islands of Polynesia. The region occupied by each is indicated by one of the colors on Plate III., and in the subjoined table of Indo-Pacific peoples the affinity of these races is exhibited.[2] It will be seen that there are two broad and very distinct divisions,—the dark and the brown races. The dark people occupy Australia, the Andaman Islands, portions of the Indian archipelago, and western Polynesia, and have more or less remote affinity with the natives of South Africa. The brown people are found in Madagascar, the Indian Archipelago, Formosa, northwestern and eastern Polynesia, together with New Zealand, and are clearly of Asiatic origin.

There are in Polynesia people who belong to both the dark and the light sections of the Indo-Pacific races. At present the dark are found only in the western islands as far as Fiji. In some islands they are considerably mixed with the lighter race, and in many places within the region occupied by them are colonies of the light people who keep themselves distinct. For this dark race the name Papuan is here used. They have generally been known of late years as Melanesians, but Papuan is an older name which has always been used for part of the race, and which clearly ought to be extended to the whole. The region which they inhabit is colored yellow on the map, and the pink bands across it indicate the presence of some of the light race there.

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[1] In these warm islands the people are generally accustomed to bathe often. When measles prevailed in Fiji many of those who were in a high fever crawled to the bathing places to cool themselves, and many died there. The present writer once visited several islands of the Ellice group about a fortnight after a trading vessel from Sydney, which had influenza on board. This vessel had taken some of the natives from one island to another as passengers, and at three of the islands the entire population was suffering from the epidemic. Had this been a more severe disease the people would have been utterly helpless.

[2] Compare Mr. Whitmee's paper on this subject in *Journ. Anthrop. Inst. Lond.*, 1875.

The whole of eastern Polynesia is inhabited by a light brown people to whom the name Sawaióri is here given.[1] They extend out of Polynesia to New Zealand. They have also formed colonies among the Papuans in various places, and in some instances they have become mixed in blood with the blacks among whom they have settled. The pink color in the map indicates this region.

The third kind of people, here called Tárapon,[2] inhabit the northern portion of the western Polynesia, the islands generally known as Micronesia (colored green on the map).

The following table shows the relationship of the Indo-Pacific races (Polynesian names in italics):

		Races.	Countries where found.
Indo-Pacific Races of Men.	Dark People: Negrito-Polynesians.	Austral.	Australia.
		Negrito.	Andaman Islands. Samang, etc.
		Papuan.	Aru Islands. Western New Guinea. *Solomon Islands, etc.* *New Hebrides, etc.* *Fiji.*
	Brown People: Malayo-Polynesians.	*Sawaiori.*	*Samoa, etc.* *Hawaii.* *Cook Islands, etc.* *Society Islands, etc.* New Zealand.
		Malagasy.	Madagascar.
		Formosan.	Formosa.
		Malayan.	Malays of Sumatra, etc. Java, etc.
		Tarapon.	*Caroline Islands.* *Marshall Islands.* *Gilbert Islands.*

I. *The Papuans.*—This name is that used by the Malays of the Indian Archipelago for the black, frizzly-haired people found in the Aru Islands and New Guinea. That the inhabitants of the western portion of Polynesia ought to be classed with these Papuans there can be no doubt. The older name is therefore adopted here to include the whole, rather than the newer and less distinctive name Melanesian which has been applied to only a part of the race. A general description of the people is all that can be given here; for further details the reader is referred to the articles MELANESIA, NEW GUINEA, etc. In speaking of the affinities of the Papuans with other peoples much caution is required; but there is some reason for thinking they may be remotely classified, together with all the other black people of the southern hemisphere, with the tribes of South Africa.[3] See NEGRO.

The Papuans are mostly black, but are not of a jet black. In some islands they are lighter than in others. It was long popularly supposed that their hair grew in small tufts. This was, however, a mistake which probably arose from the manner in which many of them are accustomed to dress it. On some islands the men collect their hair into small bunches, and carefully bind each bunch round with fine vegetable fibre from the roots up to within about two inches of the ends. Dr. Turner[4] gives a good description of this process. He once counted the bunches on a young man's head, and found nearly seven hundred. He calls attention to the resemblance between the head of a Papuan, with his hair thus dressed, and the conventional representation of the hair in Egyptian and Assyrian sculptures, and to what Dr. Livingstone says about the Banyai of South Africa, who dress their hair in a similar manner. When allowed to grow naturally, the hair of a Papuan is always frizzly. Some of the people have a considerable beard.

In the features of the Papuans there is considerable difference; but in a typical specimen the lips are thick, the nose is broad, often arched and high, and the jaws project; as a rule, the race is prognathous. They are generally small in stature, but in some islands are large. Where, however, they are of large size, we invariably find other evidence of their mixture with another race. Speaking, therefore, of typical Papuans, we may say they are small, with thin limbs, and are physically weak. In their natural condition they are a savage people and are cannibals. They are broken up into hostile tribes, holding no intercourse with one another except by warfare. The languages or dialects[5] spoken by them are very numerous, owing, no doubt, to their hostility towards one another, which has produced complete isolation. In grammatical structure there is considerable resemblance between their languages, but owing to long isolation the verbal differences have become very great. Several different dialects are often found on one island.

Among them women hold a very low position. Nearly all the hard work falls to their share, the men devoting themselves chiefly to warfare. The women cultivate the plantations, carry the burdens, and wait on the men. They take their food from the leavings of the men. Among most of them family life is not greatly elevated above the relationships existing among the lower animals, the relations between the sexes being of the most degraded character. There is, however, considerable affection often manifested towards their children. The Papauns are impulsive and demonstrative in speech and action. They are generally a wild, noisy, boisterous people, easily pleased and as easily offended. They differ so much in different islands, however, that it is extremely difficult to generalize concerning some of their characteristics. Many of them are decidedly low intellectually. On some islands they appear to be physically and intellectually a weak and worn-out race. Yet this must not be understood as applying to all. On some islands youths and men may be seen who are among the brightest and most intelligent-looking people in the Pacific. A vast difference exists between the natives of parts of the New Hebrides and those of the Loyalty Islands, the latter being much the finer. Mixture of blood may partly account for the difference. Difference of physical surroundings, doubtless, also has something to do with it. The dry, comparatively barren, and cooler islands of the Loyalty group ought to have a finer people upon them than the malarious, hot, and moist islands of the New Hebrides. In Fiji some of the finest men in Polynesia are found, but many of the Fijians are considerably mixed with Sawaiori blood.

As a rule, the Papuans lack elaborate historical traditions, poems, and songs, such as are invariably found among the Sawaiori race. They do not naturally possess much religious feeling or reverence, and their religious systems are little more than fetichism. In this respect, too, they present a marked contrast to the lighter race. In arts and manufactures they are comparatively low, although there are marked exceptions. Usually their houses are very poor structures. On many islands their canoes are of inferior construction. As a race they are indifferent navigators. Their arms are, however, somewhat elaborately made; and most of them make a coarse kind of pottery. In some parts of the Solomon Islands the people build much better houses than are usually found among the Papuans, carving some of the woodwork rather elaborately. They also build good canoes or boats. In Fiji the natives build good houses and good boats, but there the people have learned some of their arts from the Sawaioris. It may be so also in the Solomon group. Indeed, throughout the whole of the Papuan region, there is evidence of more or less mixture of the two races. In some places there are pure colonies of Sawaioris, who keep themselves distinct from their darker-colored neighbors; but in many other places the lighter immigrants have intermarried with the black race.

The following are some broad characteristics of the Papuan languages. Consonants are freely used, some of the consonantal sounds being difficult to represent by Roman characters. Many of the syllables are closed. There does not appear to be any difference between the definite and the indefinite article, except in Fiji. Nouns are divided into two classes, one of which takes a pronominal suffix, while the other never takes such a suffix. The principle of this division appears to be a near or remote connection between the possessor and the thing possessed. Those things which belong to a person, as the parts of his body, etc., take the pronominal suffix; a thing possessed merely for use would not take it. Thus, in Fijian the word *luve* means either a son or a daughter—one's own child, and it takes the possessive pronoun suffixed, as *luvena;* but the word *ngone*, a child, but not necessarily one's own child, takes the possessive pronoun before it, as *nona ngone*, his child, *i.e.*, his to look after or bring up.[1] Gender is only sexual. Many words are used indiscriminately, as nouns, adjectives, or verbs, without change; but sometimes a noun is indicated by its termination. In most of the languages there are no changes in nouns to form the plural, but an added numeral indicates number. Case is shown by particles, which precede the nouns. Adjectives follow their substantives. Pronouns are numerous, and the personal pronoun includes four numbers—singular, dual, trinal, and general plural, also inclusive and exclusive. Almost any word may be made into a verb by using with it a verbal particle. The differences in the verbal particles in the different languages are very great. In the verbs there are causative, intensive or frequentative, and reciprocal forms.

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[1] There has hitherto been no one well understood name used for this people. They are generally called "Polynesians" simply, sometimes "Malayo-Polynesians," and recently the name "Mahori" (a vile corruption of "Maori") has been proposed for them. For evident reasons we need some more distinct name than Polynesian. Malayo-Polynesian cannot be confined to them, but must rather be extended to the whole family of which they are but a branch. *Sawaiori* is a compound from *Sa*-moa, Ha-*wai*-i, and Ma-*ori*, thus derived from the native names of the three principal peoples.

[2] The name "Micronesians" has been generally adopted. Mr. Horatio Hale, in his great work on the *Ethnography and Philology of the United States Exploring Expedition*, adopted *Tárawa*—the name of one of the Gilbert Islands, there being no native name for the entire group—for the language of that group. The present writer takes part of this name *Tár*-a-wa, and part of the name of the principal island in the Caroline Islands, viz., *Pon*-a-pe, to form the compound name *Tár-a-pon*.

[3] The Rev. R. H. Codrington believes the Papuan (Melanesian) languages belong to the same stock as the rest of the Polynesian languages. But, as is pointed out by Prof. Keane, he entirely overlooks the physical aspects of the question. See *Journ. Anthrop. Soc. Lond.*, 1884.

[4] *Nineteen Years in Polynesia*, pp. 77, 78; *Samoa*, pp. 306–310.

[5] No great care is here taken to distinguish between the terms languages and dialects. While all the languages of Polynesia may be included under three classes, we cannot speak of them as three languages, each with numerous dialects any more than we could speak of those languages which have grown out of the Latin as several dialects of one language.

II. *The Sawaiori Race.*—The brown people who occupy the islands of eastern Polynesia are generally regarded as having affinities with the Malays of the Indian Archipelago, and are sometimes spoken of as a branch of the Malay race, or family. They cannot, however, with any accuracy be so described. The Malays, as they now exist, are a comparatively modern people, who have become what they are by the mixture of several elements not found in the more primitive race. The Sawaioris and the Tarapons of Polynesia, the Malagasy (Hovas) of Madagascar, and the Malays are allied races, but no one of them can be regarded as the parent of the rest. The parent race has disappeared; but the Sawaiori, as the earliest offshoot from it, and one which, owing to the conditions under which it has lived, has remained almost free from admixture of blood, may be taken as most nearly representing what the parent was. The relationship which these Malayo-Polynesian[2] races bear to one another is seen from the "tree" on Plate III.

The absence of Sanskrit (or Prakrit) roots in the languages appears to indicate that the Sawaiori migration was in pre-Sanskritic times.[3] Whether we can fix anything like a definite date for this may well be questioned. Mr. Fornander[4] has, however, with great probability, traced back the history of the Hawaiians to the 5th century. He has studied the folk-lore of those islands exhaustively, and from this source comes to the conclusion that the Sawaiori migration from the Indian Archipelago may be approximately assigned to the close of the first or to the second century. Most likely Samoa was the first group permanently occupied by them. Owing to the admixture of the Sawaioris with the Papuans in Fiji some authorities have thought the first settlement was in those islands, and that the settlers were eventually driven thence by the Papuan occupiers. We can, however, account for the presence of Sawaiori blood in Fiji in another way, viz., by the intercourse that has been kept up between the people of Tonga and Fiji. If the first resting-place of the Sawaioris was in that group, there is good reason to believe that Samoa was the first permanent home of the race, and that from Samoa they have spread to the other islands which they now occupy.

It used to be doubted whether these people could have gone from the Indian Archipelago so far eastward, because the prevailing winds and currents are from the east. But it is now well known that at times there are westerly winds in the region over which they would have to travel, and that there would be no insuperable difficulties in the way of such a voyage. The Sawaioris are invariably navigators. There is ample evidence that in early times they were much better seamen than they are at present. Indeed their skill in navigation has greatly declined since they have become known to Europeans. They used to construct decked vessels capable of carrying one or two hundred persons, with water and stores sufficient for a voyage of some weeks' duration. These vessels were made of planks well fitted and sewn together, the joints being calked and pitched.[5] It is only in recent times that the construction of such vessels has ceased. The people had a knowledge of the stars, of the rising and setting of the constellations at different seasons of the year. By this means they determined the favorable season for making a voyage and directed their course.

The ancestors of the Sawaioris were by no means a savage people when they entered the Pacific. Indeed their elaborate historical legends show that they possessed a considerable amount of civilization. Those who are familiar with these legends, and who have studied Sawaiori manners and customs see many unmistakable proofs that they carried with them, at the time of their migration, knowledge and culture which raised them much above the status of savages, and that during their residence in these islands the race has greatly deteriorated. Some indications of their former condition will appear in the following account of the people.

The Sawaioris are, physically, a very fine race. On some islands they average 5 feet 10 inches in height. De Quatrefages, in a table giving the stature of different races of men,[6] puts the natives of Samoa and Tonga as the largest people in the world. He gives the average height of this race as being 5 feet 9.92 inches. They are well developed in proportion to their height. Their color is a brown, lighter or darker generally according to the amount of their exposure to the sun—being darker on some of the atolls where the people spend much time in fishing, and among fishermen on the volcanic islands, and lighter among women, chiefs, and others less exposed than the bulk of the people. Their hair is black and straight; but in individual examples it is sometimes wavy, or shows a tendency to curl. They have very little beard. Their features are generally fairly regular; eyes invariably black, and in some persons oblique; jaws not projecting, except in a few instances; lips of medium thickness; noses generally short, but rather wide at the bases. Their foreheads are fairly high, but rather narrow. When they are young many of the people of both sexes are good-looking. The men often have more regular features than the women. In former times more attention was paid to personal appearance and adornment among men than among the women.

As a race the Sawaioris are somewhat apathetic. They differ, however, in different islands, according to their surroundings. Most of them live in an enervating climate where nature is very lavish of her gifts. Hence they lead easy lives. On the more barren islands, and on those more distant from the equator, the natives have much more energy. Under certain circumstances they become excitable, and manifest a kind of care-for-nothing spirit. This is only occasionally seen, and chiefly in time of war, in a family dispute, or on some other occasion when they are deeply moved. In the time of their heathenism they were strict in their religious observances, and religion came into almost every action of life. They were in most instances, with comparative ease led to accept Christianity, and this characteristic has remained under the new condition of things. They are a shrewd people, with quick intelligence, and they possess naturally a large amount of common sense. Where they have from early years enjoyed the advantages of a good education, Sawaiori youths have proved themselves to possess intellectual powers of no mean order. They are almost invariably fluent speakers; with many of them oratory seems to be a natural gift; it is also carefully cultivated. A Sawaiori orator will hold the interest of his hearers for hours together at a political gathering, and in his speech he will bring in historical allusions and precedents, and will make apt quotations from ancient legends in a manner which would do credit to the best parliamentary orators. Many of them are very brave, and think little of self-sacrifice for others where duty or family honor is concerned.[7]

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[1] Hazlewood's *Fijian Grammar*, pp. 8 and 9.

[2] Baron W. von Humboldt's name, Malayo-Polynesian, is here retained as a convenient term to include all these people from Madagascar to Polynesia.

[3] It is possible to make too much of the absence of Sanskrit (or Prakrit) roots, since, as remarked by Dr. Rost, "there may have been no occasion for the introduction of ready-made terms into the language." Still the migration may be tentatively put in pre-Sanskritic times.

[4] *The Polynesian Race*, vol. i. p. 168.

[5] Cocoa-nut fibre and the gum which exudes from the bread-fruit tree are generally used for "calking" and "pitching" canoes.

[6] *The Human Species* (International Scientific Series), pp. 57–60.

[7] Of various acts by Sawaioris which indicate the possession of bravery and self-possession under trying circumstances the following may serve as a sample. Some lads belonging to two villages in Samoa fell out, and began stone-throwing. One of them, who was the son of a chief, was struck and, it was feared, was killed. As soon as this was known to the young men of the village they armed themselves in order to go to the other village to seek reparation, according to a custom of former times, by killing some one belonging to the family of the boy who had thrown the stone. A report preceded them that they were going, and a young man, a cousin of the boy, in order to prevent a fight, quietly walked out of the village to meet the avengers of blood. When he met them he calmly said, "You are coming to avenge your brother. I am brother to the boy who killed him. Do not go further; kill me and be avenged, so that our villages may

The terms for family among this race are used in two senses—(1) of a household, and (2) of all blood relations on both the male and the female side, including the wife or the husband, as the case may be, brought in by marriage—also those who have been adopted by members of the clan. In the following remarks the word *family* is used with the first meaning, and *clan* with the second. Each clan has a name which is usually borne by one of the oldest members, who is the chief or head for the time being. This clan system no doubt generally prevailed in early times, and was the origin of the principal chieftainships. But changes have been made in most of the islands. In some the head of one clan has become king over several. In many cases large clans have been divided into sections under secondary heads, and have even been subdivided. The different classes of chieftainships may probably be thus accounted for.

As a rule, near relations do not intermarry. In some islands this rule is rigidly adhered to. There have been exceptions, however, especially in the case of high chiefs; but usually great care is taken to prevent the union of those within the prescribed limits of consanguinity. Children generally dwell with their kin on the father's side, but they have equal rights on the mother's side, and sometimes they take up their abode with their mother's family. The only names used to express particular relationships are father and mother, son and daughter, brother and sister.

There is usually no distinction between brothers (or sisters) and cousins, all the children of brothers and sisters speak of each other as brothers and sisters, and they call uncles and aunts fathers and mothers. Above the relationship of parents all are simply ancestors, no term being used for grandfather which would not equally apply to any more remote male ancestor. In the same way there is no distinctive term for grandchild. A man speaks of his grandchild as his son or daughter, or simply as his child.[1] Polygamy was often practiced, especially by chiefs, and also concubinage. In some places a widow was taken by the brother of her deceased husband, or, failing the brother, by some other relative of the deceased, as an additional wife. Divorce was an easy matter, and of frequent occurrence; but, as a rule, a divorced wife would not marry again without the consent of her former husband. An adulterer was always liable to be killed by the aggrieved husband, or by some member of his clan. If the culprit himself could not be reached, any member of the clan was liable to suffer in his stead. In some islands female virtue was highly regarded. Perhaps of all the groups Samoa stood highest in this respect. There was a special ordeal through which a bride passed to prove her virginity, and a proof of her immorality brought disgrace upon all her relatives. But in other islands there was much freedom in the relations of the sexes. Owing to the almost promiscuous intercourse which prevailed among a portion of the race, in some groups titles descended through the mother and not through the father. In Hawaii there was a peculiar system of marriage relationship, "brothers with their wives, and sisters with their husbands, possessing each other in common." There also, especially in the case of chiefs and chieftainesses, brothers and sisters sometimes intermarried. But these customs did not prevail in other groups. It is almost certain that they did not prevail in Hawaii in early times, but that they were the result of that deterioration in the race which their traditions and many of their customs indicate.[2]

Women have always occupied a relatively high position among the Sawaioris. In most groups they have great influence and are treated with much respect. In some cases they take hereditary titles and hold high offices. As among their congeners in Madagascar, so also in parts of Polynesia, there may be a queen or a chieftainess in her own right; and a woman in high position will command as much respect, and will exercise as great authority, as a man would in the same position. Everywhere infanticide prevailed; in some of the smaller islands it was regulated by law in order to prevent over-population. It was also a very common practice to destroy the fœtus, yet, even before the reception of Christianity, parents were affectionate towards the children who were spared. The practice of adopting children was, and still is, common. Often there is an exchange made between members of the same clan; but sometimes there is adoption from without. Tattooing generally prevailed among the men, different patterns being followed in different groups of islands. In some a larger portion of the body is tattooed than in others. A youth was considered to be in his minority until he was tattooed, and in former times he would have no chance of marrying until he had, by submitting to this process, proved himself to be a man. Puberty in the other sex was generally marked by feasting, or some other demonstration, among the female friends. Old age is generally honored. Often an inferior chief will give up his title to a younger man, yet he himself will lose but little by so doing. The neglect of aged persons is extremely rare.

Property belonging to a clan is held in common. Each clan usually possesses land, and over this no one member has an exclusive right, but all have an equal right to use it. The chief or recognized head of the clan or section alone can properly dispose of it or assign its use for a time to an outsider; and even he is expected to obtain the consent of the heads of families before he alienates the property. Thus land is handed down through successive generations under the nominal control of the recognized head of the clan or section for the time being. Changes have been made in many islands in this respect; but there can be little reason to doubt that the joint ownership of property in clans was common among the entire race in former times.

In early times the head of each clan was supreme among his own people, but in all matters he had associated with him the principal men or heads of families in the clan. Their united authority extended over all the members and the possessions of the clan, and they were independent of every other clan. There are in some places vestiges of this primitive state of society still remaining; the transition to a limited or to a despotic monarchy may be traced by means of the ancient legends in some islands, and in others it is a matter of recent history. One clan being more numerous and stronger than another, and its chief being ambitious, it is easy to see how by conquering a neighboring clan he increased the importance of his clan and extended his own power. In some of the islands this transition process has hardly yet developed into an absolute monarchy. We may even see two or three stages of the progress. In one instance a certain clan has the right to nominate the principal chief over an entire district; though it is known as the ruling clan, its rule is mainly confined to this nomination, and to decision for or against war. In all other respects the district enjoys the privilege of self-government. In another case the nominal king over a district, or over an entire island, can be elected only from among the members of a certain clan, the monarchy being elective within that alone; but this king has little authority. In other cases a more despotic monarchy has grown up—the prowess of one man leading to the subjugation of other clans. Even in this case the chiefs or heads of clans sometimes still hold their property and rule over their own people, only rendering a kind of feudal service and paying tribute to the king.

The Sawaioris are exceedingly fond of rank and of titles. Much deference is paid to chiefs and to persons of rank; and special terms are generally employed in addressing these. Every part of a chief's body and all his belongings have names different from those employed for common people. The grade of rank which a person occupies will often be indicated by the language in which he is addressed. Thus, in Samoa there are four different terms for *to come*: *sau* is for a common man; *maliu mai* is a respectful term for a person without a title; *susu mai* for a titled chief; and *afio mai* for a member of the royal family. In addressing chiefs, or others to whom one wishes to be respectful, the singular number of the personal pronoun is rarely used:

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remain at peace." His conduct somewhat disconcerted the party, and by the timely arrival of a Christian teacher matters were settled without bloodshed.

[1] Dr. Lewis H. Morgan in *Ancient Society*, pp. 419–423, makes the Sawaioris to have distinctive terms for grandfather, grandmother, grandson, and granddaughter. In this he is entirely mistaken. It is evident from his own lists that the Hawaiian *kupuna* means simply an ancestor. In like manner *moopuna* simply means a descendant of any generation after the first.

[2] Morgan has founded one of his forms of family—the consanguine—on the supposed existence in former times among the Malays and Polynesians of the custom of "intermarriage of brothers and sisters, own and collateral, in a group." All the evidence he finds in support of this is (1) the existence of the custom above mentioned in Hawaii, and (2) the absence of special terms for the relationship of uncle, aunt, and cousin, this indicating, he thinks, that these were regarded as fathers, mothers, brothers, and sisters. He admits that "the usages with respect to marriage which prevailed when the system was formed may not prevail at the present time." But he adds, "To sustain the deduction it is not necessary that they should" (*Ancient Society*, p. 408). Morgan has given special terms for grandfather and grandmother, because it would prove too much to show that the people had no grandfathers, etc. But these terms are used for ancestors of any generation. The terms used for grandchildren, in like manner, are used for any generation of descendants. He says (p. 406) the terms of husband and wife are used in common by a group of sisters or brothers, but the fact is that the words used for husband and wife in Hawaii simply mean male and female. In some islands there are terms used for wife in the most strict sense. The word wife is not used more exclusively among us than among some Sawaiori people.

the dual is employed instead,—the dual of dignity or of respect.

Offices and titles are seldom hereditary in our sense of the term, as descending from father to son. They are rather elective within the limits of the clan, or the division of a clan. A common practice is for the holder of a high title to nominate a successor; and his nomination is generally confirmed by the chiefs, or heads of households, with whom the right of election rests. In ancient times the authority of a high chief or king did not usually extend to any details of government. But in Hawaii there are traditions of a wise king who interested himself in promoting the social well-being of the people, and made good laws for their guidance.[1] Usually all matters affecting a district or an island were settled by the chiefs of the district, while those of a single village were settled by a council consisting of the chiefs and heads of households in the village. In some islands each clan, or each village, would feel itself at liberty to make war on another clan or village, without consulting the views of any higher authority. Indeed the rule was for each clan or district to settle its own affairs. In the case of offences against individuals, either the person injured, or another member of his clan, would avenge the injury done. For most offences there was some generally recognized punishment,—such as death for murder or adultery; but often vengeance would fall upon another person instead of the wrongdoer. In avenging wrong, a member of the village or of the clan to which the offender belonged would serve equally well to satisfy their ideas of justice if the culprit himself could not be easily reached. Sometimes all the members of the family, or of a village, to which a culprit belonged would flee from their homes and take refuge in another village, or seek the protection of a powerful chief. In some places, in cases of crime, the members of the family or village would convey the culprit bound—sometimes even carrying him like a pig that is to be killed—and place him with apologies before those against whom he had transgressed. The ignominy of such a proceeding was generally considered sufficient atonement for the gravest offences. There were slaves in many islands, either persons conquered in war, or those who had been condemned to lose their personal liberty on account of evil conduct.

Pottery was not manufactured by the Sawaioris. When any of them possessed it they obtained it from the Papuans. In most of their manufactures they were, however, in advance of the Papuans. They made use of the vegetable fibres abounding in the islands, the women manufacturing cloth, chiefly from the bark of the paper mulberry (*Morus papyrifera*), but also in some islands from the bark of the bread-fruit tree, and the hibiscus. This in former times furnished them with most of their clothing. They also made various kinds of mats, baskets, and fans from the leaves of the pandanus, the bark of the hibiscus, from species of böhmeria or other Urticaceous plants. Some of their mats are very beautifully made, and in some islands they are the most valuable property the people possess. The people also use the various fibre-producing plants for the manufacture of ropes, coarse string, and fine cord, and for making fishing nets. The nets are often very large, and are netted with a needle and mesh as in hand-netting among ourselves. The Sawaioris are rather clever workers in wood. Canoe and house-building are trades usually confined to certain families. The large canoes in which they formerly made long voyages are no longer built, but various kinds of smaller canoes are made, from the commonest, which is simply a hollowed-out tree cut into form, to the finely-shaped one built upon a keel, the joints of the various pieces being nicely fitted, and the whole stitched together with cord made from the husk of cocoa-nuts. Some of the larger canoes are ornamented with rude carving; and in some islands they are somewhat elaborately decorated with inlaid mother of pearl. The houses are generally well and elaborately made, but nearly all the ornamentation is put on the inside of the roof. The Sawaioris manufacture several wooden utensils for household use, such as dishes or deep bowls, "pillows" or head-rests, and stools. They also make wooden gongs, or drums, which they beat as they travel in their boats, in their dances, etc. They used to make wooden fishhooks, clubs, spears, and bows. They still make wooden fish-spears; also carved and inlaid combs. They employ the bamboo for making drums and flutes. Formerly the knives the people used were made of bamboo, which is still sometimes used for that purpose. In the manufacture of these things they employed adzes made of stone, shell, or hard wood, and a wooden drill pointed with stone, shell, or bone. They made mother-of-pearl fishhooks, and they still use a part of those old hooks—or artificial bait—in combination with steel hooks, the native-made portion being generally shaped like a small fish. For water vessels, etc., they employ gourds and large cocoa-nut shells, in preparing which they put water into them and allow the pulp or the kernel to decay, so that it may be removed without breaking the rind or shell. Their drinking cups are made of half a cocoa-nut shell. Sharks' teeth, shells, and bamboo were formerly generally used as cutting instruments; shaving was done with them, as well as surgical operations. They employ vegetable dyes for painting their bark cloth, calabashes, etc. In some islands they also use a red earth for this purpose. Their cloth is generally ornamented with geometrical patterns. Any drawings of animals, etc., which they make are exceedingly inartistic, and no attempt is made at perspective. Their musical instruments are few and rude—consisting of the drums and flutes already mentioned, and shell trumpets.

The Sawaioris were all polytheists. Without doubt many of their gods are deified men; but it is clear that some are the forces of nature personified, while others appear to represent human passions which have become identified with particular persons who have an existence in their historical myths.[2] But the conception which they had of Tangaloa (Taaroa and Kanaloa in some islands) is of a higher order. Among the Tahitians he was regarded as "the first and principal god, uncreated, and existing from the beginning, or from the time he emerged from *po*, or the world of darkness."[3] "He was said to be the father of all the gods, and creator of all things, yet was scarcely reckoned an object of worship."[4] Dr. Turner says, "the unrestricted, or unconditioned, may fairly be regarded as the name of this Samoan Jupiter."[5]

The worship of certain of the great gods was common to all the people in a group of islands. Others were gods of villages or of families, while others were gods of individuals. The gods of clans were probably the spirits of the ancestors in their own line. In some islands, when the birth of a child was expected, the aid of the gods of the family was invoked, beginning with the god of the father. The god prayed to at the instant of birth became the god of the child. In other places the name of the child's god was declared when the umbilical cord was severed. The gods were supposed to dwell in various animals, in trees, or even in inanimate objects, as a stone, a shell, etc. In some islands idols bearing more or less resemblance to the human shape were made. But in all cases the material objects were regarded simply as the abodes of the immaterial spirits of the gods.

Their temples were either national, for a single village, or for the god of a family. They were sometimes large stone enclosures (*marae*), sometimes a grove, or a house. The principal priests were a particular order, the priesthood being hereditary. In some cases, however, the father of a family was priest in his own household and presented offerings and prayers to the family god.

There was, in the Society Islands, a privileged class known as the *Areoi*. They were the special devotees of two celibate gods. They were not permitted to have children; any children they possessed when they entered the society, and all children subsequently born to them, were destroyed. The name Areoi became the synonym for all kinds of license; the party wandered about from place to place conducting obscene entertainments, and was feasted with the best of all the people possessed. There were seven regular grades among the Areoi society, besides an irregular class of attendants.

In some islands human sacrifices were of frequent occurrence; in others they were offered only on very rare and exceptional occasions, when the demand was made by the priests for something specially valuable. The usual offerings to the gods were food. The system of *tapu* or *tabu* so common among the Sawaioris was connected with their religious rites. There were two ways by which things might become *tapu*,—(1) by contact with anything belonging to the god, as his visible representation or his priest. Probably it was thought that a portion of the sacred essence of the god, or of a sacred person, was directly communicable to objects which they touched. (2) Things were made *tapu* by being dedicated to the god; and it is this form of *tapu* which is still kept up. If, *e. g.*, any one wishes to preserve his cocoa-nuts from being taken, he will put something upon the trees to indicate that they are sacred or dedicated. They cannot then be used until the *tapu* is removed from them. Disease and death were often connected with the violation of *tapu*, the offended gods thus punishing the offenders. Disease was generally attributed to the anger of the gods. Hence offerings, etc., were made to appease their anger. The first-fruits of a crop were usually dedicated to the gods to prevent them from being angry; and new canoes, fishing-nets, etc., were dedicated by prayers and offerings, in order that the gods might be propitious to their owners in their use.

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[1] See a remarkable example in Fornander's *Polynesian Race*, vol. ii. p. 69.

[2] The following recent books may be consulted on this subject: Rev. W. W. Gill's *Myths and Songs from the South Pacific*; Dr. Turner's *Samoa*; and Mr. Shortland's *Maori Religion and Mythology*.

[3] *Polynesian Researches*, vol. i. p. 323.

[4] *Tahitian Dictionary*.

[5] *Samoa*.

The Sawaiori people invariably believe in the existence of the spirit of man after the death of the body. Their traditions on the condition of the dead vary considerably in different groups; yet there is a general agreement upon main points. Death is caused by the departure of the spirit from the body. The region of the dead is subterranean. When the spirit leaves the body it is conveyed by waiting spirits to the abode of spirits. In most islands the place of descent is known. It is generally towards the west. In some traditions there is a distinction between chiefs and common people in the spirit world. In others all are much alike in condition. Some traditions indicate a marked distinction between the spirits of warriors and those of others; the former go to a place where they are happy and are immortal, while the latter are devoured by the gods and are annihilated. In some, however, the spirits are said to live again after being eaten. Some speak of the abode of spirits as being in darkness; but usually the condition of things is similar to that which exists upon earth. Amongst all the people it is believed that the spirits of the dead are able to revisit the scenes of their earthly life. The visits are generally made in the night, and are often greatly dreaded, especially when there may be any supposed reason for spite on the part of the dead towards living relatives. Some writers have connected cannibalism, where it existed among the Sawaioris, with religious customs. In the Cook and Society Islands, when a human being was offered as a sacrifice, the priest presented an eye of the victim to the king, who either ate it or pretended to do so. Probably the earliest human sacrifices were the bodies of enemies slain in battle. As it was supposed by some that the spirits of the dead were eaten by the gods, the bodies of those slain in battle may have been eaten by their victors in triumph. Mr. Shortland appears to think that cannibalism among the Maories of New Zealand may have thus originated.[1] Among the Sawaioris generally it appears to have been the practice at times to eat a portion of a slain enemy to make his degradation the greater. In several groups there is evidence that this was done. But where cannibalism was practiced as a means of subsistence, it probably originated in times of actual want, such as may have occurred during the long voyages of the people, when it was resorted to as a means of self-preservation. Being once accustomed to the practice we can easily imagine how they might resort to it again and again in times of scarcity. The testimony of cannibals is that human flesh is the best of food, and among such a people there would not be strong moral reasons to restrain them from the indulgence.

The amusements of these people are very numerous. They are a light-hearted race, usually living under easy conditions of life, and they have a large amount of enjoyment. Some of their amusements are boisterous and even savage, such as wrestling and boxing. In some islands they have a kind of "hockey" and foot-ball. They have running races, walking matches, and canoe racing. One of their most exciting amusements is swimming in the surf. When there is a moderate sea on, great numbers often join in this exercise and find immense pleasure in it. Throwing the javelin, throwing at a mark with slings, and archery are also practiced. Some resort to cock-fighting. There are fishing matches; and at a particular season large companies used to resort to pigeon-catching. In their houses they have a number of games. Betting is very often carried on in connection with these. Much time is spent, especially after the evening meal, in asking riddles, in rhyming, etc. The recital of songs and myths is also a source of great amusement; and on special occasions there is dancing. The night dances were generally accompanied by much indecency and immorality, and for that reason were discountenanced on the introduction of Christianity.

III. *The Tarapon Race.*—These people have many points of resemblance to the Sawaioris, but, as a rule, they are of smaller stature and are less robust. They have straight black hair, which is more lank than that of the Sawaioris. The Tarapons, however, differ considerably from one another, and are evidently a mixed race. The natives of the Caroline Islands are larger than the Gilbert Islanders. They are also much lighter in color; they are more yellow, whereas the Gilbert Islanders are darker, than the Sawaioris. In many respects the Tarapons bear a much closer resemblance to the people of some portions of the Indian Archipelago than do the Sawaioris. It is the belief of the present writer that the bulk of the Tarapons are the descendants of people who, in comparatively recent times, migrated from the Indian Archipelago, and that since they have been in Polynesia they have become mixed with people of other races. There appears to be a little Papuan admixture. Those in the Caroline Islands, especially, appear to have become mixed with Chinese and Japanese blood—probably more Japanese than Chinese. There are several well-authenticated instances of Japanese junks, with living people in them, having been found in various parts of the North Pacific. In 1814 the British brig "Forester" met with one off the coast of California (about 30° N. lat.), with three living men and fourteen dead bodies on board. In December, 1832, a Japanese junk arrived at the Hawaiian Islands with four of the crew living. If these junks could cross the Pacific in the latitude of Hawaii, it is not at all unlikely that others running in a southeasterly direction would reach some of the many atolls which stretch over about 35° of longitude, forming the Caroline and Marshall archipelagoes.

The traditions of the Gilbert Islanders tell us that their Islands were peopled from the west and also from the east. Those who came from the east are expressly said to be from Samoa. Those from the west were more numerous than those from the east. There are also traditions of the arrival of other strangers at some of these islands. When the present writer was at the Island of Peru, in the Gilbert group, in 1869, there were still there the remnants of a large proah which, from the description given, appears to have been like those used in the Indian Archipelago. So far as we have materials for examination, craniometry confirms other evidence, and indicates that the Tarapon people are more mixed than either of the other Polynesian races.

All the Tarapon people are navigators, but, owing to the fact that upon their atolls they have little good timber, most of their canoes are inferior to those of the Sawaioris. Their houses are also inferior. Their arms are fairly well made. In the Gilbert Islands they manufacture elaborate armor, to cover the entire body, from the fibre of the cocoa-nut husk. In the Caroline Islands very fine mats are made; and a hand-loom is used, with which a coarse cloth is made.

Among the Tarapons women occupy a lower position than among the Sawaioris. The difference is not, however, in the amount of work, or kind of drudgery that is expected from them, but rather in the social and domestic influence they exert. The gods are chiefly the spirits of the great men of past ages. The chieftainship and priesthood are often combined in the same persons. They are strict in the observance of their religious rites. The shrines of their gods are very numerous. In every house he visited in the Gilbert Islands, the present writer saw either a small circle or a square formed with pieces of coral or shells; this was neatly covered with broken coral and shells from the beach, and in the centre stood a block of coral representing the god. These were the household shrines. In various places about the islands there were similar squares or circles, only larger, for the gods of villages or districts. Offerings of food were presented to them, and often the stones were garlanded with wreaths of cocoa-nut leaves. Some embalm their dead—especially the bodies of beloved children. Women often carry the skulls of deceased children, hung by a cord around the neck, as a token of affection.

In the Tarapon languages consonants are more freely used than in the Sawaiori. They have consonantal sounds which are not found in the latter, such as *ch*, *dj*, and *sh*. Closed syllables often occur; occasionally doubled consonants are used, but among some of the people there is a tendency to introduce a slight vowel sound between them. Most words take the accent on the penult. In some languages there appears to be no true article: but in the Gilbert Island language the Sawaiori *te* is used for both the definite and the indefinite article. Gender is sexual only. Number in the noun is either gathered from the requirement of the sense, or is marked by pronominal words, or numerals. Case is known by the position of the noun in the sentence, or by prepositions. In the language of Ebon, one of the islands in the Marshall archipelago, nouns have the peculiarity which is characteristic of the Papuan languages; those which indicate close relationship—as of a son to a father, or of the members of a person's body—take a pronominal suffix which gives them the appearance of inflections. The present writer is not aware of the existence of this in any other Tarapon language, but would not make too much of this negative evidence. Many words are used indiscriminately as nouns, adjectives, or verbs without any change of form. In some languages the personal pronouns are singular, dual, and plural. In others there are no special dual forms, but the numeral for two is used to indicate the dual. In the Ebon language there are inclusive and exclusive forms of the personal pronouns which, so far as has been ascertained, do not occur in any of the other Tarapon languages. The verbs usually have no inflections to express relations of voice, mood, tense, number of person,—such distinctions being indicated by particles. In the Ebon language, however, the tenses are sometimes marked; but in that the simple form of the verb is frequently given. All have verbal directive particles. In Ponape, one of the Caroline Islands, many words of ceremony are used in addressing chiefs, as they are used in Samoa. The custom of tabooing words is also found there as it is in the Sawaiori language. For further particulars respecting the Tarapons, see MICRONESIA.

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[1] *Maori Religion and Mythology*, p. 26.

Missions.—The first mission was commenced in Tahiti by the agents of the London Missionary Society in 1797. Since then that society has continued and extended its labors until it now occupies the Society, Cook, Austral, Tuamotu, Samoan, Tokelauan, and Ellice groups, and several isolated islands, all peopled by the Sawaiori race, besides other islands in the Papuan and Tarapon areas. With the exception of a portion of the Tuamotu archipelago, all the people in the groups mentioned are now nominal Christians. There are only three groups peopled by the Sawaioris where the London Missionary Society's agents do not labor; and two of these are efficiently occupied by other societies—Hawaii mainly by the American Board, and Tonga by the Wesleyan Missionary Society. These two groups are also entirely Christian. The Marquesas Islands have not been Christianized, but are partly occupied by missionaries from Hawaii. There are, therefore, only two groups peopled by the Sawaioris where any heathen are found at the present day. An estimate of the number of this people, based upon actual counting in many islands, would be about 179,000, of which number about 161,500 are nominal Christians, leaving about 17,500 still heathen. Of the Papuans a smaller proportion are Christians. In Fiji and Rotuma the great majority of the population have become nominal Christians through the labors of Wesleyan missionaries. The Wesleyans have also successfully labored in Duke of York Island, near New Britain. In the Loyalty Islands most of the people have embraced Christianity through the labors of the London Missionary Society's agents,—a part, however, being Roman Catholics. Aneityum in the New Hebrides has become wholly Christian through the agency of Presbyterian missions. In a few other islands in the New Hebrides, also in Banks and Santa Cruz groups, small companies of converts have been gathered by the Presbyterian and the Episcopal (Melanesian) missions. The rest of the people in the Papuan area in Polynesia are still savages, and most of them are cannibals. The population of this area may be estimated at about 600,000. Of this number about 130,000 are nominal Christians. Excluding the inhabitants of the Ladrone and Pelew Islands, the Tarapon people may be estimated at about 84,000. The agents of the Hawaiian Board of Missions (taking the place of the American Board, under whose auspices the missionaries first labored in this region) are the most numerous here, occupying portions of the Gilbert, Marshall, and Caroline Islands. Six atolls south of the equator in the Gilbert group are occupied by native missionaries from Samoa in connection with the London Missionary Society. The number of nominal Christians in these groups is about 38,000. The aggregate population of Polynesia may thus be estimated at 863,000, of whom 539,500 are heathen and 323,500 are nominal or baptized Christians. From the records of the various missionary societies it appears that out of this number 69,605, or very nearly one-fifth, are communicants.

In addition to the missionary societies already mentioned, which have done the main work in the evangelization of the Polynesians, there are French Protestant missionaries in Tahiti, and Protestant Episcopal clergymen in Hawaii and Fiji. There are also in many islands French Roman Catholic missionaries; but these have a comparatively small number of adherents.

Wherever the missions have been planted schools have also been established, and the people have received more or less education. On the Christian islands nearly all the people can now read, most can write, and a large proportion are acquainted with the elements of arithmetic. General education, thus far, is much more common on those islands than it is at present in the British Isles. Advanced schools have been founded in connection with some of the missions, and many of the native youths have shown considerable aptitude for some of the higher branches of knowledge. In most of the larger groups colleges for the education of native ministers have long been conducted. In these colleges, in addition to Biblical exegesis and theology, other subjects, such as history and elementary science, are taught. Many of the European and American missionaries have devoted themselves largely to literary work in the vernacular of the islands where they reside. Next to the translation of the Scriptures and the preparation of lesson books for the common schools, they have either translated works on history, science, etc., or they have written such books as they found the natives to need. In nearly every group occupied by the Sawaiori race there is now a considerable vernacular literature, embracing elementary works on most branches of knowledge. Amongst the other races the literature is of much smaller extent. The entire Bible has been translated into five of the principal Sawaiori languages of Polynesia. The entire New Testament, and a considerable portion of the Old, has been translated into a sixth language, besides smaller portions into others. The American Bible Society has supplied the Bibles for the Hawaiian Islands. Many portions of the Scriptures for other islands have been printed either in the islands or in Australia. Of the number of copies thus circulated no record is easily accessible, but the British and Foreign Bible Society has issued 153,462 entire Bibles or New Testaments in the Samoan, Tahitian, Tongan, Rarotongan, and Niuèan languages. As among this race one translation serves for an entire group, and in some cases for two or three groups, nearly all the people possess the Scriptures. In no part of the world is the Bible more read than it is by these islanders; and it has not been necessary to give the Scriptures to them without charge in order to induce them to read.

In many islands the pastoral work is now mostly done by native ministers,—the foreign missionaries who remain devoting themselves to superintendence, higher education, and literature. The native pastors are always supported by the voluntary gifts of the people to whom they minister. The people also build their own churches and schools, and meet all the expenses connected with public worship and education, upon the voluntary principle. No portion of Christendom is better supplied with religious instruction than the Christianized islands of Polynesia, and nowhere is there more regard paid by the people generally to Sabbath observance, to public worship, and to other outward duties of religion. Family worship is almost invariably observed.

With all this, too many of the people are religious only in name; and in the neighborhood of ports, where casual visitors usually see and judge the native character, there are some who have added many of the white man's vices to their own. But in estimating the influence of Christianity upon these people we should remember that only about one-fifth of the nominal Christians are communicants. If they be judged fairly, taking into consideration their past history and the short time they have been under Christian influence, the present writer is convinced that the verdict will be favorable as compared with any Christian people in the world. Every one will admit that social, moral, and spiritual reformations are not completed in a generation, but require time to bring them to maturity.

Population—its alleged Decrease.—There is a general notion abroad that in all the islands of Polynesia the native races are rapidly decreasing; and this supposed fact is sometimes attributed to the missionaries. The alleged diminution, however, is a general conclusion from particular premises, and facts drawn from wider observations do not confirm it. The question of the decrease of population in these islands is a wide one, which cannot be fully discussed within the limits of the present article; but a few general observations, and a few particular facts, may help to throw some light upon it. (1) The estimates of population made by the first European or American visitors to Polynesia were far too high. In nearly all islands the people live almost entirely upon the coast; hence it was an error to reckon the inland portions as having a population proportionate to the number of people seen upon the coast. Then, when the visits of foreign ships were a novelty, the people from other districts would crowd to the place where the ships anchored to see them. Thus the population of particular villages was over-estimated. In the last edition of this *Encyclopædia* the population of Samoa is said to be variously estimated at from 160,000 to as few as 38,000. It is now known that even the lowest estimate was somewhat over the actual number.[1] Most of the other groups were also greatly over-estimated. Hence the decrease of population in any of the islands since they have become known is not so great as it is supposed to be. (2) Those who have resided in Polynesia, and who have made observations on the subject, know that previous to the introduction of Christianity there had been a great decrease in the population of most of the islands. There are numerous evidences that they were formerly much more thickly peopled. Wars, infanticide, human sacrifices, and cannibalism are doubtless among the causes of depopulation. (3) Where the scourge of syphilis had not spread before Christianity was received, and the love of ardent spirits has not corrupted the people, there the population has generally increased. It is found from a record of births and deaths in some parts of Samoa, and from periodical census returns as a result of actual counting from the whole of that group, that, apart from the destruction caused by war, the population there increases at the rate of about 1 per cent. per annum. Although Samoa has suffered more from internecine wars than any other Christian group in Polynesia, there are more natives now living there than when they were first counted in 1843, the number then being 33,901. The increase in Tonga has been 25 per cent. in twenty years.[1] On the island of Niuè the increase is more than 3 per cent. per annum. On several other groups there has been increase, though figures are not available. The rapid decline of population in Hawaii is entirely exceptional.

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[1] In *Nature*, for 1876, vol. xiv. pp. 190-91, Mr. Whitmee gave the latest census of Samoa, taken by actual counting, as being 34,265 in 1874. Yet, in his *Australasia*, published in 1879, Mr. A. R. Wallace says the population of these islands "is variously estimated at 35,000 or 60,000."

Commerce.—Information on this subject, as far as it is available, is given in the special articles on particular groups. The following is a fair specimen of the kind and extent of the commerce which has grown in Polynesia since Christianity has made the islands safe and profitable places for the residence of traders.[2] From Cook Islands, containing a population of about 8000, and three atolls which lie north of that group, viz., Tongareva, Rakaanga, and Manihiki, with a population of about 4000, the exports during 1883 were 150 tons of cotton free from seeds, 50 tons of coffee, 1000 tons of copra, 84 tons of pearl shell, and about 100,000 gallons of lime juice, besides 5000 crates of oranges, containing about 300 per crate. Mr. Gill estimates the market value of this produce at £50,000 [$243,000.]—more than £4 [$19.44] per head for the native population. Part is purchased by merchants in Tahiti, and part goes to Auckland, New Zealand. There are not many islands whence fruit is exported, although, if there were markets within a few day's sail, a large quantity of fine oranges, pine-apples, and bananas might be provided. In 1878 the figures collected by the present writer relating to the trade in Samoa, Tonga, and several other islands in that neighborhood, showed that the exports averaged annually about £4 each for the entire population, and that the imports were only a little less.

Prehistoric Remains.—The most remarkable of these are on Easter Island, which lies at the southeastern extremity of Polynesia, nearly 2500 miles from South America. This island is of volcanic formation, and is about 11 miles long by 4 miles wide. The present inhabitants belong to the Sawaiori race. Here are found immense platforms built of large cut stones fitted together without cement. They are generally built upon headlands, and on the slope towards the sea. The walls on the sea-side are, in some of the platforms, nearly 30 feet high and from 200 to 300 feet long, by about 30 feet wide. Some of the squared stones are as much as 6 feet long. On the land side of the platforms there is a broad terrace with large stone pedestals upon which once stood colossal stone images carved somewhat into the shape of the human trunk. On some of the platforms there are upwards of a dozen images now thrown from their pedestals and lying in all directions. Their usual height is from 14 to 16 feet, but the largest are 37 feet, while some are only about 4 feet. They are formed from a gray trachytic lava found at the east end of the island. The top of the heads of the images is cut flat to receive round crowns made of a reddish vesicular stuff found at a crater about 8 miles distant from the quarry where the images were cut. A number of these crowns still lie at the crater apparently ready for removal, some of the largest being over 10 feet in diameter. In the atlas illustrating the voyage of La Pérouse a plan of the island is given, with the position of several of the platforms. Two of the images are also represented in a plate. One statue, 8 feet in height and weighing 4 tons, was brought to England, and is now in the British Museum. In one part of the island are the remains of stone houses nearly 100 feet long by about 20 feet wide. These are built in courses of large flat stones fitted together without cement, the walls being about 5 feet thick and over 5 feet high. They are lined on the inside with upright slabs, on which are painted geometrical figures and representations of animals. The roofs are formed by placing slabs so that each course overlaps the lower one until the opening becomes about 5 feet wide, when it is covered with flat slabs reaching from one side to the other. The lava rocks near the houses are carved into the resemblance of various animals and human faces, forming, probably, a kind of picture writing. Wooden tablets covered with various signs and figures have also been found. The only ancient implement discovered on the island is a kind of stone chisel, but it seems impossible that such large and numerous works could have been executed with such a tool. The present inhabitants of Easter Island know nothing of the construction of these remarkable works; and the entire subject of their existence in this small and remote island is a mystery.

On the island Tonga-tabu, Tonga group, there is a remarkable monument. Two large rectangular blocks of stone, about 40 feet in height, stand perpendicularly, with a large slab lying across from one to the other. On the centre of the horizontal stone is a large stone bowl. The island upon which this monument is found is of coral formation slightly elevated. These immense stones must therefore have been conveyed thither by sea. The present inhabitants know nothing of their history, or of the object which they were intended to serve.

In Ponapé, one of the islands of the Caroline group, there are extensive ruins, the principal being a court about 300 feet in length, the walls of which are formed of basaltic prisms and are about 30 feet in height. Inside, on all four sides, next the wall is a terrace 8 feet high and 12 feet wide. The court is divided into three by low walls, and in the centre of each division there is a covered chamber 14 feet square. The walls above the terrace are 8 feet thick, and some of the stones are 25 feet long by 8 feet in circumference. The basaltic columns of which this structure is built were apparently brought a distance of 10 miles from the central ridge of the island. There are other ruins of smaller extent on Ponapé, and also on the island of Kusaie in the same group. Ponapé and Kusaie are remnants of larger islands which have been partially submerged. While the smaller islands around which the coral polypes built up the atolls have disappeared, these two remain as monuments of the past.

Northwest from Ponapé, in the Mariana or Ladrone Islands, there are other remains in the shape of stone columns about 14 feet high, with a semi-globular stone nearly 6 feet in diameter on the top of each, the rounded side being uppermost.

Thus in four different and widely separated parts of Polynesia there are relics of prehistoric people. These together form one of the greatest puzzles the ethnologist has to deal with. (S. J. W.)

POLYPE. In its Greek and Latin forms the word *polypus* was first used as descriptive of the CUTTLE-FISH (*q.v.*). In speaking of the *Acalephæ* Aristotle says. "They hold their prey as the polypus does with its feelers," and there is no doubt that in this and other passages he referred to the octopus. The word was also, though less generally applied to the wood-louse (*Oniscus*)—the reason for both usages being equally evident. Though the former meaning persists in the word *poulpe*, yet by the beginning of the 18th century it seems to have been forgotten, and the word was by analogy transferred to a group of animals then beginning to attract much attention. Réamur and Bernard de Jussieu were the first to fix the usage of the word polype as applicable to hydroids, corals, and *Polyzoa*. In following up the discoveries of Marsigli and Peysonelle in regard to the little coral organisms, Jussieu used the name polype definitely to describe those Sertularians, Alcyonians, sea-mats, etc., which were then (1742) known as animals. Trembley had previously rediscovered Leeuwenhoek's *Hydra*, and described it as a fresh water polype in a work which appeared in 1744. A polyzoon too, discovered both by Trembley and Baker in 1741, was called by the former *Polype à Panache*. We find the word used with the same content as Jussieu had assigned to it by Ellis in 1755, by Cavolini in 1783, and by others. In 1816 Lamouroux published his *Histoire des Polypiers Coralligènes*, in the preface of which he speaks of the varied character of this group of animals "nommés Hydres par Linné et Polypes par Réaumur." In his own use of the term he applied it to sponges, hydroids, corals, and *Flustræ*. Lamarck too used the word very widely, and spoke of *Polypei* as (1) *ciliati*, including some Infusorians and Rotifers; (2) *denudati* including *Hydra*, *Coryne*, etc.; (3) *vaginati*, including *Difflugia*, *Spongilla*, *Tubularia*, Millepores and Madrepores, *Alcyonia*, *Cristatella*, *Flustra*, etc.; and (4) *natantes*, including *Pendatula*, *Virgularia*, *Encrinus*, etc. Sometimes, however he used the word in a more restricted sense. Cuvier (1819–1830) distinguished three classes of polypes: (1) fleshy—*Actiniæ* and *Lucernariæ*; (2) gelatinous—*Hydra*, *Cristatella*, *Coryne*, *Vorticella*, etc.; and (3) *Coralliferæ*—Sponges, Madrepores, Millepores, *Tabularia*, *Sertularia*, *Alcyonidæ*, *Flustræ*, etc. Subsequently he improved on this and recognized (1) *Actinia* group, (2) a group like *Hydra* and *Sertularia*, and (3) *Polypes à Polypiers*, which he again divided into *Anthozoa* and *Bryozoa*. From 1830 onwards there was a distinct tendency to separate the *Polyzoa* from the polypes—they are spoken of as higher *Polypi*, compound polypes, etc. In 1831 Ehrenberg described the *Polypi* or *Curialia* as a class of the *Phytozoa* and distinguished the true polypes or *Anthozoa* from the *Bryozoa*. Milne-Edwards expressly excludes the *Bryozoa*, and restricts the term polype to the *Zoantharia* and *Alcyonaria* inclusive of *Hydra* and *Lucernaria*. In 1847 Frey and Leuckart placed the *Polyzoa* by themselves, and united the remaining *Polypi* of Cuvier along with the *Acalephæ* under the class named *Cœlenterata* which the latter afterwards (1853) divided into (1) *Ctenophora*, (2) *Medusæ*, and (3) *Polypes*. Modern anatomists generally agree in confining the term to the individuals (*zooids* or *personæ*) of hydriform *Hydromedusæ* and *Actinozoa*, and frequently restrict it to the former (see HYDROZOA, CORALS).

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[1] This fact is stated on the authority of the Rev. Mr. Moulton, a missionary residing there, and it is the result of counting.

[2] From figures supplied by the Rev. W. W. Gill, B. A.

POLYPTERUS, a genus of Ganoid fishes common in many rivers of tropical Africa, and known on the Nile by the name of *abū bishīr*. Their body is cylindrical in shape, elongate, and covered with hard, polished, ganoid scales, which are arranged in oblique series. The head, with flattened snout and wide mouth is protected by bony plates with ganoid external surface, of which a series of "supra-temporal" and "spiracular" ossicles are especially characteristic. Spiracles, or external openings of a canal leading into the pharynx are persistent throughout life, situated on each side of the parietal bone, and closed by an osseous valve. The lips are fleshy, but the space between the rami of the mandible is covered by a large "gular" plate. The vent is placed far backwards, in front of the anal fin, the tail being, short, with a diphycercal termination of the vertebral column. The mouth is well provided with rasp-like teeth, forming broad bands in the jaws, on the vomer and palatine bones. The paired fins are supported by an axial skeleton. The structure of the dorsal fin is unique: its anterior portion is composed of isolated finlets, from eight to eighteen in number, each of which consists of a flattened spine with a bifurcate termination; to the posterior aspect of the top of each spine several soft rays are attached, which result from the dichotomous division of a single ray, the basal portion of which is the spine. Posteriorly these finlets pass into the ordinary rays composing the caudal fin, which surrounds the tail. The ventral fins are well developed, and inserted behind the middle of the length of the trunk. The respiratory apparatus consists of three and a half gills, and is protected by an osseous gill-cover. An external gill of considerable size in the form of a tapering band fringed with respiratory laminæ exists in young examples, and is attached to the end of the gill-cover. The air-bladder is double, and communicates with the ventral wall of the pharynx.

Such are some of the principal characteristics of one of the most interesting representatives of a type which in *Polypterus* has survived from the Devonian and Carboniferous formations to our period; for further details of its internal organization see ICHTHYOLOGY. The centre of distribution of *Polypterus* is the lake region of tropical Africa, from which the Nile and the great rivers of West Africa take their origin. A very remarkable fact is its total absence in the East-African river systems which belong to the Indian Ocean. Specimens of the bishir have been found in the Nile as low as Cairo, but it is very scarce throughout the middle and lower parts of that river; such individuals have evidently been carried by the current down from southern latitudes, and do not propagate the species in the northern parts. As mentioned above, the number of the rays which are modified into finlets varies considerably, and consequently several species have been distinguished by some naturalists, while others hold that there is one species of *Polypterus* only. The largest specimens observed had a length of 4 feet. Nothing is known of its habits and propagation, and observations thereon are very desirable. Some years ago an extremely interesting dwarf form of *Polypterus* was discovered in Old Calabar, and described under the name of *Calamoichthys calabaricus*. It much resembles the bishir but is smaller, and considerably more elongate.

POLYPUS, a term in surgery, signifying a tumor which is attached by a narrow neck to the walls of a cavity lined with mucous membrane. A polypus or polypoid tumor may belong to any variety of tumor, either simple or malignant, The most common variety is a polypus of the nose of simple character and easily removed. Polypi are also met with in the ear, larynx, uterus, vagina, and rectum. See SURGERY.

POLYSPERCHON, one of Alexander's generals, and the successor of Antipater as regent in Macedonia in 318 B.C. He was driven from the kingdom by Cassander in 316. For the leading incidents of his brief term of office see PHOCION (vol. xviii. p. 813); compare also MACEDONIA.

POLYXENA, in Greek legend, a daughter of Priam, last king of Troy, and Hecuba. She had been betrothed to Achilles, and after his death and the destruction of Troy the ghost of Achilles appeared to the returning Greeks as they were encamped on the Thracian Chersonese and demanded of them the sacrifice of Polyxena. The Greeks consented and Neoptolemus, son of Achilles, sacrificed Polyxena on his father's grave. This tragic story is the subject of the *Hecuba* of Euripides and the *Troades* of Seneca. Of Sophocles's tragedy *Polyxena* a few fragments only remain.

POLYZOA.

POLYZOA is the name applied by J. Vaughan Thompson in 1830 (1)[1] to a group of minute polyp-like organisms which were subsequently (1834) termed "Bryozoa" by Ehrenberg (2). The forms included in this group were stated by Thompson to be "in a general way the whole of the Flustraceæ, in many of which I have clearly ascertained the animals to be Polyzoæ," they having been previously considered by zoologists to be allied to the Hydra-like polyps. These organisms had previously been known by the hard corneous "cells" or chambers which are formed by the animals on the surface of their bodies, and build up, in consequence of the formation of dense colonies by budding, complex aggregates known as "sea-mats" and "sea mosses." Thompson expressly stated the opinion that the organization of the animals detected by him led to the conclusion that "they must be considered as a new type of the Mollusca Acephala."

Subsequently (1844) Henri Milne-Edwards (3) pointed out the relationship of Thompson's Polyzoa to the Brachiopoda, and adopting the latter's view as to their Molluscan affinities, proposed to unite these two classes with the Tunicata in a group to be called "Molluscoidea." Recent researches have entirely separated the Tunicata from this association, and have demonstrated that they belong to the great phylum of Vertebrata. On the other hand the association of the Polyzoa with the Brachiopoda appears at present to be confirmed, though the relationship of these two classes to the Mollusca has been shown to rest on mistaken identification of parts; see, however, Harmer (**18**).

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[1] These numbers refer to the bibliography at the end of the article.

The Polyzoa appear to be related to the Sipunculoid Gephyræan worms (Gephyræa inermia) more nearly than to any other class of the animal kingdom. The study and interpretation of the facts of their ontogeny (growth from the egg) presents such extreme difficulty that in the present state of our knowledge it is necessary to regard them *ad interim* as forming with the Brachiopoda and Sipunculoids an isolated group, to which the name "Podaxonia" may be applied, pending the decision of their affinities by the increase of our knowledge of the embryology of important members of the group.[1]

The forms included at the present day in Thompson's class of "Polyzoa" may then be thus classified:

PHYLUM PODAXONIA.
CLASS I.—*SIPUNCULOIDEA.*
CLASS II.—*BRACHIOPODA.*
CLASS III.—*POLYZOA.*—
  Section 1.—VERMIFORMIA.
    Sole genus: ***Phoronis*** (**Figs. 4 and 5**).
  Section 2.—PTEROBRANCHIA.
    Genus 1: ***Rhabdopleura*** (**Fig. 7**).
    Genus 2: ***Cephalodiscus*** (**Figs. 8, 9, 10**).
  Section 3.—EUPOLYZOA.
  Sub-class 1.—Ectoprocta.
    Order 1.—PHYLACTOLÆMA.
      Examples: *Lophopus*, ***Plumatella*** (**Fig. 2, B**), *Cristatella* (Fig. 3), ***Fredericella.***
    Order 2.—GYMNOLÆMA.
      Sub-order 1.—Cyclostoma.
        Examples: ***Crisia*** (**Fig. 13, A**), ***Hornera Tubulipora, Discoporella.***
      Sub-order 2.—Ctenostoma.
        Examples: ***Alcyonidium, Vesicularia, Serialaria, Bowerbankia,*** (**Fig. 1, A**), ***Paludicella*** (**Fig. 1, E and Fig. 2, A**).
      Sub-order 3.—Chilostoma.
        Examples: ***Cellularia, Scrupocellaria, Kinetoskias*** (Fig. 14), ***Bugula, Bicellaria, Flustra*** (Fig. 1, G), *Mucronella* (**Fig. 1, C, D, F**), ***Membranipora, Lepralia, Eschara, Cellepora, Retepora.***
  Sub-class 2.—Entoprocta.
    Genera: ***Pedicellina*** (**Fig. 15**), ***Loxosoma*** (**Fig. 16**),
    Urnatella, Ascopodaria.

We shall most readily arrive at a conception of the essential structure of a Polyzoon, and of the variations to which that essential structure is subject within the class, by first examining one member of the group in detail and subsequently reviewing the characters presented by the divergent sub-classes, orders, etc., above indicated.

The most convenient form for our purpose is *Paludicella Ehrenbergii* (Fig. 2, A), belonging to the typical section of the class (the Eupolyzoa) and to the order Gymnolæma. The organism occurs as minute tree-like growths (Figs. 2, A and 1, E) attached to stones in freshwater streams and canals. The branches of the little tree **are rarely more than an inch in length, and are regularly swollen and jointed at intervals. Each of the very numerous joints is about one-fifth of an inch long, and is in reality a tubular horny box attached above and below to the preceding and succeeding joints, and having on one side of it a spoutlike aperture from which a crown of tentacles can be protruded. Each joint is thus inhabited by a distinct**

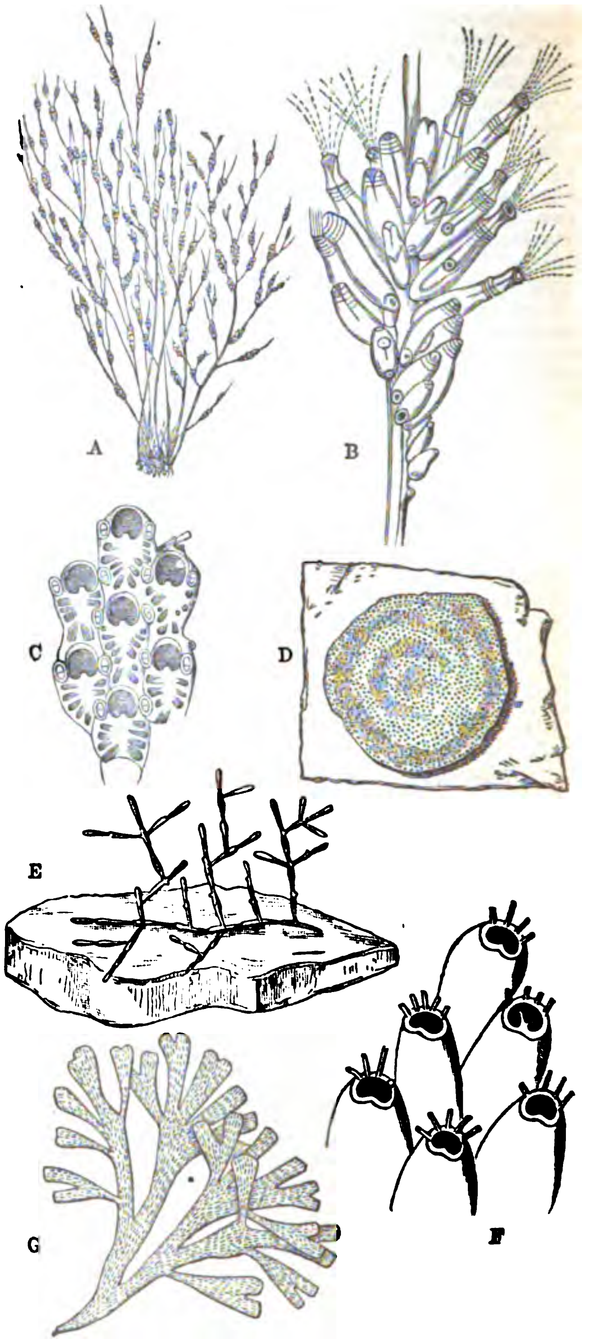

FIG. 1.—Various forms of zoaria of **Eupolyzoa.**
A. ***Bowerbankia pustulosa*****, one of the Ctenostoma; natural size.**
B. A cluster of polypides of ***Bowerbankia pustulosa*****, some with expanded** tentacles; more highly magnified.
C. Zoœcia of ***Mucronella pavonella*** (Chilostoma); **highly magnified.**
D. Zoarium of ***Mucronella pavonella*****, forming a disk-like encrustation** on a piece of stone; natural size.
E. Zoarium of ***Paludicella Ehrenbergii*** **(Ctenostoma), natural size.**
F. Zoœcia of ***Mucronella Peachii;*** **highly magnified. Compare with C in** order to note specific characters.
G. Zoarium of ***Flustra securifrons;*** **natural size.**

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[1] The research of Harmer (**18**) on Loxosoma is published too late for due notice in this article. It tends to the conclusion that the Eupolyzoa are after all degraded Mollusca, and have no connection with the Vermiformia, Pterobranchia, Brachiopoda, and Sipunculoidea. The reader is referred to Mr. Harmer's memoir.

animal which is more or less completely shut off from the one in front of it and the one behind it, although it originated from the hinder and has given rise to the fore-lying individual by a process of budding, and retains a continuity of substance with both. A single cell or joint with its contained animal is represented in Fig. 2, A.

Paludicella produces an arboriform colony, the main trunk or stolon being adherent to some stone or piece of wood. The substance of the wall of the cells is formed by a chemical body allied to chitin. Other Polyzoa may form mat-like expansions—the cells being placed in one plane, side by side (Fig. 1, C, D, F, G), as well as in linear series; others again form solid masses, whilst many agree with Paludicella in the simple linear arrangement of their units. Phoronis and Loxosoma, on the other hand, do not form colonies at all—the former because it does not bud, the latter because the buds become detached from their parent as soon as formed, as do the buds of the Hydrozoon Hydra.

On the whole Paludicella presents us with a very simple form of Polyzoon-colony (technically termed a "zoarium") in which the aggregate of budded persons, each of which is called a "polypide," does not exhibit any marked individuation, but is irregular and tree-like. But, just as in the Hydrozoa we find the Siphonophora presenting us with a very definite shape and individuality of the aggregate or colony, so in the Polyzoa we find instances of high individuation of the zoarium of a similar kind. The most remarkable example is afforded by the locomotive zoarium or colony of Cristatella Fig. 3); and another very striking instance is that of the stalked zoaria of Kinetoskias (Fig. 14) and Adeona.

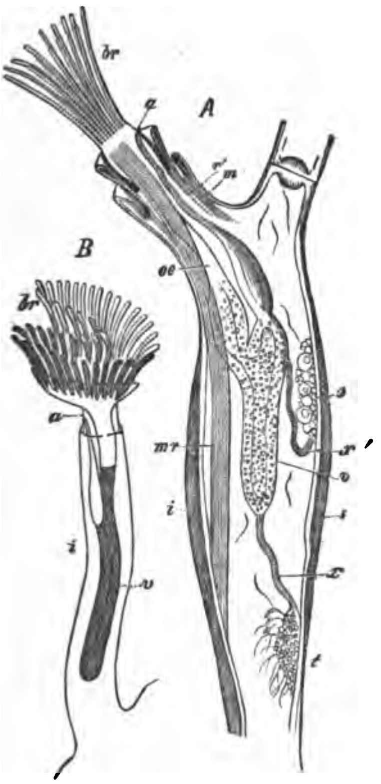

Fig. 2.—A. Polypide of *Paludicella Ehrenbergii*, seen as a transparent object in optical section and highly magnified (from Gegenbaur, after Allman). For natural size see Fig. 1, E. *a*, anus; *br*, peristomial circlet of ciliated tentacles; *i*, thickened cuticle of the body-wall, forming the horny cell or zoœcium; *m*, median retractor muscle of the introversible part of the body; *r′*, anterior retractor of the same; *mr*, great retractor muscle of the same; *o*, ovary, passing from which to the stomach is the anterior mesentery or funiculus; *t*, testis; *œ*, œsophagus; *v*, stomach; *x*, posterior mesentery or funiculus; *x′*, anterior mesentery or funiculus. Observe at the right upper corner of the figure the base of a second polypide and the "rosette-plate" of separation.

B. Diagram of a polypide of Plumatella, Letters as above.

The horny consistence of the cells which are produced by Paludicella is very usual in other Polyzoa; but we find frequently that the substance which forms the cells is gelatinous and soft instead of being horny, or again may be strongly calcareous. The term *cœnœcium* is applied to the mass of cells belonging to a colony or zoarium when considered apart from the living polypides which form it. Often such cœnœcia are found retaining form and structure when the soft living polypides have decomposed and disappeared. A single cell of the cœnœcium, corresponding to a single polypide, is called by the special students of the Polyzoa a *zoœcium*.

If we examine a single cell or zoœcium of Paludicella more carefully whilst its polypide is alive, we discover that the horny cell is nothing more than the cuticle of the polypide itself, to which it is absolutely adherent. At the so-called "mouth" or spout of the cell the cuticle suddenly changes its character and becomes a very delicate and soft pellicle instead of being thick and horny. There is no real discontinuity of the cuticle at this region, but merely a change in its qualities. This gives to that portion of the body of the polypide which lies beyond the spout a mobility and capacity for folding and pleating which is entirely denied to that part where the cuticle is more dense (Fig. 2, A). Accordingly we find that the anterior portion of the body of the polypide can be pulled into the hinder part as the finger of a glove may be tucked into the hand. It is, in fact, an "introvert" (for the use of this term see MOLLUSCA, vol. xvi. p. 676). This arrangement is universal in the Ectoproctous Eupolyzoa, but does not obtain either in the Entoprocta, the Pterobranchia, or the Vermiformia. In Phoronis, Rhabdopleura, and Cephalodiscus the anterior part of the body can *not* be tucked or telescoped into the hinder part as it can in typical Eupolyzoa. On the other hand it is very important to note that the Sipunculoid Gephyræans are all pre-eminently characterized by possessing identically this arrangement. The introversion is effected in Paludicella (as in other Eupolyzoa) by a series of long detached retractor muscles of considerable power (Fig. 2, A, *mr*, *r′*, *m*); the same is true of Sipunculus.

The view has been advanced by Allman (4) that the retractile part of the polypide is to be considered as a distinct individual budded from the basal portion, which is regarded as an equivalent individual. It does not appear to the present writer that such a theoretical conception tends to facilitate the understanding of the structure and relations of these animals.

An "ectocyst" and "endocyst" have also been distinguished in former treatises, and these terms form part of a special "polyzoarial" nomenclature, but do not appear to be any longer needful. Equally undesirable is the misapplied term "endosarc" lately introduced by Jolliet (5) to denote a certain portion of the Polyzoon structure which will not be referred to here by that name.

The retractile or introversible portion of the body of the polypide of Paludicella is terminated by a crown of sixteen stiff non-contractile tentacles (Fig. 2, A, *br*,) which form a circle around a central aperture—the animal's mouth. These tentacles are hollow and beset with vibratile cilia. The beating of the cilia causes a powerful current in the water by which food is brought to the animal's mouth. Each tentacle is also muscular, and can be bent and straightened at will. The tentacles not only serve to bring food into the mouth, but they are efficient as gill-filaments, being possibly homologous with (as well as functionally similar to) the gill-filaments of Lamellibranch Molluscs. They also serve as delicate tactile organs, and are the only sense organs possessed by the Eupolyzoa.

In Paludicella the platform around the mouth from which the tentacles arise, or *lophophore*, as it is termed, is circular. This is the case in all members of the large group of Gymnolæma and in the Entoprocta. But in the Phylactolæma the lophophore is drawn out on each side, right and left, so as to present a horse-shoe shape (Fig. 2, B), and in some forms, notably Lophopus and Alcyonella, the two arms or diverging rami of the horse-shoe are very strongly developed.

In the Pterobranchia the tentacles are confined in one genus (Rhabdopleura) to the two arm-like outgrowths of the lophophore, and are not simply hollow but contain a well-developed cartilaginoid skeleton (Fig. 7). In the allied genus Cephalodiscus there are not merely a single pair of such arm-like processes, each bearing two rows of tentacles, but the lophophore is developed into twelve arm-like processes (Fig. 9), which form a dense tuft of filaments around the anterior extremity of the animal.

In the Vermiformia (Phoronis) we again meet with a very perfect horse-shoe-shaped lophophore (Fig. 4). The tentacles upon the crescentic or otherwise lobed circumoral region of the Sipunculoids are the representatives of the tentacles of the Polyzoa; whilst the tentaculiferous "arms" of the Brachiopoda appear to be the equivalents of the Polyzoon's lophophore much drawn out and in most cases spirally rolled.

Just below the circular crown of tentacles in Paludicella we find an aperture which the study of internal anatomy proves to be the anus. In all Polyzoa the anus has this position near the mouth; and in this respect we again note an agreement with Sipunculus and the other so-called Gephyræa inermia. In one division of the Polyzoa alone is there any noteworthy variation in the position of the anus, namely, in the Entoprocta (sub-class of the section Eupolyzoa). In these forms the anus, instead of lying just below the lophophore or platform from which the tentacles spring, is included like the mouth within its area (Fig. 15, C).

Passing now to the deeper structure of Paludicella, we find that it is a Cœlomate animal; that is to say, there exists between the body-wall and the wall of the alimentary tract a distinct space termed "perigastric space," "body-cavity," or "cœlom." This is true of all Polyzoa, though it has been erroneously stated by G. O. Sars that Rhabdopleura does not possess such a cœlom. In Eupolyzoa (excepting the Entoprocta) the cœlom is very capacious; it is occupied by a coagulable hæmolymph in which float cellular corpuscles, and also the generative products, detached, as is usual in Cœlomata, from definite "gonads" developed on its lining membrane (Fig. 2, A, *o*, *t*). This lining membrane or "cœlomic epithelium" is ciliated in the Phylactolæma, but its characters appear not to have been definitely determined in other Eupolyzoa. The cœlomic space and the tissues bounding it are continuous throughout the colony or zoarium of a Polyzoon—either directly without any constriction marking off one polypide from another, or through perforate septum-like structures as in Paludicella (see right-hand upper process of Fig. 2, A), which form incomplete barriers between juxtaposed zoœcia, and are termed "rosette-places" or "communication-plates." The cœlomic cavity is continued in Paludicella and probably in all Polyzoa into the tentacles, so that these organs expose the hæmolymph fluid to a respiratory action, and hence may be called branchial.

The body-wall of Paludicella consists, alike in the anterior introversible region, and in the posterior region, of an outer cuticle which has already been spoken of as thickened around the base of the polypide so as to become there the hard tube-like zoœcium. Beneath this is the delicate layer of living epidermic cells which are the mother-cells or matrix of that cuticle. Beneath this again are a few scattered annuli of muscular fibre-cells arranged ring-wise around the cylindrical body; more deeply placed than these are five large bundles of longitudinally placed muscular fibre-cells which are attached at three different levels to the soft introversible portion of the body, and by their retraction pull it in three folds or telescopic joints into the capacious hinder part of the body. In some Polyzoa the muscular fibre-cells present transverse striations. These folds are shown in Fig. 2, A; but when the longitudinal muscles are completely contracted the tentacular crown would be pulled down far out of sight into the midst of the body by the great longitudinal muscle *mr*. Deeper than the longitudinal muscles, and clothing them and everything else which projects into the cœlom, is the cœlomic epithelium, not easily observed, and sufficiently known only in the Phylactolæma. Part of it gives rise to the generative products (Fig. 2, A, *o*, *t*). Other Eupolyzoa have a similar but not identical arrangement of the longitudinal muscles—acting essentially as retractors of the "introvert" or soft anterior region of the body—and a similar structure of the body-wall which is in essential features identical with that of the Sipunculoid worms, the Chætopod worms, and other typical Cœlomate animals.

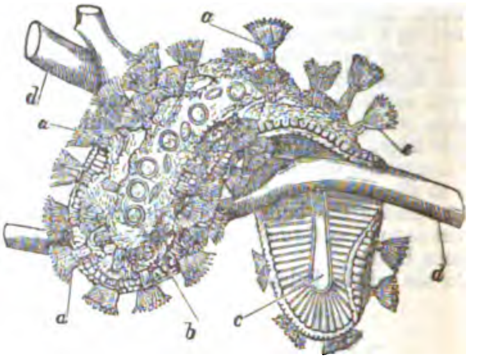

FIG. 3—The locomotive zoarium of the freshwater Phylactolæmous Polyzoon *Cristatella mucedo;* magnified six times linear (after Allman). *a*, individual polypides with their horse-shoe-shaped crown of tentacles exserted; *b*, stato-blasts seen through the transparent tissues; *c*, the muscular foot or base of the colony by means of which it crawls; *d*, portion of water-weed upon which the Cristatella is crawling.

The alimentary canal of Paludicella forms a closely compressed U-shaped loop depending from the closely approximated mouth and anus into the capacious cœlom. It is clothed on its cœlomic surface (in Phylactolæma at any rate) with cœlomic epithelium, and beneath this are extremely delicate muscular layers. Within it is lined, except in the immediate region of the mouth (which is lined by the in-pushed outer cell-layer), by the enteric cell-layer—the digestive cells derived from the archenteron of the embryo. We can distinguish in Paludicella a contractile pharyngo-œsophagus (Fig. 2, A, *œ*), a digestive stomach *v* (the lining cells of which have a yellow color), and an intestine which forms that arm of the loop connected with the anus. This simple form of alimentary canal is uniformly present in Polyzoa. In *Bowerbankia* and its allies a muscular gizzard with horny teeth is interposed between œsophagus and digestive stomach.

The alimentary canal of Paludicella does not hang quite freely in the cœlomic cavity, but, as is usually the case in other classes where the cœlom is large, *mesenteries* are present in the form of fibrous (muscular?) bands clothed with cœlomic epithelium and suspending the gut to the body-wall. In Paludicella there are two of these mesenteries, an anterior (x') and a posterior (x). The presence of two mesenteric bands is exceptional. Usually in the Eupolyzoa we find one such mesentery only, corresponding to the hinder of the two in Paludicella. The special name *funiculus* (Huxley) is applied to this mesenteric band, and it is noteworthy that the cells of the cœlomic epithelium, either upon its surface or at its point of insertion into the body-wall, are modified as reproductive elements, forming either the testis or ovary; in the Phylactolæma they form here also special asexual reproductive bodies, the stato-blasts. The nervous tissue and organs of Paludicella have not been specially investigated, but in many Eupolyzoa an oval mass of nerve-ganglion cells is found lying between the mouth and anus, and there is no doubt that it is present in this case. In Plumentella nerve-fibres have been traced from this ganglion to the tentacles and other parts around the mouth (Fig. 11, *w*, *x*, *y*). A "colonial nervous system" was described some years ago by Fr. Müller in Serialaria; but modern histologists do not admit that the tissue so named by Müller is nerve-tissue. The ganglion above mentioned is the only nervous tissue at present known in Polyzoa (but see Fig. 17, *x*).

No heart or bloodvessels of any kind exist in Paludicella nor in any of the Eupolyzoa or Pterobranchia. On the other hand the isolated vermiform genus Phoronis presents a closed contractile system of longitudinal vessels (dorsal and ventral) which contain nucleated corpuscles colored red by hæmoglobin (Figs. 4, 5).

No excretory organs (nephridia) or genital ducts have been observed in Paludicella, nor have such organs been detected in the majority of the Polyzoa which have been studied. In the Entoprocta, however, a pair of minute ciliated canals are found in the nearly obliterated body-cavity opening to the exterior near the tentacular crown in both Pedicellina and Loxosoma, which represent the cephalic nephridia of worms. A definite pair of nephridia occur in Phoronis. A similar significance is perhaps to be attributed to the "intertentacular organ" of Farre—a ciliated passage opening between two tentacles of the lophophore in Membranipora, Alcyonidium, and other forms—through which Hincks has observed the spermatozoa to escape in large numbers. This organ occurs equally in female specimens of Membranipora, and is not therefore simply a spermatic duct.

Paludicella, as we have seen, develops both ova and spermatozoa in one and the same polypide. The details of impregnation and development have not been followed in this instance, but in some of the marine Eupolyzoa (Gymnolæma) remarkable bud-like structures termed *oœcia* are developed for the special reception of the ova, and in these organs fertilization takes place. In the Entoprocta there is a peculiar brood-pouch. The spermatozoa of one polypide probably in all cases fertilize the ova of another, but we have not yet in many cases a knowledge of how the spermatozoa get to the eggs, or how the eggs escape from the body-cavity of the parent. In the hippocrepian freshwater Polyzoa (Phylactolæma) the ova appear to be fertilized and undergo the early stages of development within the body-cavity of the parent or in a hernia-like protrusion of it. Probably in such cases the embryos escape by the death of the parent and rupture of the parental tissues, as do also the peculiar asexual internal buds or statoblasts of these forms.

The embryo Polyzoon or "larva" swims freely in its early condition by means of cilia, and is in this condition a single polypide or "person." The forms assumed by these ciliated larvæ in different Polyzoa are very various and exceedingly difficult of interpretation. We shall have more to say with regard to them below (see Figs. 19, 20, 21). The ciliated larva then fixes itself and commences to produce polypides by a process of budding, the buds remaining not merely in contact but in organic continuity, and increasing continually in number so as to form a large colony or zoarium. In Paludicella we have seen that this colony has a simple tree-like form. The new buds form as wart-like growths, usually one, sometimes two in number, at the free end of a cell or zoœcium near the spout-like process from which the tentacular crown is everted. In Paludicella all the polypides of a colony are alike; there is no differentiation of form or distribution of function amongst the members of the colony. In many Eupolyzoa this simplicity is by no means maintained, but a great variety of form and function is assumed by various members of the aggregate. The only approach to a differentiation of the polypides in Paludicella is in the arrest of growth of some of the buds of a colony in autumn, which, instead of advancing to maturity, become conical and invested with a dark-colored cuticle. They are termed *hybernacula.* Should the rest of the polypides die down in winter, these arrested buds survive and go on to complete development on the return of spring.

In Paludicella we have thus seen a fairly simple and central example of Polyzoon structure and life-history. The variations upon this theme presented in different groups of Polyzoa have been to some small extent noted in the preceding account, but we shall now be able to indicate them more precisely by considering the various groups of Polyzoa in succession. The limit assigned to this article necessitates very large omissions. The reader who wishes to have the fullest information on the many difficult and uncertain matters connected with this subject is referred to Allman, *Freshwater Polyzoa* (Ray Society, 1856); Hincks, *British Marine Polyzoa* (Van Voorst, 1880); Haddon, "Budding in Polyzoa," *Quart. Journ. Micr. Sci.*, 1883; Balfour, *Embryology*, vol. i. p. 242; and the original memoirs cited by these writers.

THE VERMIFORMIA.

The first section of the Polyzoa comprises but a single genus, Phoronis. It differs from all other Polyzoa

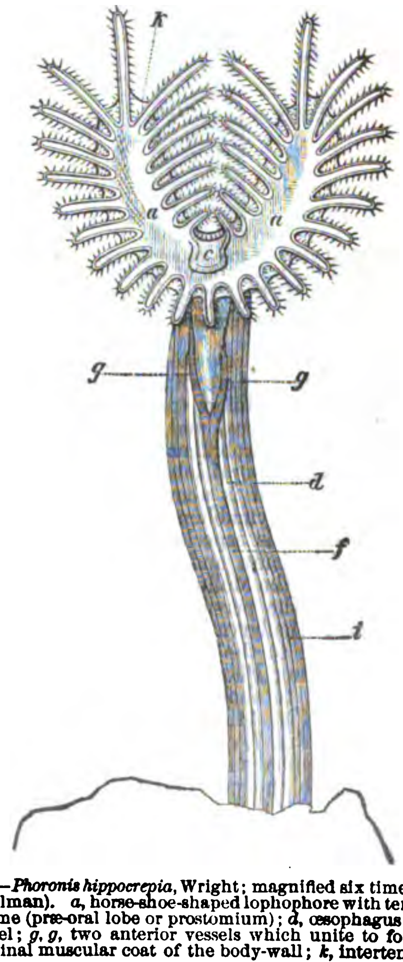

FIG. 4.—*Phoronis hippocrepia*, Wright; magnified six times linear (from Allman). *a*, horse-shoe-shaped lophophore with tentacles; *c*, epistome (præ-oral lobe or prostomium); *d*, œsophagus; *f*, ventral vessel; *g*, *g*, two anterior vessels which unite to form *f*; *l*, longitudinal muscular coat of the body-wall; *k*, intertentacular membrane.

first in its greater size (species 2 inches long are known) and elaboration of organization, and correlatively with that in the fact that it does not produce buds. Further, it does not produce a closely adherent cuticular zoœcium as do Paludicella and the Eupolyzoa generally, but a leathery tube in which the animal freely moves, resembling that of some Chætopods (Sabella). Like some Sabellæ, Phoronis forms closely packed aggregates of individuals not brought together by any process of budding, but each separately developed from an egg. Phoronis has an elongate, wormlike, unsegmented body, with a conical posterior termination (like Sipunculus), and anteriorly provided with a horse-shoe-shaped crown of tentacles surrounding the mouth (Figs. 4, 5). There is an intertentacular "web" between the bases of the tentacles as in the Phylactolæma. Caldwell (6) has recently shown that the tentacles are supported by a mesoblastic skeleton, as is also the case in Rhabdopleura, but apparently not the case in any other Polyzoa. Close to the mouth, as in all Polyzoa, is placed the anus, outside the horse-shoe-shaped lophophore or tentacular platform (Fig. 11, *i*). The tentacular crown is not introversible; in this point Phoronis differs from Paludicella and the Ectoproctous Eupolyzoa, and agrees with the Entoprocta and the Pterobranchia. Overhanging the mouth is a small præ-oral lobe or "epistome" (Figs. 4, 5, *c*). This organ is aborted in Paludicella, and indeed in all the Gymnolæma, but is present in the other Polyzoa, and is especially large and well developed in Rhabdopleura and Cephalodiscus. It has been compared to the Molluscan foot, but undoubtedly in Phoronis it is the persistent representative of the præ-oral lobe of the larva (Fig. 6), and therefore cannot be compared to the Molluscan foot. If we are right in associating Phoronis with the Polyzoa, this fact is sufficient to show that the epistome of the Phylactolæma (Fig. 11, *e*) and the buccal shield of Rhabdopleura (Fig. 7, *d*) and of Cephalodiscus (Fig. 9, *b*) are also cephalic in nature, and cannot rightly be identified with the post-oral and ventral muscular lobe known as the foot in Mollusca. A circum-oral nerve ring occurs at the base of the tentacles and sends off a cord which runs along the left side of the body. The alimentary canal presents the same general form and regions as in Paludicella. It hangs in the body-cavity, to the walls of which it is suspended by definite mesenteries.

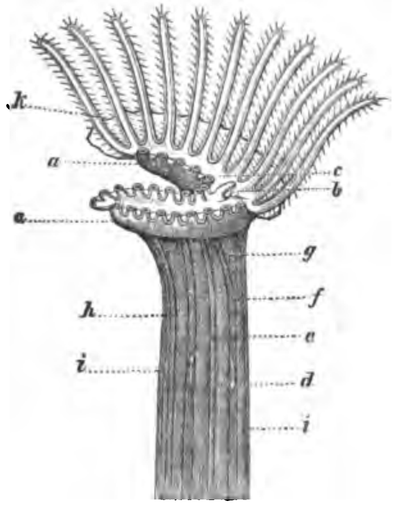

FIG. 5.—Lateral view of the anterior region of Phoronis. The tentacles of the right arm of the lophophore are cut short in order to expose clearly the mouth *b* and the overhanging "epistome" or præ-oral lobe *c*. *e*, intestine; *h*, dorsal vessel. Other letters as in Fig. 4.

Phoronis presents a closed contractile vascular system containing red-colored blood-corpuscles (Figs. 4, 5, *f*, *g*, *h*). A pair of ciliated canals acting as genital pores is found near the anus; these have been shown by Caldwell to be typical nephridia.

The development of Phoronis is remarkable. The egg gives rise (after the usual phases of cleavage and gastrulation) to the larval form known as *Actinotrocha* (Fig. 6). This larva possesses a hood-like region overhanging the mouth and a number of ciliated post-oral processes or tentacles. The anus is placed at the extremity of the elongate body opposite to that bearing the mouth and præ-oral hood. The præ-oral hood becomes the epistome, and the tentacles, by further development (new tentacles replacing the larval ones), become the horse-shoe-shaped group of tentacles of the adult. A very curious process of growth changes the long axis of the body and results in the anus assuming its permanent position near the mouth. An invagination appears on the ventral face of the larva between the anus and mouth, and attains considerable size. At a definite moment in the course of growth this invagination is suddenly everted, carrying with it in its cavity the intestine in the form of a loop. Thus

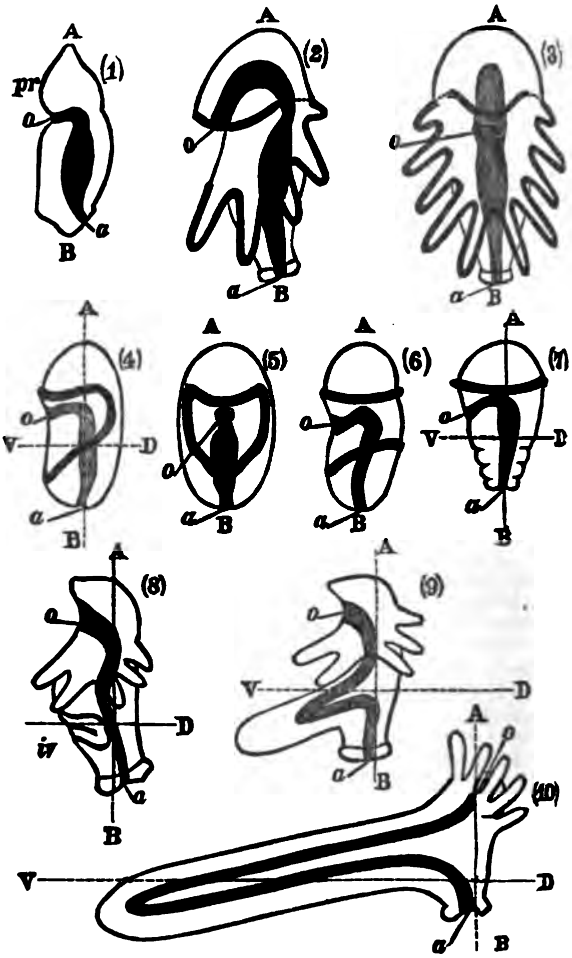

FIG. 6.—Development of Phoronis and typical ciliate larvæ. (1), (2), (3), (8), (9), (10), stages in the development of Phoronis—(1), earliest larva; (2), lateral view of the Actinotrocha; (3), ventral view of the same; (8), the ventral invagination *iv* is formed; (9), the ventral invagination is everted, carrying with it a loop of intestine; (10), the permanent relations of mouth, anus, and body (Podaxonia) are attained. (4), (5). Echinoderm larva with architroch, as in Actinotrocha, but band-like, not digitate. (6), Echinoderm larva, with the architroch divided into a præ-oral cephalotroch (Molluscan and Rotifer's velum), and a post-oral branchiotroch. (7), Chætopod trochosphere larva with cephalotroch only, and elongation and segmentation of the oro-anal axis. *a*, anus; *o*, mouth; *pr*, prostomium; *iv*, ventral invagination of Phoronis larva. A B, oro-anal axis; V D, dorso-ventral axis.

a new long axis is suddenly established at right angles to the original oro-anal axis, and continues to develop as the main portion of the body. The short area extending from the præ-oral hood to the anus is thus the true *dorsal* surface of Phoronis, whilst the elongated body is an outgrowth of the ventral surface perpendicular to the primary oro-anal axis, as conversely in many Mollusca we find a short *ventral* area (the foot) between mouth and anus, and an outgrowth of the dorsal surface (the visceral hump) perpendicular to the primary oro-anal axis, forming the chief body of the animal. In these relations Phoronis (and with it the other Polyzoa) agrees with Sipunculus. On the other hand Echiurus, the Chætopods, Nemertine worms, and some other groups which start from a simple larval form not unlike that of Phoronis, present a continual elongation of the original oro-anal axis, and no transference of the long axis by the perpendicular or angular growth of either the ventral or the dorsal surface of the larva.

Phoronis was discovered originally in the Firth of Forth by Dr. Strethill Wright. It occurs in the Mediterranean and in Australian seas (Port Jackson).

THE PTEROBRANCHIA.

This section of the Polyzoa also comprises forms which differ very widely from Paludicella. Inasmuch as their development from the egg is at present quite unknown, it may possibly prove that they have other affinities. Only two genera are known, Rhabdopleura (Allman) and Cephalodiscus (M'Intosh), the former dredged by Dr. Norman in deep water off the Shetlands (and subsequently in Norway), the latter taken by the "Challenger" expedition in 250 fathoms off the coast of Patagonia.

The Pterobranchia have the mouth and anus closely approximated, and immediately below the mouth are given off a series of ciliated tentacles, but these do not form a complete circle as in Paludicella, nor is the lophophore (the platform of their origin) horshoe-shaped as in Phoronis. The lophophore is drawn out into a right and a left arm in Rhabdopleura (Fig. 7), upon each of which are two rows of ciliated tentacles; no tentacles are developed centrally in the region between the two arms, so that the mouth is not completely surrounded by these processes. The horse-shoe-shaped lophophore of Phoronis could be modified so as to represent the tentaculiferous arms of Rhabdopleura by suppressing both rows of tentacles at the curve of the horse-shoe, and leaving only those which occur on the arms or rami of the horse-shoe (see Fig. 4). The lophophore of Cephalodiscus presents us with twelve processes, each carrying two rows of ciliated tentacles; in fact we have six pairs of tentaculiferous arms instead of a single pair, and each of these arms is precisely similar to one of the arms of Rhabdopleura (Fig. 9), excepting that it terminates in a knob instead of tapering. There is no arrangement for introverting the anterior portion of the body into the hinder portion in the Pterobranchia.

The little epistome or præ-oral lobe of Phoronis is represented in the Pterobranchia by a large muscular shield or disk-like structure (Fig. 7, *d* and Fig. 9, *b*) which overhangs the mouth and has an actively secreting glandular surface by which the tube or case (tubarium) in which the polypide is enclosed is secreted.

Both Rhabdopleura and Cephalodiscus produce colonies by budding; but the colonies of the former are large, definite, and arborescent, whilst those of Cephalodiscus are remarkable for the fact that the buds do not remain long in organic continuity with their parent, but become detached and nevertheless continue to be enclosed by the same common envelope or secretion. The bud-formation of Rhabdopleura recalls that of Paludicella in the fact that it leads to the formation of continuous arboriform communities. That of Cephalodiscus resembles the budding of Loxosoma, since no two fully-formed individuals remain in organic continuity. Both Rhabdopleura and Cephalodiscus (like Phoronis) produce cases or investments in which they dwell. These are free secretions of the organism, and are not, like the cœnœcia of Eupolyzoa, cuticular structures adherent to and part of the polypide's integument. The dwelling of Rhabdopleura is a branched system of annulated tubes of a delicate membranous consistency, each tube corresponding to a single polypide, the rings of which it is built being successively produced at the termination of the tube by the secreting activity of the præ-oral disk (Fig. 7, E). The polypides freely ascend and descend in these tubes owing to the contractility of their stalks. On the other hand, the dwelling of Cephalodiscus is a gelatinous, irregularly branched, and fimbriated mass (Fig. 8), excavated by numerous cavities which communicate with the exterior. In these cavities are found the numerous *detached* small colonies of Cephalodiscus (Fig. 9), or we should rather say the isolated budding polypides. The remaining important feature in the organization of the Pterobranchia, namely, the parts connected with the formation of buds, are best understood by first exam-

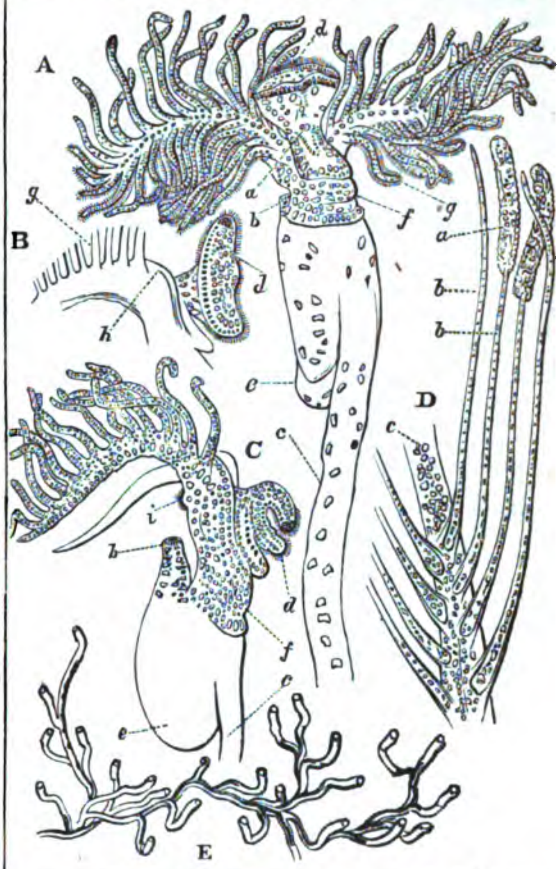

FIG. 7.—*Rhabdopleura Normani*, Allman (original drawings, Lankester). A. A single polypide removed from its tube and greatly magnified. *a*, mouth; *b*, anus; *c*, polypide-stalk or gymnocaulus, the "contractile cord" of Sars; *d*, the præ-oral lobe (buccal shield or disk of Allman); *e*, intestine; *f*, thoracic region of the polypide; *g*, one of the ciliated tentacles. B. Lateral view to show the form of the buccal shield and its pigment spot. *g*, ciliated tentacle (in outline); *h*, basal ridge of the right arm of the lophophore. C. Lateral view of a polypide. *i*, ciliated patch (Sars's organ) at the base of the lophophore-arm. Other letters as above. D. Part of a lophophore-arm, with soft tissues rubbed off to show the cartilaginoid skeleton. *a*, epithelium and soft tissues still adherent at the tip of a tentacle; *b*, skeleton of tentacle; *c*, skeleton of axis. E. Portion of a colony of *Rhabdopleura Normani*, showing the branched tube-like cases formed by the polypides. The black line within the tubes represents the retracted polypides connected together by their common stalk, the pectocaulus. Magnified to three times the size of nature.

ining Cephalodiscus. The body of Cephalodiscus is seen (Fig. 9) to be an oval sac; in this is suspended the U-shaped alimentary canal, and from the walls of its cavity (cœlom) the ova and the spermatozoa are developed. Projecting from the ventral face of this oval sac is a muscular cylindrical stalk, into which the viscera do not pass, though the cœlom is continued into it (Fig. 9, *c*). This stalk is merely the outdrawn termination of the body. It is about as long as the whole of the rest of the animal, and it is from its extremity that the buds are produced (Fig. 9, *a*). Before the buds have attained half the size of their parent they become detached, but continue to occupy some portion of the common gelatinous dwelling.

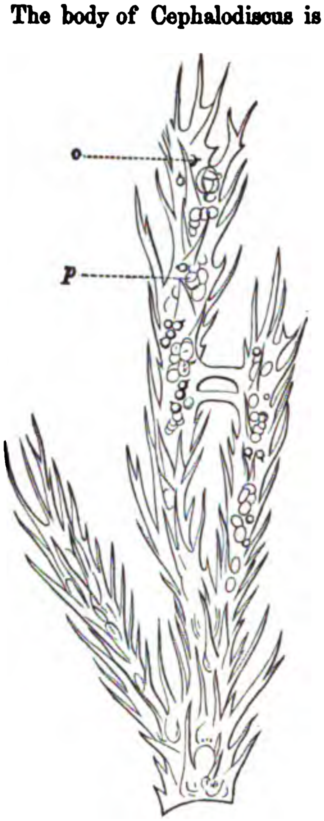

FIG. 8.—Dwelling of gelatinous consistence and brown color formed by the polypides of *Cephalodiscus dodecalophus*, M'Intosh; natural size (from an original drawing kindly supplied by Prof. M'Intosh, F.R.S.). *o*, polypide within the jelly; *p*, cavity once occupied by polypides.

Turning to Rhabdopleura, we find that each polypide has a body of similar shape and character to that described for Cephalodiscus, and a similar ventrally developed "stalk" (Fig. 7, A, *c*). But, inasmuch as the buds developed on the stalk of a Rhabdopleura polypide do not detach themselves, we find that we can trace the stalk of each polypide of a colony into connection with the stalk of the polypide from which it was originally budded, which may now be considered as a "branch" bearing many-stalked polypides upon its greatly extended length, and such a "branch-stalk" may be further traced to its junction with the "stem-stalk" of the whole colony. The stem-stalk was at one time the simple terminal stalk of a single polypide, but by lateral budding it gave rise to other polypides, and so became a gemmiferous "branch"; and further, when some of these in their turn budded and became branches, it became the main "stem" of a copious colony.

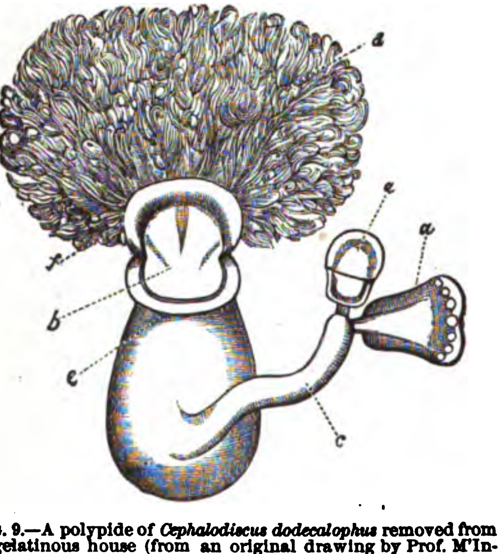

FIG. 9.—A polypide of *Cephalodiscus dodecalophus* removed from the gelatinous house (from an original drawing by Prof. M'Intosh). No organic connection has been severed in thus isolating this polypide with its attached buds *a*, *a*. The figure represents the furthest point to which colony-formation attains in this form. *a*, buds growing from the base of the polypide stalk; *b*, the præ-oral lobe (buccal shield or disk); *c*, the polypide stalk; *d*, the ciliated tentacles of the twelve lophophore arms (six pairs, each like the single pair of Rhabdopleura) inextricably matted and confused; *e*, anterior margin of the præ-oral lobe; *f*, posterior margin of the same. Magnified about fifty times linear.

A serious error has been made in comparing the contractile stalk of the Pterobranchiate polypide to the "funiculus" or cord-like mesentery of Eupolyzoa. With this it has morphologically nothing in common, since it is not an internal organ, but simply the elongated termination or stalk of the body, comparable to the stalk of Pedicellina (Fig. 15) and Loxosoma (Fig. 16), or to the hydrocaulus of such a Hydrozoon colony as Cordylophora. The stalk where it bears only very young buds, or none at all, as is always its condition in Cephalodiscus and in many polypides of a Rhabdopleura colony, may be called a "gymnocaulus"; when once its buds have developed into full grown polypides, and it has elongated proportionally with their growth, it becomes a "pectocaulus"; that is to say, it is to that part of it which bears such polypides that this term may be conveniently applied. The pectocaulus of Rhabdopleura, both in the form of branch and stem, undergoes remarkable change of appearance as compared with the gymnocaulus. It loses its contractility, shrinks, and develops on its surface a hard, dark, horny cuticle (whence its name), comparable precisely in its nature to the hardened cuticle which forms the zoœcia of Eupolyzoa. It now has the appearance of a black cord or rod-like body lying within and adherent to the inner face of the much wider tubular stem, and branches formed by the gradual building up and arborescent extension of the annulated tubarium secreted by the individual polypides. It has been regarded both by Allman and by Sars as a special structure, and called by the former "the chitinous rod" or "blastophore," by the latter "the axial cord."

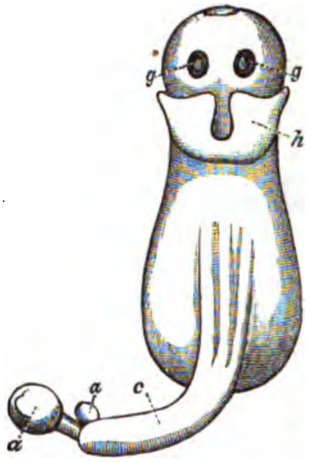

FIG. 10.—A Polypide of *Cephalodiscus dodecalophus*, from which the lophophore-tentacles and buccal shield have been removed in order to show the remarkable eyes. *a*, buds; *c*, stalk; *g*, eyes; *h*, post-oral collar, hidden by the buccal shield in Fig. 9. (Original drawing by Prof. M'Intosh, F. R. S.)

In reality it is the black-colored pectocaulus of Rhabdopleura which corresponds to the Cœnœcium of an ordinary Polyzoon; whilst the term "cœnœcium" is totally inapplicable morphologically to the annulated branched tube in which the Rhabdopleura colony lives, this having absolutely no parallel in the Eupolyzoa.

A sac-like testis has been discovered in Rhabdopleura opening by the side of the anus (Lankester, 7); but the ova have not yet been seen, nor is anything known of its development. Similarly the eggs of Cephalodiscus are observed within the body of the parent in the "Challenger" specimens, but nothing further is known of its life-history.

A body-cavity is present (Lankester), though its existence has been denied by Sars and M'Intosh.

Nephridia and nerve-ganglia are not described. Cephalodiscus has two remarkable eye spots dorsal to the cephalic disk (Fig. 10, *g*).

THE EUPOLYZOA.

Whilst it is necessary to include in the group Polyzoa the forms we have already noticed as Vermiformia and Pterobranchia, there can be no doubt that those organisms to which we assign the name Eupolyzoa are primarily those upon which naturalists have framed their conception of the group, and that they constitute a very consistent assemblage, held together by well-defined characters, and yet presenting an immense number of varied forms showing a wide range of modifications.

All the Eupolyzoa have closely approximated mouth and anus, and, like Paludicella, a complete range of hollow ciliate tentacles describing either a circle or a horse-shoe, surrounding the mouth. The anus as well as the mouth is included in this area in a few exceptional forms (the Entoprocta); it lies near but outside the lophophore (as the area is termed) in the vast majority (the Ectoprocta). Except in the Entoprocta, where the movement is limited, the whole anterior portion of the body bearing the lophophore can be invaginated into the hinder part (as described above for the typical Eupolyzoon Paludicella). This character distinguishes the Eupolyzoa from both Vermiformia and Pterobranchia. The polypides of all the Eupolyzoa are minute, but all produce buds which remain in organic continuity with their parent (except in Loxosoma) and build up very considerable and sometimes massive colonies.

In all Eupolyzoa the cuticle of the hinder part of each polypide is thick and dense, thus forming a hard-walled sac, the zooecium. This is peculiar to and universal in the Eupolyzoa (except Loxosoma), and is not to be confounded with the non-adherent tubes of Phoronis and Rhabdopleura or the jelly-house of Cephalodiscus. The connected zooecia of a colony of Eupolyzoa constitute a coenoecium. A simple nerve-ganglion between mouth and anus, a large body-cavity (except in Entoprocta), simple gonads without accessory glands or ducts, usually testis and ovary in the same polypide, absence of a blood-vascular system, of any but the most rudimentary nephridia, and of eyes, otocysts, or other special sense-organs, are features characterizing all adult Eupolyzoa.

The section Eupolyzoa, with its vast number of species and genera, requires a somewhat elaborate classification. The forms in which the anus is enclosed within the tentacular circle are very few, and are peculiar in other respects. We follow Nitsche (8) in separating them as the sub-class Entoprocta from the majority of Eupolyzoa forming the sub-class Ectoprocta.

Sub-class 1. **Ectoprocta,** Nitsche.

Eupolyzoa with the anus not included within the area of the lophophore. Anterior portion of the body of the normal polypide introversible. Tentacles not individually capable of being coiled or flexed.

Order 1. PHYLACTOLÆMA, Allman.

Ectoproctous Eupolyzoa in which the polypide possesses a præ-oral lobe or epistome, similar to that of Phoronis, and comparable to the more highly developed buccal shield or disk of the Pterobranchia. Lophophore (except in Fredericella, where it is nearly circular) horse-shoe-shaped (hippocrepian). Polypides of a colony equi-formal, that is, not differentiated in structure and function. Neighboring zooecia are in free and open communication, the bud never becoming shut off by a perforated cuticular plate from its parent. Cuticle of the zooecia either gelatinous or horny, forming massive or else arborescent coenoecia, in one genus (Cristatella) having the form of a plano-convex ellipse and locomotive (Fig. 3). In addition to the multiplication of polypides in a colony by budding, and to the annual production of new individuals from fertilized eggs which initiate new colonies, a reproduction by internal buds called "statoblasts," comparable to the gemmæ of Spongilla, has been observed in all the genera (Fig. 3, *b*). The statoblasts are developed from the funiculus (mesentery), and are enclosed in ornate lenticular capsules of chitinous substance, characteristic in form in each species.

The fertilized egg of the Phylactolæma does not give rise to a zonociliate larva, but to a uniformly ciliate cyst-like diblastula, which develops directly and produces polypides by budding. The Phylactolæma are all inhabitants of fresh water (lacustrine).

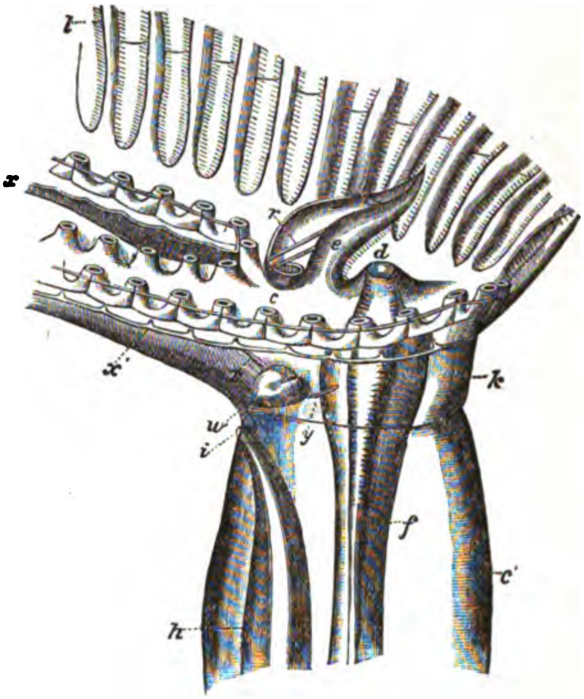

FIG. 11.—Semi-ideal view of part of the lophophore of *Lophopus* and its tentacles—intended to show the nerve-ganglion, nerves and parts around the mouth. The tentacles have been cut away all along the right arm of the lophophore and from the inner margin of the left arm. *c*, foramen placing the cavity of the epistome in communication with the body-cavity; *c'*, body-wall; *d*, mouth; *e*, the epistome or præ-oral lobe; *f*, wall of the pharynx; *h*, wall of the intestine; *i*, anus; *k*, lophophore; *l*, a ciliated tentacle; *r*, elevator muscle of the epistome; *w*, the nerve-ganglion; *x*, *x'*, nerves to lophophore and tentacles: *y*, nerve to pharynx.

The Phylactolæma include the genera Lophopus, Cristatella, Alcyonella, Plumatella and Fredericella, which have been beautifully figured and described in Allman's classical *Freshwater Polyzoa*, Ray Society, 1856. The colonies of Lophopus are small, consisting of half a dozen polypides embedded in a massive glass-like coenoecium. Cristatella (Fig. 3) is remarkable amongst all Polyzoa for its locomotive zoarium. Alcyonella forms massive coenoecia of many hundred polypides, as large as a man's fist. Plumatella and Fredericella are delicate arborescent forms commonly encrusting stones and the leaves of water-plants. All the genera known are British.

The Phylactolæma furnish a remarkable instance of a well-marked zoological group being confined to fresh water. Their reproduction by statoblasts (not known in the marine Polyzoa) appears to be related to the special conditions of lacustrine life, since it is also observed under the same exceptional conditions in the single freshwater genus of another great group of animals, viz., Spongilla. Also related to their non-marine conditions of life is the development of the fertilized egg, which, as in so many similar cases, does not produce the remarkable banded forms of locomotive larvæ which are characteristic of their marine congeners.

Order 2. Gymnolæma, Allman.

Ectoproctous Eupolyzoa in which the polypide is devoid of any trace of the præ-oral lobe or epistome, whilst the lophophore is perfectly circular. The polypides of a colony are frequently highly differentiated as avicularia, vibracularia, oœcia (egg-receptacles), and even as root and stem segments. The neighboring polypides of a colony communicate (?) with one another by "rosette-plates" or "communication-plates"—perforated areas in the walls of contiguous zoœcia. The greatest variety in the character of the cuticle forming the zoœcia (gelatinous, horny, calcareous) and in the grouping of the polypides, as well as in the shape of their zoœcia, is observed in different sub-orders and families. In addition to the ordinary sexual reproduction, there are various modifications of the process of budding, the full exposition of which would necessitate more space than is here allotted, and is not yet indeed within the possibilities of present knowledge. The fertilized egg of the Gymnolæma gives rise to remarkable ciliate larvæ of various forms (Figs. 19, 20, 21), from which the first polypide of a colony is developed by an extraordinary and unexplained series of changes. The Gymnolæma are, with the single exception of the genus Paludicella, inhabitants of the sea.

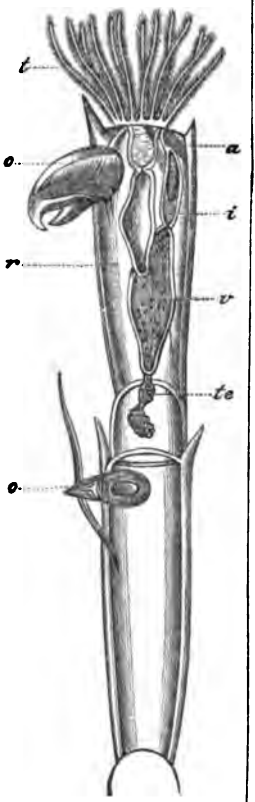

Fig. 12.—Two zoœcia of *Acamarchis* (*Bugula*) *avicularia*, Lmx. (Chilostoma), of which the anterior contains a living polypide, whilst the posterior is empty. To each is attached one of the characteristically modified polypides known as an "avicularium" *o*; the hinder of these has grasped and holds in its beak a small worm. *a*, anus; *i*, intestine; *v*, stomach; *r*, body-cavity (cœlom); *t*, tentacular crown surrounding the mouth; *te*, testis cells developed on the surface of the terminal mesentery or "funiculus"; *o*, *o*, avicularia.

The Gymnolæma are divided, according to the system of Busk, into three sub-orders characterized by the shape of their zoœcia, and the nature of the mouth-like margin which it presents when the exsertile portion of the polypide is withdrawn within it. The **Cyclostoma** have long tubular zoœcia, often of large size and often calcified, placed side by side in cylindrical bundles, or in other definite grouping; the mouth of the zoœcium is circular and devoid of processes. There is little or no differentiation of the polypides constituting a colony. Most of this group are fossil, and the living genera belong mostly to southern seas. The genera Crisia (Fig. 13, A), Diastopora, Tubulipora, and Hornera are typical. The **Ctenostoma** have usually a soft zoœcium; its orifice is closed by the folds of the retracted polypide or by a circlet of bristles which surround it. *Alcyonidium gelatinosum* is the commonest representative of this group on the British coasts. Bowerbankia (Fig. 1, A) and Paludicella (Fig. 1, E) also belong here. The **Chilostoma** form the largest and most varied suborder of Gymnolæma. The zoœcia are horny or calcified; their orifices can be closed by a projecting lip in the form of an operculum. The operculum is a separable plate developed on the cuticle of the retractile part of the polypide, and has muscles attached to it (Fig. 13, B, C, D). The surface of the zoœcia is frequently sculptured, and its orifice provided with processes and spines (Fig. 1, C, F). Very usually some of the polypides of a colony are modified as avicularia, vibracularia, radical fibres and oœcia. The avicularium is a polypide reduced to a simple muscular apparatus working upon the modified operculum and zoœcium so as to cause these hard parts to act as a snapping apparatus comparable to a bird's head (Fig. 12, *o*). They are frequently found regularly distributed among the normal cells of a colony, and probably have a cleansing function similar to that attributed to the Pedicellariæ of the Echinoderms. "Vibracularia" are even more simplified polypides, being little more than motile filaments, probably tactile in function. The opercula of zoœcia, oœcia, and avicularia have recently been used by Busk in characterizing genera and species, in a systematic way. Stem-building and root-forming polypides are frequently found, being closed polypides which subserve anchoring or supporting functions for the benefit of the whole colony. The stem of Kinetoskias (Fig. 14) is produced in this way. The Chilostoma include a large series of genera arranged in the sections Cellularina, Flustrina, Escharina, and Celleporina. For the systematic description of the highly complex and very varied colonial skeletons or cœnœcia of the Gymnolæma, the reader is referred to the works of Busk (9), Hicks (10), Smitt (11), and Heller (12). See also Ehlers (13) on Hypophorella.

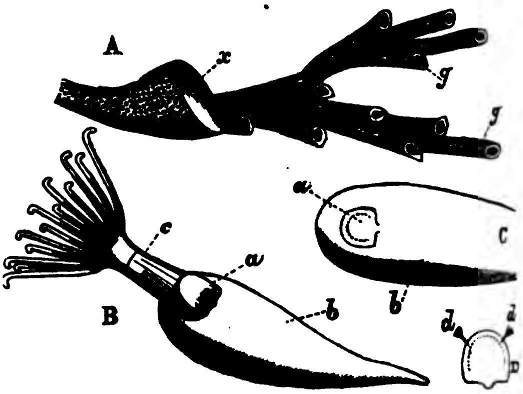

Fig. 13.—A. Cænœcium of *Crisia eburnea*, Lin., one of the Cyclostoma; *g*, *g*, tubular zoœcia with circular terminal mouths; *x*, oœcium, being a zoœcium modified to serve as a brood-chamber.

B. Diagram of a single polypide of one of the Chilostoma in a state of expansion, in order to show the position and action of the operculum. *a*, operculum, a plate of thickened cuticle hinged or jointed to *b*, the main area of dense cuticle of the anti-tentacular region known as the zoœcium; *c*, the soft-walled portion of the polypide in expansion.

C. The same zoœcium with the polypide invaginated (telescoped) and the operculum *a* shut down over the mouth of the zoœcium.

D. Operculum detached, and seen from its inner face, to show the occlusor muscles *d d*.

Sub-class 2. **Entoprocta**, Nitsche.

Eupolyzoa in which the anal aperture lies close to the mouth within the tentacular area or lophophore. Lophophore sunk within a shallow basin formed by the inversion of the broad truncated extremity of the cup-shaped body. Tentacular crown not further introversible, the individual tentacles (as in the Pterobranchia and unlike the Ectoprocta) capable of being flexed and partially rolled up so as to overhang the mouth (see Fig. 15, B and C). Body-cavity (cœlom) almost completely obliterated. The anti-tentacular region of the polypide's body is drawn out to form a stalk similar to the gymnocaulus of the Pterobranchia. The extremity of this stalk is provided with a cement gland in the young condition which persists in the adult of some species (*Loxosoma neapolitanum*, Fig. 16, *shs*). Cuticular investment (zoœcium) of the polypides feebly developed. A pair of small nephridia are present.

The Entoprocta consist of the marine genera Pedicellina (Fig. 15), Loxosoma (Fig. 16), and probably the insufficiently known freshwater American genus Urnatella of Leidy. To these must be added Busk's new genus Ascopodaria, as yet undescribed, based on a specimen dredged by the "Challenger," showing a number of Pedicellina-like polypides, carried as an umbel on a common stalk of very peculiar structure. Pedicellina is found attached to algæ, shells, zoophytes, etc., and to the integument of some Gephyræan worms (*Sipunculus punctatus*) and Annelids (Aphro-

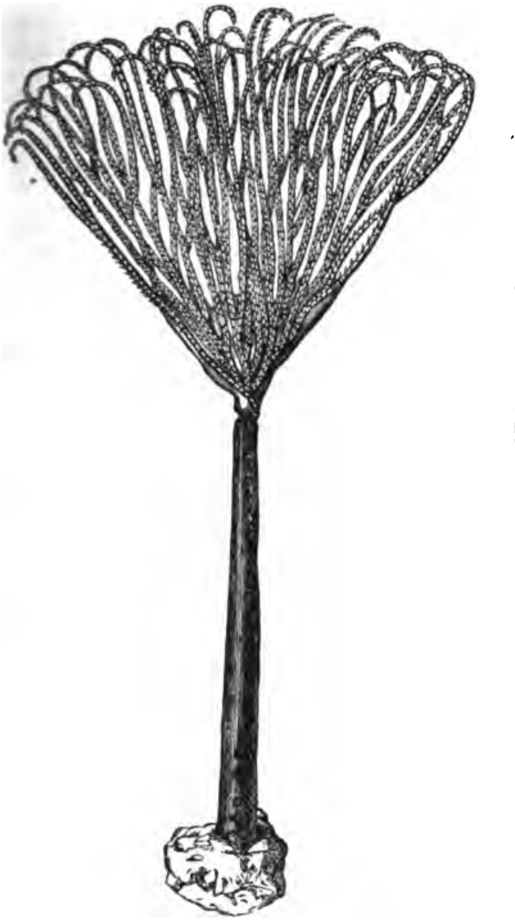

FIG. 14.—*Kinetoskias* (*Naresia*) *cyathus* (from Sir Wyville Thom- n). The polypides and zoœcia are allied to *Bugula*, but the arium as a whole is remarkable for its definite shape, consisting a number of slightly branched gracefully bending filaments pported like the leaves of a palm on a long transparent stalk. e Busk, in *Quart. Journ. Micr. Sci.*, 1881, for further details.)

te); Loxosoma occurs on various worms, etc. Whilst e buds of Pedicellina remain connected so as to con- itute a colony, those produced by Loxosoma are con- nually detached, so that the polypide is solitary. arther, the cup-like body of Pedicellina is deciduous, d frequently falls from the stalk and is replaced by w growth. There is less distinction between body d stalk in Loxosoma, and the former does not be- me detached. Apparently a very important feature the structure of the Entoprocta is the absence of a dy-cavity. This is, however, more apparent than al. The Entoprocta are true Cœlomata, but the elom is partially obliterated by the growth of meso- astic tissue. The nephridia presumably lie in a space hich, small as it is, represents the cœlom. See Har- er (18) for details.

enealogical Relationships of the Groups of Polyzoa.

It is necessary that we should try to form some pinion as to which of the various groups of Polyzoa e most like the ancestral form from which they have l sprung, and what are the probable lines of descent ithin the group. Any attempt of the kind is specu- tive, but it is absolutely needful since zoology has ecome a science—that is to say, an investigation of uses and not merely a record of unexplained obser- ations—to enter upon such questions. Colonial or- anisms have necessarily descended from solitary ances- rs, and it is probable that the ancestral form of olyzoa was not only solitary, as are Phoronis and Loxosoma at the present day, but of relatively large size and more elaborately organized than the majority of living Polyzoa. Whilst the polypides have dwindled in size and lost some of their internal organs, the modern Polyzoa have developed *pari passu* with this

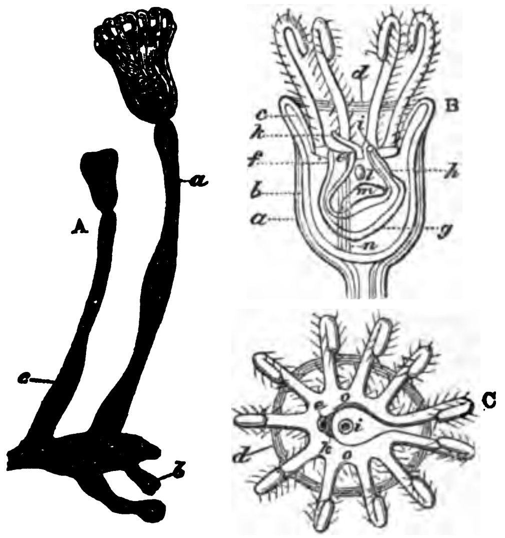

FIG. 15.—A. Two polypides and buds of *Pedicellina belgica*, Van B. (after Van Beneden): greatly magnified. *a*, the polypide-stalk of a fully developed polypide; *c*, that of a less mature individual; *b*, a bud. All are connected by a common stalk or stolon. B. and C. Two views of the body of the polypide of Pedicellina (after Allman). *a*, cuticle; *b*, body-wall; *c*, permanently introverted anterior region of the body; *d*, margin of the tentacular cup or calyx thus formed; *e*, mouth; *f*, pharynx; *g*, stomach; *h*, intestine; *i*, anus; *k*, epistome or præ-oral lobe; *l*, nerve-ganglion; *m*, gonad; *n*, retractor muscle of the lophophore; *o*, lophophore.

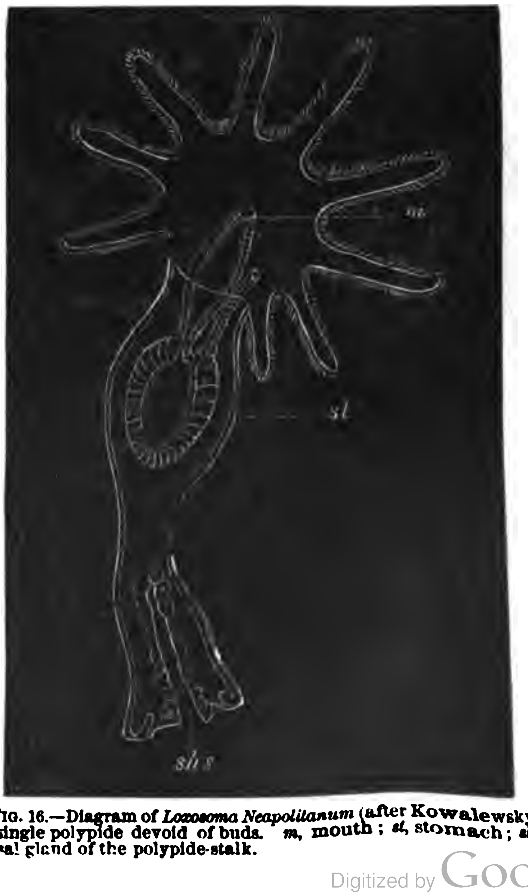

FIG. 16.—Diagram of *Loxosoma Neapolitanum* (after Kowalewsky). A single polypide devoid of buds. *m*, mouth; *st*, stomach; *shs*, basal gland of the polypide-stalk.

degeneration an elaborate system of bud-production and colony-formation. The new individuality (the tertiary aggregate) attains a high degree of development (Cristatella, Kinetoskias) in proportion as the constituent units merged in this new individuality have suffered a degeneration. The præ-oral lobe (epistome, buccal disk) present in all Polyzoa except the most minute and most elaborately colonial forms—namely, the Gymnolæma—is to be regarded as an ancestral structure which has been lost by the Gymnolæma. The horse-shoe-shaped lophophore, such as we see it in Phoronis and in Lophopus, is probably the ancestral form, and has given rise to the two other extreme forms of lophophore,—namely, the "pterobranchiate," associated with a great development of the epistome, and the "circular," associated with a complete suppression of the epistome. The entoproctous lophophore is a special modification of the horse-shoe-shaped, as shown in the diagram Fig. 15, C. The formation of zoœcia, and so of an elaborate colonial skeleton, was not a primary feature of the Polyzoa. Even after budding and colony-formation had been established zoœcia were not at once produced, but possibly dwellings of another kind (Pterobranchia). We are thus led to look upon the Gymnolæma as the extreme modification of the Polyzoon type. Starting with an organism similar to Phoronis, we may suppose the following branchings in the pedigree to have oocurred.

VERMIFORMIA

A. The complete hippocrepian lophophore becomes specialized in the form of ctenidia or gill-plumes; the epistome enlarged.
— PTEROBRANCHIA.

α. The anti-tentacular region of the body elongated as a stalk gives rise to one or two rapidly detached buds (Cephalodiscus).

β. The stalk gives rise to buds which do not detach themselves, but remain in continuity so as to form a colony of a hundred or more individuals (Rhabdopleura).

B. The complete hippocrepian lophophore retains its form, but acquires a gradually increasing power of being telescoped into the hinder part of the body.
— The Pro-Eupolyzoon.

A. The anti-tentacular region of the body becomes stalk-like. and develops buds which either detach themselves as they form (Loxosoma) or remain to form a small colony (Pedicellina). The telescopic introversibility of the lophophore does not advance beyond an initial stage. The arms of the lophophore grow round so as to embrace the anus.
— Sub-class 1 (of the Eupolyzoa) Entoprocta.

B. The complete hippocrepian lophophore remains in its original form, and also the præ-oral epistome, but the telescopic introversibility of the anterior region of the body is greatly developed at the same time that the cuticle of the hinder part of the body is increased in thickness and toughness. Bud production, not from a stalk-like pedicle, but from all parts of the body, now becomes characteristic, the buds, which were at first deciduous, now remaining in permanent continuity so as to form colonies.
—The Pro-Ectoprocton.

A. The polypides acquire the property of carrying their young so as to avoid the disastrous influences of fluviatile currents, and also the property of producing resistent statoblasts, and thus are enabled to become isolated and to persist in the peculiar conditions of fresh waters.
— The 1st order (of Ectoprocta) Phylactolæma.

B. The polypides forming relatively larger colonies, and themselves becoming relatively more minute, lose by atrophy the præ-oral epistome; and simultaneously the arms of the hippocrepian lophophore dwindle, and a simple circum-oral circlet of tentacles is the result. The cuticle of the hinder part of the polypide becomes more and more specialized as the cell or zoœcium, and in different polypides in various parts of the colony acquires special forms—as egg-cases, snappers (avicularia), tentacles, stalk and root segments.
— The 2d order (of Ectoprocta) Gymnolæma.

Distinctive Characters of the Polyzoa.

From all that has preceded it appears that the really distinctive characters common to all the Polyzoa may be summed up as follows:

Cœlomata with closely approximated mouth and anus, the bulk of the body forming a more or less elongate growth at right angles to the original (ancestral) oro-anal axis, and starting from the original ventral (*i.e.*, oral) surface. A variously modified group of ciliated tentacles is disposed around the mouth, being essentially the development by digitiform upgrowth of a post-oral ciliated band. As negative characters it is important to note the absence of all trace of metameric segmentation, of setæ, and of paired lateral (parapodia of Appendiculata) or median ventral (podium of Mollusca) outgrowths of the body-wall.

Larval Forms of Polyzoa.

In the consideration of the probable pedigree and affinities of the Polyzoa, we are not at present able to make use of the facts of development from the egg, on account of the extreme difficulty which the study of the young stages of these organisms presents. In the case of Phoronis we have the only readily intelligible history. The larva, to start with, is of that form known as an architroch (see Lankester, "Notes on Embryology and Classification," *Quart. Journ. Micr. Sci.*, 1876), having a præ-oral ciliated area (velum or cephalotroch) continuous with a post-oral ciliated band (the branchiotroch), which latter becomes developed into the tentacular crown of the adult.

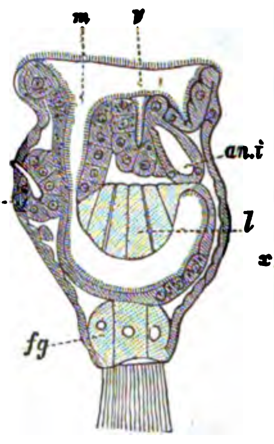

FIG. 17.

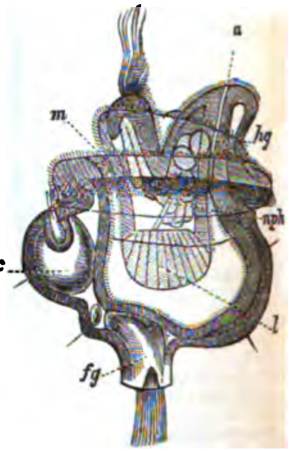

FIG. 18.

FIG. 17.—Larva of Pedicellina (from Balfour, after Hatschek) *v*, vestibule (the cup-like depression of the tentaculiferous end of the body); *m*. mouth; *l*, digestive gland; *an.i*, anal invagination; *fg*, the ciliated disk (corresponding to the cement gland of Loxosoma (Fig. 16, *shs*); *x*, so-called "dorsal organ," supposed by Balfour to be a bud, by Harmer (18) regarded as the cephalic ganglion.

FIG. 18.—Later stage of the same larva as Fig. 17. Letters as before, with the addition of *nph*, duct of the right nephridium; *a*, anus; *hg*, hind-gut.

The actinotrocha (Phoronis) larva is readily comparable with the trochosphere larvæ of Echinoderms, Chætopods, Gephyræans, and Molluscs. Its special character consists in the strong development of the post-oral ciliated band, whereas the præ-oral ciliated band is in most other classes (the Sipunculoids excepted) the predominant one. The Phoronis larva exhibits first of all an oro-anal long axis, and this is suddenly abandoned for a new long axis, by the growth of the ventral surface of the larva at right angles to the primary axis (hence the term Podaxonia).

In the other Polyzoa we do not at present know of any larva which retains even in its earliest phases the original oro-anal long axis. They all appear to start at once with the peculiar and secondary long axis of the adult Phoronis, so that Balfour has diagrammatically represented the Polyzoon larva by the sketch given in Fig. 19. This diagram applies, however, more especially to the Entoprocta, since the anus is represented as included in the area of the post-oral ciliated ring. The development of Pedicellina has been very carefully followed by Hatschek, and may be said to be the only instance among the Eupolyzoa which the growth of the different organs and the con- quent relation of the form of the larva to the form of e adult is understood (see Figs. 17 and 18).

In the other Polyzoa, in spite of the painstaking and inute studies of Barrois (14), the ct is that we do not know what ce of the larva corresponds to e tentacular area, what to the lk or anti-tentacular extremity, hat to the anterior and what to e posterior surface. The con- rsion of the larva into the first olypide has not been observed in e case of these free-swimming rms, and it is even probable that o such conversion ever takes lace, but that the first polypide rms as a bud upon the body-wall f the larva.

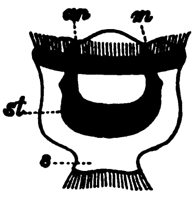

FIG. 19.—Diagram of an ideal Polyzoon larva (from Balfour). *an*, anus; *m*, mouth; *st*, stomach; *s*, ciliated disk (*fg* in Figs. 17, 18, and 21).

Two of the most remarkable rms of free-swimming larvæ of ymnolæma are represented in igs. 20 and 21. In both, in addition to the chief post- ral ciliated band, a smaller ciliated ring is observed, which identified by Balfour with that which is found at the nti-tentacular extremity (base of the stalk) in the Pedi- ellina larva.

It does not seem justifiable, in the face of the existing ncertainties as to the identification of parts, and in view of the high probability that the Gymnolæma are extremely modified and degenerate forms (a consideration which applies in some respects even more strongly to the Entoprocta), to assume that the larval form schematized in Fig. 19 represents an ancestral condition of the Polyzoa. Professor Balfour (15) was, however, led to entertain such a view, and, assuming that the chief ciliated band (drawn as a broad black line) corresponds to the single præ-oral ciliated band of the trochosphere larva of Echiurus, Polygordius, Chætopods, and Mollusca, he pointed out that in both cases the ciliated girdle divides the larva into a hemisphere in which mouth and anus lie and a hemisphere which is the complement of this; in most classes the first hemisphere elongates and forms the bulk of the body, whilst the second hemisphere forms the prostomium or præ-oral lobe. But, according to Balfour's theory, in Polyzoa it is the second hemisphere which enlarges and becomes the stalk-like body of the adult, whilst the first hemisphere remains small and insignificant. Thus the Polyzoa would fix themselves in later growth by what corresponds to the head or prostomium of other animals, as do the Barnacles and the Ascidians. Ingenious as this speculation is, we must remember that it takes no account of the facts known as to Phoronis, nor of the Pterobranchia, and that it is confessedly based upon the assumption that the larvæ of extremely degenerate and peculiar members of the group are not adaptive and modified, but retain primary and archaic characters. Further, it is to be distinctly borne in mind that the interpretation of parts upon which this speculation rests is, except in the case of Pedicellina, altogether hypothetical.

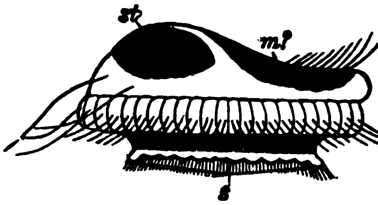

FIG. 20.—Larva of *Alcyonidium mytili* (from Balfour after Barrois). *m?*, problematic structure; *st*, oral invagination (?)—Harmer's cephalic ganglion; *s*, ciliated disk (corresponding to *fg* in Figs. 17, 18, and 21).

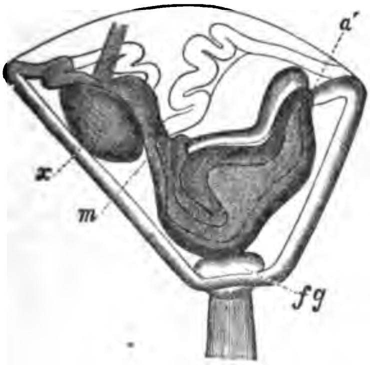

FIG. 21.—Larva of Membranipora (known as Cyphonautes). *m*, mouth; *a*, anus; *fg*, ciliated body; *x*, problematical body, supposed by Balfour to be a bud, similar to the dorsal organ *x* in Figs. 17, 18, and to either *st* or *m* in Fig. 20.

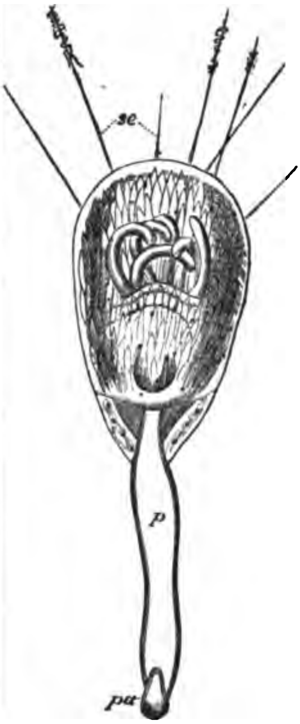

FIG. 22.—Young Terebratulina at a stage when only six tentacles are present. *se*, setæ at the margin of the calyx; *p*, stalk comparable to the stalk of Pedicellina, Loxosoma, Cephalodiscus, and Rhabdopleura; *pa*, cement gland at the apex of the stalk (after Morse).

Relations of the Polyzoa to the Brachiopoda.

The Polyzoa were first associated with the Brachiopoda by H. Milne-Edwards. The investigation of the development of Terebratulina by Morse (16) led to a further perception of the points of agreement in structure between these two groups. Lastly, Caldwell (6) has shown that the mesenteries of Phoronis have precisely similar relations to the lophophore, the nephridia, and the termination of the intestine as have the gastro-parietal and ilio-parietal bands or mesenteries of the Terebratulidæ. The young Terebratulina (Fig. 22) may be readily compared with Loxosoma (Fig. 16),—the peduncle with its cement glands in the former being identical with the stalk and basal gland of the latter. The form of the alimentary canal and the disposition of the tentacular arms (Fig. 23) is the same in Brachiopoda and Polyzoa. The nephridia (oviducts) of Terebra-

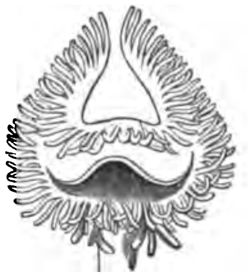

FIG. 23.

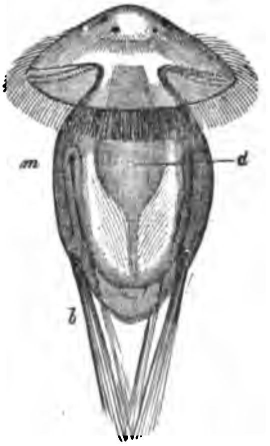

FIG. 24.

FIG. 23.—Lophophore and epistome of young Terebratulina, showing the horse-shoe shape; the arms are turned in the direction the reverse of that taken by the lophophore-arms in Polyzoa (see Fig. 4). In later growth they will become spirally coiled. (After Morse).

FIG. 24.—Larva of the Brachiopod Argiope (from Gegenbaur, after Kowalewsky). *m*, setigerous lobe; *b*. setæ; *d*, enteron.

tula have a position and relations similar to those of the nephridia (genital ducts) of Phoronis. The chief difference between Polyzoa and Brachiopoda consists in the special development of the margin of the cupped end of the body, into which the lophophore is sunk, as in Pedicellina (see Fig. 15, B, *c*). This up-standing margin is enormously increased in the Brachiopoda, so as to form a voluminous hood or collar, which surrounds the large tentacular arms, and forms a protective chamber for them. It is notched right and left so as to be divided into two lobes, and on its surface is developed a horny or a calcareous shell in two corresponding moieties. Until recently it was held (see Lankester, 17), that both Brachiopoda and Polyzoa were modifications of the Molluscan type, and the Brachiopods' collar was identified with the pallial fold of Mollusca. The resemblance of the two structures must now be considered as purely homoplastic, and not as having any real morphological (homogenetic) significance.

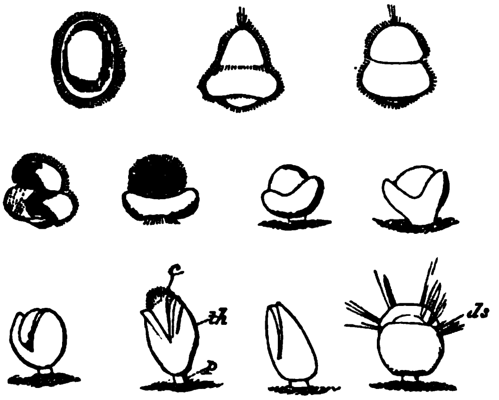

FIG. 25.—Surface views of ten stages in the development of Terebratulina, showing the free-swimming larva and its mode of fixation (after Morse). *c*, lophophoral segment; *th*, thoracic segment; *p*, peduncular segment; *ds*, deciduous setæ.

The larvæ of the Brachiopoda (Figs. 24, 25) are as exceptional and difficult of interpretation as those of Polyzoa, but no attempt has been yet made to show that the one can be reduced to a common form with the other. The three segments presented by some Brachiopod larvæ (Fig. 25) have been compared to the segments of Chætopod worms by some writers, and these, together with the presence of setæ, have been regarded as indicative of affinity between the Brachiopoda and Chætopoda (Morse). But it is sufficient, in order to dispose of this suggestion, to point out that the segments of the Chætopoda follow one another along the primary oro-anal axis, whilst those of Brachiopoda are developed along an axis at right angles to this (Caldwell).

The Brachiopoda must be classified together with the Polyzoa and Sipunculoidea in a phylum (Podaxonia) characterized by the development of this secondary axis.

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(E. R. L.)

POMBAL, SEBASTIAN JOSEPH DE CARVALHO E MELLO, MARQUIS DE (1699-1782), the greatest statesman Portugal has produced in modern times, was the son of a fairly wealthy country gentleman, Emmanuel de Carvalho, and was born at Soure, near Pombal, on 13th May, 1699. He was educated at the university of Coimbra, and was then for a short time in the army, but it was not until he was nearly forty and had been married some years that he received his first public appointment, and was sent as minister to London in 1739. There he studied English administration, but never learnt the English language, and was promoted to the embassy at Vienna by King John V. in 1745, and recalled in 1750 to become minister for foreign affairs. Before he reached Lisbon John was dead, and his successor, King Joseph, at once placed entire confidence in him. He soon began to show his strength. In 1751 he checked the Inquisition by allowing no executions without the royal permission, he improved the navy, the police, and the finances, and freed the Indians of the Brazils from slavery. The great earthquake of Lisbon on 1st November, 1755, showed him in his true greatness; when the king asked him despairingly what he should do, he answered briefly: "Bury the dead and feed the living," and by his calmness at that frightful moment gained an ascendency over the royal mind which lasted till Joseph's death. His power was at once used to check the Roman Catholic Church, which, with the Jesuits and the Inquisition, had eaten the life out of the country, and in 1757 the Jesuits were expelled from court (see JESUITS, vol. xiii. p. 665). The Count d'Oeyras, as he was now made, then devoted himself to internal administration; he founded the Oporto Wine Company, encouraged sericulture, rebuilt Lisbon, and improved on the Jesuit system of education, and in 1762, showed his concurrence in the hereditary policy of Portugal in helping England against Spain, when the Family Compact had united the interests of Spain and France. On the 3d September, 1769, an attempt on the king's life was frustrated by the count, who was in 1770 made marquis of Pombal. He remained in power till the death of the king in 1777, but the new sovereign, Queen Maria, at once accepted his resignation, and persecuted him till his death in 1782.

POMEGRANATE. The pomegranate (*Punica Granatum*) is of exceptional interest by reason of its structure, its history, and its utility. It forms a tree of small stature, or a bush with opposite, shining, lance-shaped leaves, from the axils of some of which proceed the brilliant scarlet flowers. These are raised on a short stalk and consist of a thick fleshy cylindrical or bell-shaped calyx tube, with five to seven short lobes at the top. From the throat of the calyx proceed five to seven roundish, crumpled, scarlet or crimson petals, and below them very numerous slender stamens. The pistil consists of two rows of carpels placed one above another, both rows imbedded in, and partially inseparate from, the inner surface of the calyx tube. The styles are confluent into one filiform thread. The fruit, which usually attains the size of a large orange, consists of a hard, leathery rind, which is the enlarged calyx tube, enclosing a quantity of pulp derived from the coats of the numerous seeds. This pulp, filled as it is with refreshing acid juice, constitutes the chief value of the tree. The more highly cultivated forms contain more of it than the wild or half-wild varieties. The great structural peculiarity consists in the presence of the two rows of carpels one above another (a state of things which occurs exceptionally in apples and oranges), and in the fact that, while in the lower series (Fig. 1) the seeds are attached to the inner border or lower angle of the cavity, they occupy the outer side in the

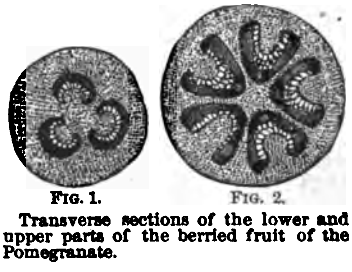


FIG. 1. FIG. 2.

Transverse sections of the lower and upper parts of the berried fruit of the Pomegranate.

upper series (Fig. 2), as if, during growth, the upper whorl had become completely bent over.

By Bentham and Hooker the genus *Punica* is included under *Lythraceæ;* others consider it more nearly allied to the myrtles; while its peculiarities are so great as, in the opinion of many botanists, to justify its inclusion in a separate order. Not only is the fruit valuable in hot countries for the sake of its pulp, but the rind and the bark and the outer part of the root are valuable as astringents owing to the large quantity of tannin that they contain. The bark of the root is likewise valued in cases of tape-worm.

The tree is without doubt wild in Afghanistan, northwestern India, and the districts south and southwest of the Caspian, but it has been so long cultivated that it is difficult to say whether it is really native in Palestine and the Mediterranean region. It has been cited as wild in northern Africa, but this appears to be a mistake. Recently, however, Prof. Bayley Balfour met with a wild species, heretofore unknown, in the island of Socotra, the flowers of which have only a single row of carpels, which suggests the inference that it may have been the source of the cultivated varieties. But, on the other hand, in Afghanistan, where Aitchison met with the tree truly wild, a double row of carpels was present as usual. The antiquity of the tree as a cultivated plant is evidenced by the Sanskrit name *Dadimba*, and by the references to the fruit in the Old Testament, and in the *Odyssey*, where it is spoken of as cultivated in the gardens of the kings of Phæacia and Phrygia. The fruit is frequently represented on ancient Assyrian and Egyptian sculptures, and had a religious significance in connection with several Oriental cults, especially the Phrygian cult of Cybele (Arnob., v. 5 *sq.;* see also Baudissin, *Studien*, ii. 207 *sq.*). It was well known to the Greeks and Romans, who were acquainted with its medicinal properties and its use as a tanning material. The name given by the Romans, *malum punicum*, indicates that they received it from Carthage, as indeed is expressly stated by Pliny; and this circumstance has given rise to the notion that the tree was indigenous in northern Africa. On a review of the whole evidence, botanical, literary, and linguistic, Alphonse de Candolle (*Origine des Plantes Cultivées*) pronounces against its African origin, and decides in favor of its source in Persia and the neighboring countries. According to Saporta the pomegranate existed in a fossil state in beds of the Pliocene epoch near Meximieux in Burgundy. The pomegranate is sometimes met with in cultivation against a wall in England, but it is too tender to withstand a severe winter. The double-flowered varieties are specially desirable for the beauty and long duration of their flowers.

POMERANIA (Germ. *Pommern*) is a maritime province of Prussia, bounded on the N. by the Baltic, on the W. by Mecklenburg, on the S. by Brandenburg, and on the E. by West Prussia. Its area is 11,620 square miles. The province is officially divided into the three districts of Stralsund, Stettin, and Cöslin; but more historical interest attaches to the names of Vorpommern and Hinterpommern, or Hither and Farther Pomerania, applied to the territory to the west and to the east of the Oder respectively. As a whole Pomerania is one of the lowest and flattest parts of Germany, but to the east of the Oder it is traversed by a range of low hills, and there are also a few isolated eminences to the west. Off the west coast, which is very irregular, lie the islands of Rügen, Usedom, and Wollin; the coast of Farther Pomerania is smooth in outline and bordered with dunes or sandbanks. Besides the Oder and its affluents, there are several small rivers flowing into the Baltic, none of which, however, are navigable except for rafts. Many of these end in small littoral lakes, separated from the sea by a narrow strip of land through which the water escapes by one or more outlets. The interior of the province is also thickly sprinkled with lakes, the combined area of which is equal to about one-twentieth of its entire surface. The soil of Pomerania is for the most part thin and sandy, especially to the east of the Oder; but patches of good soil occur here and there. About 55 per cent. of the surface is under tillage, while 19 per cent. consists of meadow and pasture and 20 per cent. is covered by forests. The principal crops are potatoes, rye, and oats, but wheat and barley are grown in the more fertile districts; tobacco and beetroot for sugar are also cultivated. Agriculture is still in many respects carried on in a somewhat primitive fashion, and the live stock is as a rule of an inferior quality. Large flocks of sheep are kept both for their flesh and wool, and geese and goose-feathers form lucrative articles of export. (A tabular view of the agricultural products of Pomerania will be found under PRUSSIA.) Owing to the long coast-line and the numerous lakes, fishing forms a not unimportant industry, and large quantities of herring, eels, lampreys, etc., are sent from Pomerania to other parts of Germany. With the exceptions of its inexhaustible layers of peat or soft coal, the mineral wealth of Pomerania is insignificant. Its industrial activity is also of no great importance, though there are a few manufactories of machinery, chemicals, tobacco, sugar, and other articles, chiefly in or near the larger towns, and linen-weaving is practiced as a domestic industry. Shipbuilding is carried on at Stettin and other places on the coast. Commerce, however, is relatively much more flourishing. Stettin is one of the chief seaports of Prussia, and Stralsund, Greifswald, and Colberg also possess a foreign trade, the exports consisting mainly of grain, timber, and fish.

In 1880 Pomerania contained 1,540,034 inhabitants, all of whom were Protestants except 23,877 Roman Catholics and 13,886 Jews. The Slavonic element in the population is now represented only by a few thousand Poles and a handful of the ancient Cassubians on the east border. Pomerania is the most sparsely populated province in Prussia, the ratio being 132 inhabitants per square mile. About 67 per cent. of the population belong to the rural districts, while the remainder live in communities of 2000 and upwards. There are only nine towns with more than 10,000 inhabitants, at the head of which stands Stettin with 91,000. The Pomeranians belong mainly to the old Saxon stock, and are, as a rule, tall, strong, and well-built. They somewhat resemble the Scots in their cautious and persevering character, their strong theological bias (which perpetuates the existence of numerous small Protestant sects), and their turn for dry humor; but they are by no means so enterprising or so open to new ideas. In 1883 only 0.32 per cent. of the Pomeranian recruits were illiterate, a fact which speaks well for the educational system of the province. There is a university at Greifswald. The province sends 16 members to the reichstag and 26 to the Prussian house of representatives. The heir-presumptive of the Prussian crown bears the title of governor of Pomerania.

History.—In prehistoric times the southern coast of the Baltic seems to have been occupied by Celts, who afterwards made way for tribes of Teutonic stock. These in their turn migrated to other settlements and were replaced, about the beginning of the 6th century of our era, by Slavonians. The name of Pomore or Pommern, meaning "on the sea," was attached to the district by the last of these immigrant races, and has often changed its political and geographical significance. Originally it seems to have denoted the coast district between the Oder and the Vistula, a territory which was at first more or less dependent on Poland, but which appears towards the end of the 12th century as divided between two native dukes owning the supremacy of the German emperor. Afterwards Pomerania spread much farther to the west, while correspondingly curtailed on the east, and a distinction was made between Slavinia, or modern Pomerania, and Pomerellen. The latter, corresponding substantially to the present province of West Prussia, remained subject to Poland down to the beginning of the 14th century, when part of it fell away to the Teutonic knights and part of it was annexed to the duchy of Pomerania-Wolgast. Christianity was introduced in the 12th century, and its advance went hand in hand with the Germanizing of the district. The later mediæval history of Pomerania is occupied with an endless succession of subdivisions among different lines of the ducal houses, and with numerous expansions and contractions of territory through constant hostilities with the elector of Brandenburg, who claimed to be the immediate feudal superior of Pomerania, and with other neighboring powers. The names Vorpommern and Hinterpommern were at first synonymous with Slavinia and Pomerellen, but towards the close of the 14th century they were transferred to the two duchies into which the former (Pomerania proper) was divided. In 1625 the whole of Pomerania became united under the sway of Bogeslaus XIV., and, on his death without issue in 1637, Brandenburg laid claim to the duchy in virtue of a compact of 1571. The Swedes, however, had in the meantime occupied the country, and at the peace of Westphalia (1648) the elector had to content himself with East Pomerania and see the other half awarded to Sweden. In 1720 Swedish Pomerania was curtailed by extensive concessions to Prussia, but the district to the west of the Peene remained in possession of Sweden down to the dissolution of the German empire. On the downfall of Napoleon, Sweden assigned her German possessions to Denmark in exchange for Norway, whereupon Prussia, partly by purchase and partly by the cession of Lauenburg, finally succeeded in uniting the whole of Pomerania under her sway.

POMEROY, a city of the United States, in Meigs county, Ohio, lies on the right bank of the Ohio about half-way between Pittsburgh and Cincinnati. It is the terminus of the Ohio River division of the Columbus, Hocking Valley, and Toledo Railway, and has extensive coal mines dating from 1833, salt works (14,000,000 bushels per annum), and bromine factories. Incorporated as a village in 1841 and as a city in 1868, Pomeroy had 5824 inhabitants in 1870 and 5560 in 1880.

POMFRET, John (1667–1703), holds a certain place in English letters as the author of a short poem, *The Choice*, which embodies in easy and happy Drydenic diction the refined Epicureanism of the 18th century, and was consequently widely popular throughout that century. Pomfret was an English clergyman, rector of Maulden in Bedfordshire, son of the vicar of Luton in the same county. The story is preserved by Johnson that the bishop of London stopped him in some church preferment because in his *Choice* he declared that he would have no wife, although he expressed a wish for the occasional company of a modest and sprightly young lady. The poet was married in real life all the same, and, while waiting in London to clear up a misunderstanding caused by the paganism of his poetry—the bishop apparently thinking that he had openly preferred a mistress to a wife—he caught small-pox and died at the age of thirty-five. Of his poetry Johnson happily says, "He pleases many; and he who pleases many must have some species of merit."

POMONA, the old Roman goddess of tree-fruits (*poma*). Ovid (*Met.*, xiv. 623 *sq.*) tells how she was loved by the sylvan deities, the satyrs, pans, etc., and how Vertumnus, god of the turning year, wooed and won the shy goddess. Corresponding to Pomona there seems to have been a male Italian deity called Puemunus, who was perhaps identical with Vertumnus. At Rome Pomona had a special priest, the flamen Pomonalis, who ranked lowest among the fifteen flamens. About 12 miles from Rome on the way to Ostia there was a Pomonal, or place (perhaps grove) sacred to Pomona. She was also worshipped in the neighborhood of Amiternum.

POMPADOUR, Jeanne Antoinette Poisson le Normant d'Étioles, Marquise de (1721–1764), the most famous of all the mistresses of Louis XV., was born in Paris on 29th December, 1721, and was baptized as the legitimate daughter of François Poisson, an officer in the household of the duke of Orleans, and his wife Madeleine de la Motte, in the church of St. Eustache, but she was suspected, as well as her brother, afterwards Marquis of Marigny, to be the child of a very wealthy financier, and farmer-general of the revenues, Le Normant de Tournehem. He at any rate took upon himself the charge of her education; and, as from the beauty and wit she showed from childhood she seemed to be born for some uncommon destiny, he declared her "un morceau de roi," and specially educated her to be a king's mistress. This idea was confirmed in her childish mind by the prophecy of an old woman, whom in after days she pensioned for the correctness of her prediction. In 1741 she was married to a nephew of her protector and guardian, Le Normant de Étioles, who was passionately in love with her, and soon became a queen of fashion. Yet the world of the financiers at Paris was far apart from the court world, where she wished to reign; she could get no introduction at court, and could only try to catch the king's eye when he went out hunting. But Louis XV. was then under the influence of Madame de Mailly, who carefully prevented any further intimacy with "la petite Étioles," and it was not until after her death that the king met the fair queen of the financial world of Paris at a ball given by the city to the dauphin in 1744, and he was immediately subjugated. She at once gave up her husband, and in 1745 was established at Versailles as "maîtresse en titre." Louis XV. bought her the estate of Pompadour, from which she took her title of marquise. She was hardly established firmly in power before she showed that ambition rather than love had guided her, and began to mix in politics. Knowing that the French people of that time were ruled by the literary kings of the time, she paid court to them, and tried to play the part of a Mæcenas. Voltaire was her poet in chief, and the founder of the physiocrats, Quesnay, was her physician. In the arts she was even more successful; she was herself no mean etcher and engraver, and she encouraged and protected Vanloo, Boucher, Vien, Greuze, and the engraver Jacques Guay. Yet this policy did not prevent her from being lampooned, and the famous Poissardes against her contributed to the ruin of many wits suspected of being among the authors, and notably of the Comte de Maurepas. The command of the political situation passed entirely into her hands; she it was who brought Belle-Isle into office with his vigorous policy; she corresponded regularly with the generals of the armies in the field, as her recently published letters to the Comte de Clermont prove; and she introduced the Abbé de Bernis into the ministry in order to effect a very great alteration of French politics in 1756. The continuous policy of France since the days of Richelieu had been to weaken the house of Austria by alliances in Germany; but Madame de Pompadour changed this hereditary policy because Frederick the Great wrote scandalous verses on her; and because Maria Theresa wrote her a friendly letter she entered into an alliance with Austria. This alliance brought on the Seven Years' War with all its disasters, the battle of Rosbach and the loss of Canada; but Madame de Pompadour persisted in her policy, and when Bernis failed her, brought Choiseul into office, and supported him in all his great plans, the Pacte de Famille, the suppression of the Jesuits, and the peace of Versailles. But it was to internal politics that this remarkable woman paid most attention; no one obtained office except through her; in imitation of Madame de Maintenon she prepared all business for the king's eye with the ministers, and contrived that they should meet in her room; and she daily examined the letters sent through the post office with Janelle, the director of the post office. By this continuous labor she made herself indispensable to Louis. Yet, when she had lost the heart of her lover after a year or two, she had a difficult task before her; to maintain her influence she had not only to save the king as much trouble as possible, but to find him fresh pleasures. When he first began to weary of her, she remembered her talent for acting and her private theatricals at Étioles, and established the "théâtre des petits cabinets," in which she acted with the greatest lords about the court for the king's pleasure in tragedies and comedies, operas and ballets. By this means and the "concerts spirituels" she kept in favor for a time; but at last she found a surer way, by encouraging the king in his debaucheries, and Louis wept over her kindness to his various mistresses. Only once, when the king was wounded by Damiens in 1757, did she receive a serious shock, and momentarily left the court; but on his recovery she returned more powerful than ever. She even ingratiated herself with the queen, after the example of Madame de Maintenon.

and was made a lady-in-waiting; but the end was soon to come. "Ma vie est un combat," she said, and so it was, with business and pleasure; she gradually grew weaker and weaker, and when told that death was at hand she dressed herself in full court costume, and met it bravely on 15th April, 1764, at the age of forty-two.

See Capefigue, *Madame la Marquise de Pompadour*, 1858; E. and J. de Goncourt, *Les Maîtresses de Louis XV.*, vol. ii., 1860: and Campardon, *Madame de Pompadour et la Cour de Louis XV. au milieu du dix-huitième siècle*, 1867. Far more valuable are Malassis's two recently published volumes of correspondence, *Correspondance de Madame de Pompadour avec son père M. Poisson, et son frère M. de Vandières, etc.*; 1878, and Bonhomme, *Madame de Pompadour, général d'armée*, 1880, containing her letters to the Comte de Clermont. For her artistic and theatrical tastes see particularly J. F. Leturcq, *Notice sur Jacques Guay, Graveur sur pierres fines du Roi Louis XV.; Documents inédits émanant de Guay et notes sur les œuvres de gravure en taille douce et en pierres durs de la Marquise de Pompadour*, 1873; and Adolphe Julien, *Histoire du Théâtre de Madame de Pompadour, dit Théâtre des Petits Cabinets*, 1874.

POMPEII, an ancient town of Campania, situated on the shore of the Bay of Naples, almost immediately at the foot of Mount Vesuvius. To its proximity to that volcano it owes its celebrity—the peculiar circumstances of its destruction by the great volcanic outburst of Vesuvius in 79 A.D., and of its rediscovery in modern times, having converted that which would otherwise have been known only as an obscure country town into a place of world-wide fame, as one of the most interesting relics preserved to us from antiquity. Of its previous history comparatively little is recorded, but it appears that, like most other towns in the beautiful region in which it was situated, it had a population of a very mixed character, and it passed successively into the hands of several different nations, each of which probably contributed an additional element to its composition. Though its foundation was ascribed by Greek tradition to Heracles, in common with the neighboring city of Herculaneum, no value can be attached to these mythological or etymological fables; it is certain that it was not a Greek colony, in the proper sense of the term, as we know to have been the case with the more important cities of Cumæ and Neapolis. Strabo, in whose time it was a populous and flourishing place, tells us that it was first occupied by the Oscans, afterwards by the Tyrrhenians (*i.e.*, Etruscans) and Pelasgians, and lastly, by the Samnites. The conquest of Campania by the last-mentioned people is an undoubted historical fact, and there can be no doubt that Pompeii shared the fate of the neighboring cities on this occasion, and afterwards passed in common with them under the yoke of Rome. But its name is only once mentioned during the wars of the Romans with the Samnites and Campanians in this region of Italy, and then only incidentally (Liv., ix. 38). At a later period, however, it took a prominent part in the outbreak of the nations of central Italy known as the Social War (91–89 B.C.), when it withstood a long siege by Sulla, and was one of the last cities of Campania that was reduced by the Roman arms. After that event the inhabitants were admitted to the Roman franchise, but a military colony was settled in their territory by the dictator Sulla, and there can be no doubt that the whole population became rapidly Romanized. Before the close of the republic it became a favorite resort of the leading nobles of Rome, many of whom acquired villas in the neighborhood. Among the most prominent of these was Cicero, whose letters abound with allusions to his Pompeian villa, which was one of his favorite places of occasional residence. The same fashion continued under the Roman empire, and there can be no doubt that during the first century after the Christian era, Pompeii, without rising above the rank of an ordinary provincial town, had become a flourishing place with a considerable population, for which it was indebted in part to its position at the mouth of the river Sarnus, which rendered it the port of the neighboring towns in the interior. But two events only are recorded of its history during this period. In 59 A.D. a tumult took place in the amphitheatre of Pompeii between the citizens of the place and the visitors from the neighboring colony of Nuceria, which led to a violent affray, in which many persons were killed and wounded on both sides. The Pompeians were punished for this violent outbreak by the prohibition of all gladiatorial and theatrical exhibitions for ten years (Tacitus, *Ann.*, xiv. 17). A characteristic, though rude, painting, found on the walls of one of the houses, gives a representation of this untoward event.

Only four years afterwards (63 A.D.) a much more serious disaster befell the city. An earthquake, which affected all the neighboring towns, vented its force especially upon Pompeii, a large part of which, including most of the public buildings, was either destroyed or so seriously damaged as to require to be rebuilt rather than repaired (Tacit., *Ann.*, xv. 21; Seneca, *Q. N.*, vi. 1). The actual amount of the injuries sustained, which is intimated in general terms by Tacitus and Seneca, is more accurately known to us from the existing remains. For the inhabitants were still actively engaged in repairing and restoring the ruined edifices when the whole city was overwhelmed by a much more appalling catastrophe. In 79 A.D. the neighboring mountain of Vesuvius, the volcanic forces of which had been slumbering for unknown ages, suddenly burst into a violent eruption, which, while it carried devastation all around the beautiful gulf, buried the two cities of Herculaneum and Pompeii under dense beds of cinders and ashes. It is singular that, while we possess a detailed description of this famous eruption in two well-known letters of the younger Pliny (*Epist.* vi. 16, 20), he does not even notice the destruction of Pompeii or Herculaneum, though his uncle perished in the immediate neighborhood of the former city. But their unhappy fate is noticed by Dion Cassius, and its circumstances may be gathered with certainty from the condition in which it has been found. These were such as eminently to conduce to its preservation and interest as a relic of antiquity. Pompeii was not, like Herculaneum, buried in a solid mass of volcanic tuff, but merely covered with a bed of lighter substances, cinders, small stones, and ashes, thrown out by the volcano, and falling from above on the devoted city. It is clearly established that the whole of this superincumbent mass, though attaining to an average thickness of from 18 to 20 feet, was the product of one eruption—though the materials may be divided generally into two distinct strata, the one consisting principally of cinders and small volcanic stones (called in Italian "lapilli"), and the other and uppermost layer of fine white ash, often consolidated by the action of water from above, so as to take the moulds of objects contained in it like clay or plaster of Paris.

So completely was the unfortunate city buried under this overwhelming mass that its very site was forgotten, and even the celebrated topographer Cluverius in the 17th century was unable to fix it with certainty. This difficulty arose in part from the physical changes consequent on the eruption, and it was not till 1748 that an accidental discovery drew attention to its remains, and revealed the fact that beneath the vineyards and mulberry grounds which covered the site there lay entombed the ruins of a city, far more accessible, if not more interesting, than those (previously discovered) of the neighboring Herculaneum. It was not till 1755 that systematic excavations on the site were begun, and, though they were thenceforth carried on more or less continuously during the whole of that century, it was not till the beginning of the present century that they assumed a regular character; and the work, which had received a vigorous stimulus during the period of the French government (1806–1814), was prosecuted, though in a less methodical and systematic manner, under the succeeding rule of the Bourbon kings (1815–61). Of late years the process has been carried on, under the enlightened direction of Signior Fiorelli, in a much more careful and scientific manner than before, and the results have been in many respects of the highest interest. At the same time the invention of photography has enabled the directors to preserve a far more satisfactory record of every step in the explorations than could previously be attempted.

It would be impossible for us to present our readers in this place with anything like an idea of the results of these excavations. Interesting as are the numerous works of art that have been brought to light, and important as is their bearing upon the history of some branches of ancient art, they cannot compare in interest with the flood of light which this marvellous discovery has thrown upon ancient life in all its details, enabling us to picture to ourselves the ways and manners and habits of life of a cultivated and flourishing population eighteen centuries ago, in a manner which no amount of study of ancient literature could possibly accomplish. We must confine ourselves in the present article chiefly to those points which bear more immediately on the topography and character of the town of Pompeii, referring our readers for other details to the numerous works in which they have been described and delineated.

The town was situated on a rising ground of small elevation, separated by a distance of less than a mile from the foot of the actual rise of the outer cone of Vesuvius. This eminence is itself undoubtedly due to an outflow of lava from that mountain, during some previous eruption in prehistoric times, for we know from Strabo that Vesuvius, though presenting in his time all the appearances of an extinct volcano, had been quiescent ever since the first records of the Greek settlements in this part of Italy. But the position of Pompeii in ancient times differed materially from that which it occupies at the present day. It was situated close to the sea-shore, from which it is now more than a mile distant, and adjoining the mouth of the river Sarnus or Sarno, which now enters the sea nearly two miles from its site, but the present course of this stream is due in part to modern alteration of its channel, as well as to the effects of the great eruption. It is certain, however, that in Strabo's time Pompeii owed much of its prosperity to its serving as the port of the adjoining plain, and the neighboring towns of Nuceria, Nola, and Acerræ (Strabo, v. c. 4, § 8).

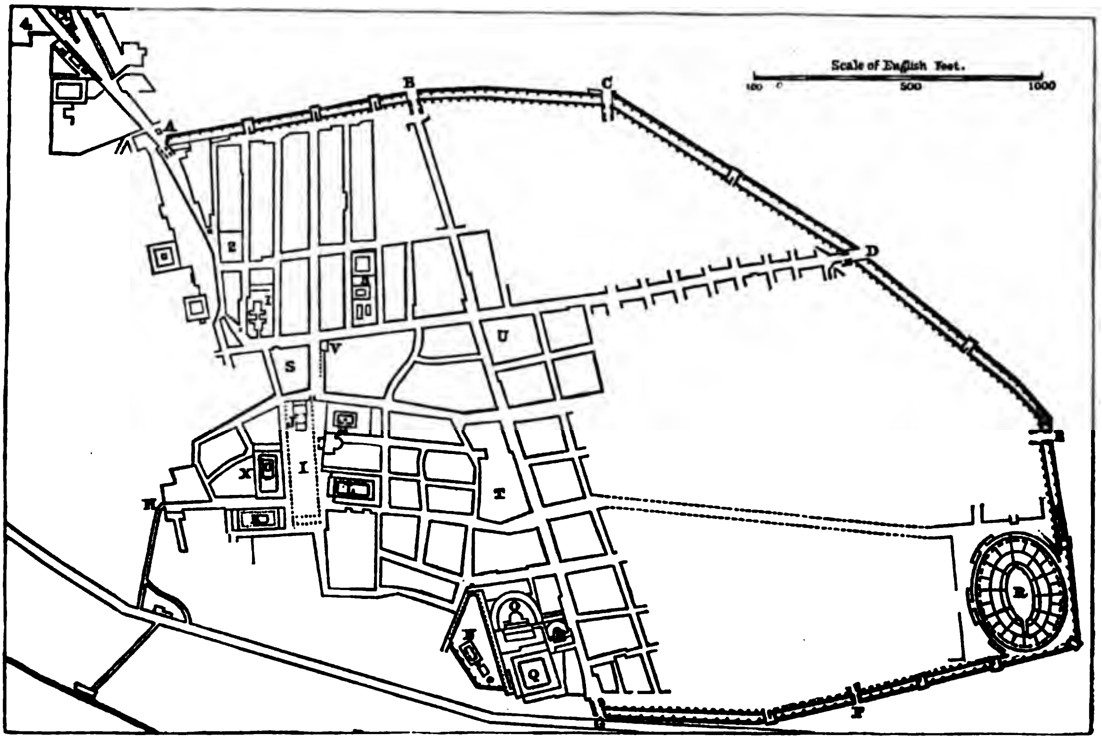
The area occupied by the ancient city was of an irregular oval form, and about two miles in circumference. It was surrounded by a wall, which is still preserved around more than two-thirds of its extent, but no traces of this are found on the side towards the sea, and there is no doubt that on this side it had been already demolished in ancient times, so as to give room for the free extension of houses and other buildings in that direction. These walls are strengthened at intervals by numerous towers, which occur in some parts at a distance of only about 100 yards, but in general much less frequently. They are, however, of a different style of construction from the walls, and appear to have been added at a later period, probably that of the settlement of the Roman colony by Sulla. Similar evidences of the addition of subsequent defences are to be traced also in the case of the gates, of which no less than eight are found in the existing circuit of the walls. Some of these present a very elaborate system of defence, but it is evident from the decayed condition of others, as well as of parts of the walls and towers, that they had ceased to be maintained for the purposes of fortification long before the destruction of the city. The gates are now known by names given them in modern times from the direction in which they led, as, the gate of Herculaneum, of Stabiæ, of Nola, etc. No trace has been found of their ancient appellations.

The general plan of the town is very regular, the streets being generally straight, and crossing one another at right angles or nearly so. But an exception is found in the street leading from the gate of Herculaneum to the forum, which, though it must have been one of the principal thoroughfares in the city, was crooked and irregular, as well as very narrow, in some parts not exceeding 12 to 14 feet in width, including the raised *trottoirs* or footpaths on each side, which occupy a considerable part of the space, so that the carriage-way could only have admitted of the passage of one vehicle at a time. The other streets are in some cases broader, but rarely exceed 20 feet in width, and the broadest yet found is less than 30, while the back streets running parallel to the main lines are only about 15 feet. They are uniformly paved with large polygonal blocks of hard basaltic lava, fitted very closely together, though now in many cases marked with deep ruts from the passage of vehicles in ancient times. They are also in all cases bordered by raised trottoirs on both sides, paved in a similar manner; and for the convenience of foot passengers, these are connected from place to place by stepping-stones raised above the level of the carriage-way. Such an arrangement must have presented a considerable obstacle to the passage of vehicles; and altogether it is evident that the streets of Pompeii, like those of most Roman towns, were calculated much more for foot passengers than for any extensive traffic of wheeled carriages. In other respects they must have been far from presenting the lively aspect of the streets of modern and even mediæval towns, and must rather have resembled those of Oriental cities,—the living apartments all opening towards the interior, and showing only blank walls towards the street; while the windows were generally to be found only in the upper story, and were in all cases small and insignificant, without any attempt at architectural effect. In some instances indeed the monotony of their external appearance was broken by small shops, occupying the front of the principal houses, as it were let in to the main building; these were in some cases numerous enough to form a continuous *façade* to the street. This is seen especially in the case of the Street of Herculaneum, and that of Stabiæ, both of which were among the principal and most frequented thoroughfares.

The former of these main lines of street, which, as already described, led from the gate of Herculaneum to the forum, was crossed, a little before it reached that important centre, by a long straight line of street, which led directly to the gate of Nola. Two other parallel lines of street struck off from the forum itself towards the east, and these have been followed as far as the points where they cross nearly at right angles another main line of street, which leads direct from the gate of Vesuvius to that of Stabiæ, near the theatres, thus traversing the city in its whole width from north to south. Almost the whole portion of the city which lies to the west of this last line, towards the forum and the sea, has been more or less completely excavated; but the greater part of that on the other side of it remains still unexplored, with the exception of the amphitheatre, and a small space in its immediate neighborhood. Altogether it may be calculated that about two-fifths of the whole extent has been already excavated. But there can be little doubt that the portion already known is the most important, as it includes the forum, with the temples and the public buildings adjacent to it, the thermæ, theatres, amphitheatre, etc.

The forum was unquestionably at Pompeii, as at Rome itself, and in all other Italian cities, the focus and centre of all the life and movement of the city, and was at once the resort of the lounger and the gathering place of men of business. Hence it was surrounded on all sides by public buildings or edifices of a commanding character. It was not, however, of large size, as compared to the open spaces in modern towns, being only 160 yards in length by 35 in breadth. Nor was it a centre of traffic in the modern sense of the word, being only accessible to any description of wheeled carriages at one angle, and the nature of its pavement, composed of broad flags of travertine, excluding the idea of its being intended for their passage. It was surrounded on three sides by a portico, or rather by a series of porticos, some supported on arcades, others in the Grecian manner on columns; and these porticos were originally surmounted by a gallery or upper story, traces of the staircases leading to which still remain, though the gallery itself has altogether disappeared. It is, however, certain from the existing remains that both this portico and the adjacent buildings had suffered severely from the earthquake of 63, and that they were undergoing a process of restoration, involving material changes in the original arrangements, which was still incomplete at the time of their final destruction.

The north end of the forum, where alone the portico is wanting, is occupied in great part by a building, the most imposing in the whole city, which is now generally known, on grounds that may be considered satisfactory, as the temple of Jupiter. It was raised on a *podium* or base of considerable elevation, and had a portico with six Corinthian columns in front, which, according to Sir W. Gell, are nearly as large as those in the portico of St. Paul's. This magnificient edifice had, however, been evidently overthrown by the earthquake of 63, and is in its present condition a mere ruin. On each side of it were two arches, affording an entrance into the forum, but capable of being closed by iron gates. The principal of these, at the northeast angle of the forum, was the approach by which that open space was entered in coming from the gate of Herculaneum; the passage, however, was barred to wheeled carriages by a descent of three small steps. On the east side of the forum were four edifices, all of them unquestionably of a public character, but of which the names and attribution have been the subject of much controversy. The first (proceeding from the north) is generally known, though without doubt erroneously, as the Pantheon, or temple of the Twelve Gods; but it is very doubtful whether it is a temple at all, and the latest authorities are disposed to regard it as a macellum or meat-market, though the situation would seem to be unhappily chosen for such a purpose. Next to this comes a building generally regarded as the curia or senaculum—the meeting-place of the local senate, or town council. Beyond this comes another temple of small dimensions commonly called the temple of Mercury, but supposed also, on very slight grounds, to have been dedicated to Augustus; and beyond this again, bounded on the south by a street known as the Street of the Silversmiths, is a large and spacious edifice, which, as we learn from an extant inscription, was erected by a priestess named Eumachia. Notwithstanding this, its purpose and character are open to considerable doubt; but it resembles a basilica in its form and disposition, and was probably designed for similar purposes. The name of Chalcidicum, by which it is commonly known, is an erroneous inference from the inscription just referred to. The south end of the forum is occupied by three small buildings of very similar form and arrangement, which are supposed to have served as courts of law, though their destination is a matter of much uncertainty; while the greater part of the west side is occupied by two large buildings,—a basilica, which is the largest edifice in Pompeii, and a temple, which presents its side to the forum, and hence fills up a large portion of the surrounding space. The former, as we learn from an inscription on its walls, was anterior in date to the consulship of M. Lepidus and Q. Catulus (78 B.C.), and therefore belongs to the



Plan of Pompeii.

A. Gate of Herculaneum.
B. Gate of Vesuvius.
C. Gate of Capua.
D. Gate of Nola.
E. Gate of Sarno.
F. Gate of Nocera.
G. Gate of Stabiæ.
H. Gate of the Seashore.
I. Forum.
J. Temple of Jupiter.
K. Basilica.
L. Building of Eumachia ("Chalcidicum").
M. "Pantheon."
N. Temple of Hercules.
O. Great Theatre.
P. Smaller Theatre.
Q. Gladiators' Barracks.
R. Amphitheatre.
S, T, U. Public Baths.
V. Temple (Fortuna Augusta).
X. Temple of Venus.
1. House of Pansa.
2. House of Sallust.
3. House of the Faun.
4. Villa of Arrius Diomedes.

Oscan period of the city, before the introduction of the Roman colony. The temple was an extensive edifice, having a comparatively small *cella*, raised upon a *podium*, and standing in the midst of a wide space surrounded by a portico of columns, outside which again is a wall, bounding the sacred enclosure. It is commonly called the temple of Venus, but without any evidence; the most recent authorities regard it, on somewhat better grounds, as dedicated to Apollo. Between this temple and the basilica a street of unusual width leads off direct to the gate which opens towards the sea, and is still preserved, though the walls on this side of the city have ceased to exist.

Besides the temples which surrounded the forum, the remains of four others have been discovered, three of which are situated in the immediate neighborhood of the theatres. Of these by far the most interesting, though the least perfect, is one which is commonly known as the temple of Hercules (an appellation wholly without foundation), and which is not only by far the most ancient edifice in Pompeii, but presents us with all the characters of a true Greek temple, resembling in its proportions that of Neptune at Pæstum, and probably of as remote antiquity. Unfortunately only the basement and a few capitals and other architectural fragments remain, and, though these suffice to enable us to restore its plan and design, of course its effect as a monument is wholly lost. The period of its destruction is unknown, for it appears certain that it cannot be ascribed wholly to the earthquake of 63. On the other hand the reverence attached to it in the later periods of the city is evidenced by its being left standing in the midst of a triangular space adjoining the great theatre, which is surrounded by a portico, so as to constitute a kind of forum, though scarcely deserving that appellation. In the immediate neighborhood of the preceding, and close to the great theatre, stood a small temple, which, as we learn with certainty from the inscription still remaining, was dedicated to Isis, and was restored, or rather rebuilt, by a certain Popidius Celsinus, after the original edifice had been reduced to ruin by the great earthquake of 63. Though of small size, and by no means remarkable in point of architecture, it is interesting as the only remaining temple dedicated to the Egyptian goddess, whose worship became so popular under the Roman empire. There is nothing peculiar in the arrangements of the building itself, but a small edifice within the sacred enclosure, to which nothing similar was found in any other instance, was doubtless in some way connected with the peculiar rites of the mysterious deity. Close to this temple was another, of very small size, and of little interest, commonly known as the temple of Æsculapius, but by others supposed to have been dedicated to Jupiter and Juno. No real foundation exists for either attribution. More considerable and important was a temple which stood at no great distance from the forum, at the point where the street leading thither from the gate of Herculaneum was crossed by the wide line of thoroughfare leading to the gate of Nola. We learn from an inscription that this was dedicated to the Fortune of Augustus (Fortuna Augusta), and was erected, wholly at his own cost, by a citizen of the name of M. Tullius, unfortunately no connection of the orator. This temple appears to have suffered very severely from the earthquake, and at present affords little evidence of its original architectural ornament; but we learn from existing remains that its walls were covered with slabs of marble, and that the columns of the portico were of the same valuable material.

All the temples above described, except that ascribed to Hercules, agree in being raised on an elevated *podium* or basement,—an arrangement usual with all similar buildings of Roman date. Neither their materials nor the style of their architecture exceeds what might reasonably be expected in a second-rate provincial town; and the same may be said in general of the other public buildings. Among these the most conspicuous are the theatres, of which there were two, placed, as was usual in Greek towns, in close juxtaposition with one another. The largest of these, which was partly excavated in the side of the hill, was a building of considerable magnificence, being in great part cased with marble, and furnished with seats of the same material, which have, however, been almost wholly removed. Its internal construction and arrangements resemble those of the Roman theatres in general, though with some peculiarities that show Greek influence, and we learn from an inscription that it was erected in Roman times by two members of the same family, M. Holconius Rufus and M. Holconius Celer, both of whom held important municipal offices at Pompeii during the reign of Augustus. It appears, however, from a careful examination of the remains that their work was only a reconstruction of a more ancient edifice, the foundations of which, and some other portions, may be distinctly traced. The smaller theatre, which was erected, as we learn from an inscription, by two magistrates specially appointed for the purpose by the decurions of the city, was of older date than the large one, and appears to have been constructed about the same time as the amphitheatre, soon after the establishment of the Roman colony under Sulla. From the same source we learn that it was permanently covered—a rare thing with Roman theatres; but in the case of the larger theatre also the arrangements for the occasional extension of an awning (*velarium*) over the whole are distinctly found. The smaller theatre is computed to have been capable of containing fifteen hundred spectators, while the larger could accommodate five thousand persons.

Adjoining the theatres is a large rectangular enclosure, surrounded by a portico, the purpose of which has been the subject of considerable controversy, but it is now generally admitted to have been the quarters or barracks of the gladiators, who were permanently maintained in the city with a view to the shows in the amphitheatre. It is singular that it should have been at so considerable a distance from that building, which is situated at the southeastern angle of the town, above 500 yards from the theatres. The amphitheatre was erected by the same two magistrates who built the smaller theatre, at a period when no permanent edifice of a similar kind had yet been erected in Rome itself. But apart from its early date it has no special interest, and is wholly wanting in the external architectural decorations that give such grandeur of character to similar edifices in other instances. Being in great part excavated in the surface of the hill, instead of the seats being raised on arches, it is wanting also in the picturesque arched corridors which contribute so much to the effect of those other ruins. Nor are its dimensions (430 feet by 335) such as to place it in the first rank even of provincial structures of this class, though it may still strike a visitor of the present day as surprisingly large for a town of the population of Pompeii. But, as we learn from the case of their squabble with the people of Nuceria, the games celebrated in the amphitheatre on grand occasions would be visited by large numbers from the neighboring towns.

Adjoining the amphitheatre was found a large open space, nearly square in form, which has been supposed to be a forum boarium or cattle market, but, no buildings of interest being discovered around it, the excavation was filled up again, and this part of the city has not been since examined.

Among the more important public buildings of Pompeii were the thermæ, or public baths, an institution that always held a prominent position in every Roman or Græco-Roman town. Three different establishments of this character have been discovered, of which the first, excavated in 1824, was for a long time the only one known. Though the smallest of the three, it is in some respects the most complete and interesting; and it was until of late years the principal source from which we derived our knowledge of this important branch of the economy of Roman life. The vast series of edifices known by the name of thermæ at Rome, as well as those in other provincial towns, are in such a state of ruin as to throw little light upon the details of their arrangements. At Pompeii on the contrary the baths are so well preserved as to show at a glance the purpose of all the different parts—while they are among the most richly decorated of all the buildings in the city. We trace without difficulty all the separate apartments that are described to us by Roman authors, the *apodyterium*, *frigidarium*, *tepidarium*, *caldarium*, etc., together with the apparatus for supplying both water and heat, the places for depositing the bather's clothes, and other minor details which were for the first time revealed to us by the discovery of these interesting buildings. It is obviously impossible for us in this place to enter into a detailed description of these arrangements, for which we must refer our readers to the professed treatises on Roman antiquities, as well as to the larger works on Pompeii (see also BATHS, vol. iii. p. 376). The greater thermæ, which were not discovered till 1857, nor fully excavated till 1860, so that they are not described in the earlier works on the subject, are on a much more extensive scale than the others, and combine with the special purposes of the building a palæstra and other apartments for exercise or recreation. The arrangements of the baths themselves are, however, almost similar to those of the lesser thermæ. In this case an inscription records the repair and restoration of the edifice after the earthquake of 63, but the period of its original construction is unknown. It appears, however, that these two establishments were found inadequate to supply the wants of the inhabitants, and a third edifice of the same character, but on a still more extensive scale, was in course of construction when the town was overwhelmed. The remains of this, which were first discovered and excavated in 1877, are, however, of comparatively little interest from the incomplete state in which the buildings were left.

Great as is the interest attached to the various public buildings of Pompeii, and valuable as is the light that they have in some instances thrown upon similar edifices in other ruined cities, far more curious and interesting is the insight afforded us by the numerous private houses and shops into the ordinary life and habits of the population of an ancient town. In this respect Pompeii stands alone, among all antiquarian discoveries,—the difficulties of exploration at Herculaneum having greatly checked all further investigations on that equally promising site. But here again it is impossible in an article like the present to do more than briefly advert to the general results of the excavations (compare ARCHITECTURE, vol. ii. p. 368–369 and Pl. XVII.). The houses at Pompeii are generally low, rarely exceeding two stories in height, and it appears certain that the upper story was generally of a slight construction, and occupied by small rooms, serving as garrets, or sleeping places for slaves, and perhaps for the females of the family. From the mode of destruction of the city these upper floors were in most cases crushed in and destroyed, and hence it was long believed that the houses for the most part had but one story; but recent researches have in many cases brought to light incontestable evidence of the existence of an upper floor, and the frequent occurrence of a small staircase is in itself sufficient proof of the fact. The windows, as already mentioned, were generally small and insignificant, and contributed nothing to the external decoration or effect of the houses. In some cases they were undoubtedly closed with glass, but its use appears to have been by no means general. The principal living rooms, as well as those intended for the reception of guests or clients, were all on the ground floor, the centre being formed by the *atrium*, or hall, which was almost always open above to the air, and in the larger houses was generally surrounded with columns. Into this opened other rooms, the entrances to which seem to have been rarely protected by doors, and could only have been closed by curtains. All the apartments and arrangements described by Vitruvius and other ancient writers may be readily traced in the houses of Pompeii, and in many instances these have for the first time enabled us to understand the technical terms and details transmitted to us by Latin authors. We must not, however, hastily assume that the examples thus preserved to us by a singular accident are to be taken as representing the style of building in all the Roman and Italian towns. We know from Cicero that Capua was remarkable for its broad streets and wide-spread buildings, and it is probable that the Campanian towns in general partook of the same character. At Pompeii indeed the streets were not wide, but they were straight and regular, and the houses of the better class occupied considerable spaces, presenting in this respect no doubt a striking contrast, not only with those of Rome itself, but with those of many other Italian towns, where the buildings would necessarily be huddled together from the circumstances of their position. Even at Pompeii itself, on the west side of the city, where the ground slopes somewhat steeply towards the sea, houses are found which consisted of three stories or more.

The excavations systematically conducted for many years past have presented us with examples of houses of every description, from the humble dwelling-place of the artisan or proletarian, with only three or four small rooms, to the stately mansions of Sallust and Pansa,[1]—the last of which is the most regular as well as the most extensive of all, and may be taken as an almost perfect model of a complete Roman house of a superior class. But the general similarity in their plan and arrangement is very striking, and in all those that rise above a very humble class the leading divisions of the interior, the *atrium*, *tablinum*, *peristyle*, etc., may be traced with unfailing regularity. Another peculiarity that is found in all the more considerable houses in Pompeii is that of the front, where it faces one of the principal streets, being occupied with shops, usually of small size, and without any communication with the interior of the mansion. In a few instances indeed such a communication is found, but in these cases it is probable that the shop was used for the sale of articles grown upon the estate of the proprietor, such as wine, fruit, oil, etc., a practice that is still common in Italy. In general the shop had a very small apartment behind it, and probably in most cases a sleeping chamber above it, though of this the only remaining evidence is usually a portion of the staircase that led to this upper room. The front of the shop was open to the street, but was capable of being closed with wooden shutters, the remains of which have in a few instances been preserved. Of course it is only in a few cases that the particular purpose of the shop or trade of its owner can be determined, though, from the exceptional manner of their preservation, this can be done more frequently than might be expected. Thus not only have the shops of silversmiths been recognized by the precious objects of that metal found in them, but large quantities of fruits of various kinds preserved in glass vessels, various descriptions of corn and pulse, loaves of bread, moulds for pastry, fishing-nets, and many other objects, too numerous to mention, have been found in such a condition as to be identified without difficulty. Cooks' shops appear to have been numerous, as well as *thermopolia*, where hot drinks were sold. Bakers' shops are also frequent, though arrangements for grinding and baking appear to have formed part of every large family establishment. In other cases, however, these were on a larger scale, provided with numerous querns or hand-mills of the well-known form, evidently intended for public supply. Another establishment on a large scale was a *fullonica* or fuller's shop, where all the details of the business were illustrated by paintings still visible on the walls. A dyer's shop, a tannery, and a shop where colors were ground and manufactured—an important business where almost all the rooms of every house were painted—are of special interest, as is also the house of a surgeon, where numerous surgical instruments were found, some of them of a very ingenious and elaborate description, but all made of bronze. Another curious discovery was that of the abode of a sculptor, containing his tools, as well as blocks of marble and half-finished statues. The number of utensils of various kinds found in the houses and shops is almost endless, and, as these are in most cases of bronze, they are generally in perfect preservation.

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[1] It may be observed that the names given in most cases to the houses are either arbitrary, or founded in the first instance upon erroneous inferences. Hence they are frequently changed, and great confusion arises in consequence in comparing the different works on the subject. A few only of the best known may be considered as established by long usage, among which are the two here referred to.

Of the numerous works of art discovered in the course of the excavations the statues and large works of sculpture, whether in marble or bronze, are inferior to those found at Herculaneum, but some of the bronze statuettes are of exquisite workmanship, while the profusion of ornamental works and objects in bronze and the elegance of their design, as well as the finished beauty of their execution, are such as to excite the utmost admiration,—more especially when it is considered that these are the casual results of the examination of a second-rate provincial town. The same impression is produced in a still higher degree by the paintings with which the walls of the private houses, as well as those of the temples and other public buildings, are adorned, and which are not merely of a decorative character, but in many instances present us with elaborate compositions of figures, historical and mythological scenes, as well as representations of the ordinary life and manners of the people, which are full of interest to us, though often of inferior artistic execution. An illustration of the character of the Pompeian wall-paintings is given in the article MURAL DECORATION, vol. xvii. p. 48, Fig. 8. Our knowledge of ancient painting is indeed derived to a much greater extent from Pompeii than from all other sources whatever; and when we contemplate the variety and beauty of what we find here entombed, we cannot but ask ourselves what would have been the result had a great and opulent city like Capua or Neapolis been preserved to us in the same manner as the comparatively insignificant Pompeii. The same character of elaborate decoration, guided almost uniformly by good taste and artistic feeling, is displayed in the mosaic pavements, which in all but the humbler class of houses frequently form the ornament of their floors. One of these, well known as the battle of Alexander, presents us with the most striking specimen of artistic composition that has been preserved to us from antiquity (see MOSAIC, vol. xvi. p. 878, where part of this composition is shown in Fig. 2).

The architecture of Pompeii must be regarded as presenting in general a transitional character from the pure Greek style to that of the Roman empire. The temples (as already observed) have always the Roman peculiarity of being raised on a *podium* of considerable elevation; and the same characteristic is found in most of the other public buildings. All the three orders of Greek architecture—the Doric, Ionic, and Corinthian—are found freely employed in the various edifices of the city, but rarely in strict accordance with the rules of art in their proportions and details; while the private houses naturally exhibit still more deviation and irregularity. In many of these indeed we find varieties in the ornamentation, and even in such leading features as the capitals of the columns, which remind one rather of the vagaries of mediæval architecture than of the strict rules of Vitruvius or the monotonous regularity of Greek edifices. One practice which is especially prevalent, so as to strike every casual visitor, is that of filling up the flutings of the columns for about one-third of their height with a thick coat of stucco, so as to give them the appearance of being smooth columns without flutings below, and only fluted above. The unpleasing effect of this anomalous arrangement is greatly aggravated by the lower part of each column being almost always colored with red or yellow ochre, so as to render the contrast between the two portions still stronger. The architecture of Pompeii suffers also from the inferior quality of the materials generally employed. No good building-stone was at hand; and the public as well as private edifices were constructed either of volcanic tuff, or brick, or the irregular masonry known to the Romans as *opus incertum*. Those which belong to the earlier or Oscan period of the city (before the establishment of the Roman colony) are for the most part of the former material, while those erected under the Roman empire, and especially those subsequent to the great earthquake of 63, are generally of slighter construction, and of a less durable character. In the private houses even the columns are mostly of brick, covered merely with a coat of stucco. In a few instances only do we find them making use of a kind of travertine, found in the valley of the Sarno, which, though inferior to the similar material so largely employed at Rome, was better adapted than the ordinary tuff for purposes where great solidity was required. The portion of the portico surrounding the forum which was in the process of rebuilding at the time when the city was destroyed was constructed of this material, while the earlier portions, as well as the principal temples that adjoined it, were composed in the ordinary manner of volcanic tuff. Marble appears to have been scarce, and was sparingly employed. In some instances where it had been freely introduced, as in the great theatre, it would seem that the slabs must have been removed at a period subsequent to the entombment of the city.

Outside the gate leading to Herculaneum is found a house of a different character from all the others, which from its extent and arrangements was undoubtedly a suburban villa, belonging to a person of considerable fortune. It is called—as usual without any authority—the villa of Arrius Diomedes; but its remains are of peculiar interest to us, not only for comparison with the numerous ruins of similar buildings which occur elsewhere,—often of greater extent, but in a much less perfect state of preservation,—but as assisting us in understanding the description of ancient authors, such as Vitruvius and Pliny, of the numerous appurtenances frequently annexed to houses of this description. The remains of a still more extensive suburban house which were discovered in 1764, and to which the name was given, without the slightest foundation, of the villa of Cicero, are no longer visible, having been covered up again with earth (as was frequently done in the last century) after the works of art had been removed.

In the vaulted corridors of the first villa were discovered no less than seventeen skeletons of the unfortunate inhabitants, who had evidently fled thither for protection. Almost all the skeletons and remains of bodies found in the city were discovered in similar situations, in cellars or underground apartments,—those who had sought refuge in flight having apparently for the most part escaped from destruction, or having perished under circumstances where their bodies were easily recovered by the survivors. According to Dion Cassius, a large number of the inhabitants were assembled in the theatre at the time of the catastrophe, but no bodies have been found there, and they were probably sought for and removed shortly afterwards. Hence the whole number of such remains discovered is not so large as might at first be supposed. It cannot indeed be accurately estimated, the records of the excavations in the last century having been very imperfectly kept; but the total number as yet discovered can scarcely exceed three hundred. Of late years it has been found possible in many cases to take casts of the bodies found—a complete mould having been formed around them by the fine white ashes, partially consolidated by water.

The road leading from the gate of Herculaneum towards that city is bordered on both sides for a considerable extent by rows of tombs, as was the case with all the great roads leading into Rome, and indeed in all large Roman towns. Without of course approximating to the stately structures that adorned the Via Appia or Latina, these tombs are in many instances monuments of considerable pretension, and of a highly ornamental character, and naturally present in the highest degree the peculiar advantage common to all that remains of Pompeii, in their perfect preservation. Hardly any scene even in this extraordinary city is more striking than the *coup d'œil* of this long street of tombs, preserving uninjured the records of successive generations eighteen centuries ago. Unfortunately the names are all otherwise unknown; but we learn from the inscriptions that they are for the most part those of local magistrates and municipal dignitaries of Pompeii.

There appears to have been in the same quarter a considerable suburb, outside the gate, extending on each side of the road towards Herculaneum, apparently much resembling those which are now found throughout almost the whole distance from thence to Naples. It appears to have been known by the name of Pagus Augustus Felix.

No manuscripts have been discovered in Pompeii. Inscriptions have naturally been found in considerable numbers, and we are indebted to them for much information concerning the municipal arrangements of the town, as well as the construction of various edifices and other public works. The most interesting of these are such as are written in the Oscan dialect, which appears to have continued in official use down to the time when the Roman colony was introduced by Sulla. From that time the Latin language was certainly the only one officially employed, though Oscan may have still been spoken by a portion at least of the population. Still more curious, and almost peculiar to Pompeii, are the numerous writings scratched or rudely painted upon the walls, which have in some instances a semi-public character, such as recommendations of candidates for municipal offices, but more frequently are the mere expression of individual impulse and feeling, not uncommonly conveyed in rude and imperfect verses. In one house also a whole box was found filled with written tablets—diptychs and triptychs—containing the record of the accounts of a banker named L. Cæcilius Jucundus.

The inscriptions of a more formal character have been published by Mommsen, first in his *Inscriptiones Regni Neapolitani Latinæ* (fol., Leipsic, 1852) and again in the tenth volume of the great *Corpus Inscriptionum Latinarum*, published at Berlin (1883). The fourth volume of the same work published in 1871 contains all the scratched and written inscriptions discovered up to that date, edited by Zangemeister (under the title *Inscriptiones Parietariæ Pompeianæ, Herculanenses, et Stabianæ*); but the number has been since greatly increased, and a supplementary volume is in the press. The Oscan inscriptions, which are not comprised in the above collections, have been published by Fiorelli.

Most of the movable objects from Pompeii are now in the Museo Borbonico at Naples (see vol. xvii. p. 196).

Of the numerous works devoted to the antiquities and description of Pompeii generally it must suffice to mention a few. The earlier works, especially that of Mazois (*Les Ruines de Pompeii*, with its continuation by Gau, 4 vols. fol., Paris, 1812-38), and the two well-known works of Sir W. Gell (*Pompeiana*, 1st series, 2 vols. 8vo, London, 1824, 2d series, 1830), are still valuable for reference, though necessarily very imperfect. The popular treatise published by the Society for Useful Knowledge (*Pompeii*, 2 vols. 8vo, London, 1831) gives a good account of what had been then discovered, and the light thrown by it on ancient manners and customs. The more recent works of Breton (*Pompeia*, 8vo, Paris, 1855) and of Mr. Dyer (*Pompeii: its History, Buildings, and Antiquities*, 8vo, London, 1867) bring down the record to a later period; and the successive editions of Overbeck's *Pompeii* (first published in 1856) have been kept continually on a par with the progress of discovery and research. The last edition of this valuable treatise (1884) is much the most complete and useful compendium of the whole subject that has yet appeared, and will supply all the wants of the ordinary reader. More special students will find there detailed references to the official records of the later discoveries that have been made under the direction of Signor Fiorelli, and to the numerous dissertations to which they have given rise. The great illustrated works of Zahn (Berlin, 1827-29) and Presuhn (fol., Leipsic, 1882) will furnish more elaborate representations of the decorative works with which almost all the buildings are adorned, while the student of ancient art may have recourse to the less ambitious collection of the ancient paintings by Helbig (*Wandgemälde der von Vesuv verschütteten Städte Campaniens*, Leipsic, 1868), with a supplementary volume published by Sogliano at Naples. A complete catalogue of all the works concerning Pompeii and Herculaneum will be found in a little book published at Milan in 1879 under the title of *Bibliotheca Pompeiana*. Unfortunately all works are rendered imperfect within a few years by the continued progress of the explorations and discoveries on the site.

(E. H. B.)

POMPEY is the common English form of the Roman name Pompeius.

I. Cneius Pompeius Magnus (106–48 B.C.), the great triumvir, whose name we always associate with Cæsar and Crassus, may be said to have led a soldier's life from his boyhood to his death. Born in 106 B.C., he fought by his father's side when a stripling of seventeen in the social or Italian War on the side of Sulla against the party of Marius and Cinna. Thus early in life he connected himself with the cause of the aristocracy, and a decisive victory which he won in 83 over the Marian armies gained for him from Sulla the title of "imperator." He followed up his successes in Italy by defeating the Marians in Sicily and Africa, and on his return to Rome in 81, though he was still merely an "eques" and not legally qualified to celebrate a triumph, he was allowed by general consent to enjoy this great distinction, while Sulla greeted him with the surname of Magnus, a title he always retained and handed down to his sons. Yet in 79 he used his influence in getting elected to the consulship a man politically opposed to Sulla, Æmilius Lepidus, who threatened Rome with another revolution and civil war in the interest of the democratic party. Pompey, however, at this crisis was loyal to his friends, and with the defeat of Lepidus the danger passed away. With some fears and misgivings the senate permitted him to retain the command of his victorious army, and decided on sending him to Spain, where, under a leader of singular ability, Sertorius, the Marian party was still formidable. Pompey was fighting in Spain from 76 to 71, and though at first he met with serious reverses he was ultimately successful, his great opponent, Sertorius, having, it would seem, lost the confidence of some of the native Spanish tribes. In 71 he was again in Italy at the head of his army, and won fresh glory by giving a finishing blow to the slave insurrection of Spartacus. That same year, amid great popular enthusiasm, but without the hearty concurrence of the senate, whom he had alarmed by talking of restoring the dreaded power of the tribunes, and though still merely an "eques," he was elected with Crassus to the consulship, and entered Rome in triumph for his Spanish victories. The following year saw the work of Sulla undone; the tribuneship was restored, and the administration of justice was no longer left exclusively to the senate, but was to be shared by them with the wealthier portion of the middle class, the "knights," as from old time they had been called, and the farmers and collectors of the revenue. The change was really necessary, as the provincials could never get justice from a court composed of senators, and it was carried into effect by Pompey with Cæsar's aid. Pompey as a matter of course rose still higher in popularity, and on the motion of the tribune Gabinius in 67 he was entrusted with an extraordinary command over the greater part of the empire, specially for the extermination of piracy in the Mediterranean, by which the corn supplies of Rome were seriously endangered, while high prices of provisions caused great distress. It soon appeared that the right man had been chosen for the work: the price of corn fell immediately on Pompey's appointment, and in forty days the Mediterranean was swept from end to end and the pirates cleared out of its waters. Next year, on the proposal of the tribune Manilius, he had a yet further extension of his powers, the whole of Rome's empire in the East being put under his control for three years with the view of finally terminating the war with Mithradates, king of Pontus, who had recovered from the defeats he had sustained from Lucullus, and regained his dominions. Both Cæsar and Cicero supported the tribune's proposal, which was easily carried in spite of the interested opposition of the senate and the aristocracy, several of whom held provinces which would now be practically under Pompey's command. Pompey was now by far the first man in the Roman world. His operations in the East were thoroughly successful, and, though no doubt he owed something to the victories of Lucullus, he showed himself an able soldier. The wild tribes of the Caucasus were cowed by the Roman arms, and the king of Pontus himself fled from Asia across the Black Sea to Panticapæum, the modern Kertch. In the years 64 and 63 Syria and Palestine were annexed to Rome's empire. After the capture of Jerusalem Pompey is said to have entered the temple, and even the Holy of Holies. Asia and the East generally were left under the subjection of petty kings who were mere vassals of Rome. Several cities had been founded which became centres of Greek life and civilization. A really great work had been accomplished, and Pompey, now in his forty-fifth year, returned to Italy in 61 to celebrate the most magnificent triumph which Rome had ever witnessed, and to be hailed as the conqueror of Spain, Africa, and Asia.

The remainder of Pompey's life is inextricably interwoven with that of Cæsar. He was married to Cæsar's daughter Julia, and as yet the relations between the two had been friendly. On more than one occasion Cæsar had supported Pompey's policy, which of late had been in a decidedly democratic direction. Pompey was now in fact ruler of the greater part of the empire, while Cæsar had only the two provinces of Gaul. The control of the capital, the supreme command of the army in Italy and of the Mediterranean fleet, the governorship of the two Spains, the superintendence of the corn supplies, which were mainly drawn from Sicily and Africa, and on which the vast population of Rome was wholly dependent, were entirely in the hands of Pompey. The senate and the aristocracy disliked and distrusted him, but they felt that, should things come to the worst, they might still find in him a champion of their cause. At the same time the senate itself was far from unanimous: among many of its members there was a feeling that a military imperialism had become a necessity, while to the rich and idle world generally peace and quiet at any price seemed the best of all blessings. Hence the joint rule of Pompey and Cæsar was not unwillingly accepted, and anything like a rupture between the two was greatly dreaded as the sure beginning of anarchy throughout the Roman world. With the death of Pompey's wife Julia, in 54, came strained relations between him and Cæsar, and soon afterwards he drew closer to what we may call the old conservative party in the senate and aristocracy. The end was now near, and Pompey blundered into a false political position and an open quarrel with Cæsar. In 50 the senate by a very large majority revoked the extraordinary powers conceded to Pompey and Cæsar in Spain and Gaul respectively. Pompey's refusal to submit gave Cæsar a good pretext for declaring war and marching at the head of his army into Italy. At the beginning of the contest, the advantages were decidedly on the side of Pompey, but very speedily the superior political tact of his rival, combined with extraordinary promptitude and decision in following up his blows, turned the scale against him. Pompey's cause, with that of the senate and aristocracy, was finally ruined by his defeat in 48 in the neighborhood of the Thessalian city Pharsalus. That same year he fled with the hope of finding a safe refuge in Egypt, but was treacherously murdered as he was stepping on the shore by one of his old centurions. He had just completed his fifty-eighth year.

Pompey, though he had some great and good qualities, hardly deserved his surname of "the Great." He was certainly a very good soldier, and is said to have excelled in all athletic exercises, but he fell short of being a first-rate general. He won great successes in Spain and more especially in the East, but for these he was no doubt partly indebted to what others had already done. Of the gifts which make a good statesman he had really none. As plainly appeared in the last years of his life, he was too weak and irresolute to choose a side and stand by it. Pitted against such a man as Cæsar, he could not but fail. But to his credit be it said that in a corrupt time he never used his opportunities for plunder and extortion, and his domestic life was pure and simple.

A very complete life of Pompey will be found in Smith's *Dict. of Greek and Roman Biography*. The allusions to him in Cicero's works are very frequent.

II. Sextus Pompeius Magnus (75–35 B.C.), the younger son of Pompey the Great, born 75 B.C., continued after his father's death to prolong the struggle against the new rulers of the Roman empire. Cæsar's victory at Munda in 45 drove him out of Corduba (Cordova), though for a time he held his ground in the south of Spain, and defeated Asinius Pollio, the governor of the province. In 43, the year of the triumvirate of Octavius, Antony, and Lepidus, he was proscribed along with the murderers of Cæsar, and not daring to show himself in Italy he put himself at the head of a fleet manned chiefly by slaves or proscribed persons, by means of which he made himself master of Sicily, and from thence ravaged the coasts of Italy. Rome was threatened with a famine, as the corn supplies from Egypt and Africa were cut off by his ships, and it was thought prudent to negotiate a peace with him, which was to leave him in possession of Sicily, Sardinia, and Achaia, provided he would allow Italy to be freely supplied with corn. But the arrangement could not be carried into effect, as Sextus renewed the war and gained some considerable successes at sea. However, in 36 his fleet was defeated and destroyed by Agrippa off the north coast of Sicily, and in the following year he was murdered at Mitylene by an officer of Antony. He had his father's bravery as a soldier, but seems to have been a rough uncultivated man. (W. J. B.)

PONCE DE LEON, Luis. See Leon, Luis Ponce de.

PONCELET, Jean Victor (1788–1867), mathematician, was born at Metz, July 1, 1788. From 1808 to 1810 he attended the Polytechnic School, and afterwards, till 1812, the Practical School at Metz. He then became lieutenant of engineers, and took part in the Russian campaign, during which he was taken prisoner and was confined at Saratoff on the Volga. It was during his imprisonment here that "privè de toute espèce de livres et de secours, surtout distrait par les malheurs de ma patrie et les miens propres," as he himself puts it, he began his researches on projective geometry which led to his great treatise on that subject. This work, the *Traitè des Propriétès Projectives des Figures*, which was published in 1822

(2d ed., 1865), is occupied with the investigation of the projective properties of figures, that is, such properties as are not altered by projection. In his investigation he employs the ideas of continuity, of homologous figures, and of reciprocal polars; and by means of these, without any analysis, he was able to establish all the known properties of lines and surfaces of the second degree, and to discover others unknown before. This work entitles Poncelet to rank as one of the greatest of those who took part in the development of the modern geometry of which Monge was the founder. From 1815 to 1825 he was occupied with military engineering at Metz; and from 1825 to 1835 he was professor of mechanics at the Practical School there. In 1826, in his *Mémoire sur les Roues Hydrauliques à Aubes Courbes*, he brought forward improvements in the construction of water-wheels, which more than doubled their efficiency. In 1834 he became a member of the Academy; from 1838 to 1848 he was professor to the faculty of sciences at Paris, and from 1848 to 1850 commandant of the Polytechnic School, where he effected a reform in the course of study. At the London International Exhibition in 1851 he had charge of the department of machinery, and wrote a report on the machinery and tools on view at that exhibition. He died December 22, 1867. Besides those referred to above, he wrote a number of works, and contributed many papers to *Crelle's Journal*, etc., on different branches of engineering and mathematics.

POND, John (*c.* 1767–1836), astronomer-royal, was born about 1767 in London, where his father made a fortune in trade. He entered Trinity College, Cambridge, at the age of sixteen, but took no degree, his course being interrupted by severe pulmonary attacks which compelled a prolonged residence abroad. His travels extended from Lisbon to Constantinople and the Nile, and were turned to account for astronomical observation. In 1800 he settled at Westbury near Bristol, and began to determine star-places with a fine altitude and azimuth circle of 2½ feet diameter by Troughton. His demonstration in 1806 (*Phil. Trans.*, xcvi. 420) of a change of form in the Greenwich mural quadrant led to the introduction of astronomical circles at the Royal Observatory, and to his own appointment as its head. Elected a fellow of the Royal Society, February 26, 1807, he married and went to live in London in the same year, and in 1811 succeeded Maskelyne as astronomer-royal.

During an administration of nearly twenty-five years, Pond effected a reform of practical astronomy in England comparable to that effected by Bessel in Germany. In 1821 he began to employ the method of observation by reflection; and in 1825 he devised means (see *Mem. R. A. Soc.*, ii. 499) of combining two mural circles in the determination of the place of a single object, the one serving for direct and the other for reflected vision. (By an invention of Airy's, the same object is now attained with one instrument.) During Pond's term of office the instrumental equipment at Greenwich was completely changed, and the number of assistants increased from one to six. The superior accuracy of his determinations was due in part to his systematic attention to the errors of his instruments, in part to his plan of multiplying observations. During a prolonged controversy (1810–24), he consistently denied the reality of Brinkley's imaginary star-parallaxes (see his papers in *Phil. Trans.*, cviii. 477; cxiii. 53). Delicacy of health impeded his activity, and compelled his retirement in the autumn of 1835. He died at Blackheath, September 7, 1836, and was buried beside Halley in the churchyard of Lee. The Copley medal was conferred upon him in 1823, and the Lalande prize in 1817 by the Paris Academy, of which he was a corresponding member. He published eight folio volumes of *Greenwich Observations*, translated Laplace's *Système du Monde* (in 2 vols. 8vo., 1809), and contributed thirty-one papers to scientific collections. His catalogue of 1112 stars (1833) was of great value.

See *Mem. R. A. Soc.*, x. 357; *Annual Biography and Obituary*, 1837; Grant, *Hist. of Phys. Astr.*, p. 491; Royal Society's *Cat. of Sc. Papers*.

PONDICHERRI, chief settlement of the French possessions in the East Indies, situated on the Coromandel coast, in 11° 56′ N. lat. and 79° 53′ E. long.; it is 86 miles south of Madras, and is connected with the South Indian Railway system. The territory consists of three districts—Pondicherri, Villianur, and Bahur—comprising an area of 112 square miles, with a population in 1881 of 139,210. The town is divided into a European and a native quarter, separated from one another by a canal. The French first settled at Pondicherri in 1674; it was besieged four times by the British, the last time in 1793; but it was finally restored in 1816. On the whole the town is considered very salubrious; the purity of its water-supply is said to be unrivalled in any other town in southern India.

PONEVYEZH, a district town of Russia, in the government of Kovno, situated on the upper course of the Nevyeja river, and connected by rail with Libau on the northwest and with Dünaburg (80 miles distant) on the east. It is an old town which was almost totally destroyed by the pestilence of 1550, but was rebuilt and repeopled owing to its advantageous situation on the highway to the Baltic. After having suffered severely from wars in the 17th and 18th centuries it was annexed to Russia on the third dismemberment of Poland, but had neither manufacturing nor commercial importance until it was brought into railway connection with Libau, with which seaport it now carries on some trade in agricultural produce. Its population (8070 in 1865) had in 1881 reached 15,030, of whom nearly one-half were Jews.

PONIATOWSKI, a family of Poland, the earliest member of which to acquire high distinction was Stanislaus Ciolek (1677–1762), regarding whose descent there are conflicting accounts,—some tracing it to the Lombard Counts Torelli, one of whom in the seventeenth century married a daughter of Albert of Poniatow, and added the name of Poniatowski to his own, which he changed to its equivalent in Polish, Ciolek, while others affirm that the name Poniatowski was adopted by one of two brothers from an estate which fell to his share, while it is also asserted that Stanislaus Ciolek was the natural son of Prince Sapieha, and was adopted by a Polish nobleman named Poniatowski (see Szymanowski, *Die Poniatowski*, Geneva, 1880). In any case he had sufficient influence and ability to insure his rapid promotion in the army of Charles XII., and as major-general at the battle of Poltava in 1709 was able by his self-command in facilitating the passage of the Dnieper to save the retreating army. In 1711 he was sent on a special embassy to Constantinople, when he succeeded in obtaining from the sultan a promise to send an army to aid Charles in the war with Russia; but on account of a change in the office of grand vizier the promise was never carried out. All possibility of undertaking a Russian invasion being therefore at an end, he was appointed by Charles governor of the duchy of Zweibrücken. After the death of Charles, he gave his adhesion to Augustus II., by whom he was in 1724 made grand treasurer of Lithuania, and in 1731 palatine of Mazovia. On the death of Augustus II. he sought to effect the promotion of Stanislaus Leszczynski to the throne, but ultimately he gave in his submission to Augustus III., and after holding under him several high offices was in 1752 appointed castellan of Cracow. He was the author of *Remarques d'un Seigneur Polonais sur l'Histoire de Charles XII. par Voltaire*, 1741, which was translated into English in the same year. He died in 1762, leaving by his marriage with Constance Princess Czartoryski four sons, the best known of whom was the second, Stanislaus Augustus (1732–1798), king of Poland, born 17th January, 1732. Sent by Augustus III. to the court of Russia, he won the favor of the grand duchess Catherine, who succeeded to the throne by the assassination of her husband, 9th July, 1762. Through her influence he was, 7th September, 1764, chosen king of Poland. For an account of his despicable and disastrous rule see POLAND (pp. 309–10). After signing his abdication, 25th November, 1795, he took up his residence at St. Petersburg, where he enjoyed a pension of 200,000 ducats paid jointly by Austria, Russia, and Prussia. He died unmarried, 12th February, 1798 (see *Mèmoires Secrets inèdits de Stanislas II. Auguste*, Leipsic, 1867, and De Mouy, *Correspondance inédite de Roi Stanislas-Auguste et de Madame Geoffrin*, Paris, 1875). Of the other sons of Stanislaus Poniatowski, Casimir (1721–1800), the eldest, was grand chamberlain of Poland and commander of the royal guard; Andrew (1735–1773) became an Austrian field marshal; and Michael (1736–1794) was ultimately promoted primate of Poland. JOSEPH ANTON (1762–1813), prince and marshal of France, son of Andrew Poniatowski was born at Warsaw, 7th May, 1762. At the age of sixteen he entered the service of Austria. After the resolution of the diet to reorganize the Polish army he was recalled and obtained the rank of major-general. On the outbreak of hostilities with Russia in 1792 he was made commander of the army defending central Poland. When the king his uncle acceded to the confederation of Targovitza he resigned his commission, but on the outbreak of the insurrection in 1794 he enrolled himself as a volunteer under Kosciuszko, although Kosciuszko had previously held inferior military rank to his own. In command of a division he had charge of the defence of the northern side of Warsaw, and after its capitulation he went to Vienna. In 1798 he returned to Warsaw, having obtained from the Prussians a portion of his confiscated estates. On the arrival of Napoleon at Warsaw, 19th December, 1806, Poniatowski accepted his invitation to become general of a national Polish army, which fired by the hope of national independence, gathered to the number of 27,000, to assist Napoleon in his Russian campaign. After the peace of Tilsit, 7th July, 1807, the duchy of Warsaw was created, and Poniatowski became minister of war. On the invasion of the duchy in 1809 he fought a desperate battle near the village of Raszyn, and, being permitted afterwards to retreat across the Vistula, invaded Galicia and compelled the Russians to evacuate Cracow. In Napoleon's campaigns he held the command of the Polish army corps, distinguishing himself at Smolensk, Borodino, and Leipsic, where he took 1,000 prisoners, and in token of his brilliant exploit was created by Napoleon a marshal of France the same evening. He was employed in covering the retreat from Leipsic, and while charging a column of Prussian infantry was wounded by a ball in the shoulder. When the enemy obtained possession of the suburbs he endeavored to join the main army by plunging into the Elster, but was fired upon and, enfeebled by wounds, was drowned, 19th October, 1813. JOSEPH (1816–1873), grandson of Casimir mentioned above, was born 4th February, 1816, at Rome. Entering the Tuscan service, he went in 1849 as minister of Tuscany to London. In 1850 he took up his residence in Paris, and becoming a naturalized citizen was in 1854 chosen a member of the French senate. In 1870 he removed to London, where he supported himself by teaching music. He was the composer of several operas. He died 3d July, 1873.

PONS, JEAN LOUIS (1761–1831), French astronomer, born at Peyre (Haut-Dauphiné), 24th December, 1761, received a place at the Marseilles observatory in 1789, and in 1819 became the director of the new observatory at Marlia near Lucca, which he left in 1825 for the observatory of the museum at Florence. Here he died October 14, 1831. Pons was famous as a comet-hunter, discovering between 1801 and 1827 thirty-seven of these bodies, one of which (discovered 26th November, 1818) is the famous comet named after Encke, who determined its orbit.

PONSARD, FRANÇOIS (1814–1867), French dramatist, was born at Vienne in Dauphiné on the 1st June, 1814. He was bred a lawyer, and his first performance in literature was a translation of *Manfred* (1837). But the first important, and indeed the most important, event of his life was the representation of his play *Lucrèce* at the Théâtre Français on the 1st April, 1843. This date is a kind of epoch in literary and dramatic history, because it has been supposed to mark a reaction against the romantic style of Dumas and Hugo. In reality, however, Ponsard was only a romantic of a somewhat tamer genius than those who had gone before him. It so happened that the tastes and capacities of the most popular actress of the day, Rachel, suited his style of drama, and this contributed greatly to his own popularity. He followed up *Lucrèce* with *Agnès de Méranie* (1846), *Charlotte Corday* (1850), and others. Ponsard accepted the empire, though with no very great enthusiasm, and received the post of librarian to the senate, which, however, he soon resigned, fighting a bloodless duel with a journalist on the subject. *L'Honneur et L'Argent*, one of his most successful plays, was acted in 1853, and he became an Academician in 1855. For some years he did little, but in 1866 he obtained great success with *Le Lion Amoureux*. He died a year later in Paris in July, 1867, soon after his nomination to the commandership of the Legion of Honer. His widow was pensioned. Ponsard is no doubt in some ways a remarkable dramatist. Unlike most men who have achieved considerable success on the stage, he did not overwrite himself, and most of his plays hold a certain steady level of literary and dramatic ability. But, as has been said, his popularity is in the main due to the fact that he found an actress ready to hand for his pieces, and that his appearance coincided with a certain public weariness of the grander but also more extravagant and unequal style of 1830.

PONTANUS, JOVIANUS (1426–1503), a famous Italian humanist and poet, was born in 1426 at Cerreto in the duchy of Spoleto, where his father was murdered in one of the frequent civil brawls which then disturbed the peace of Italian towns. His mother escaped with the boy to Perugia, and it was here that Pontano received his first instruction in languages and literature. Failing to recover his patrimony, he abandoned Umbria, and at the age of twenty-two established himself at Naples, which continued to be his chief place of residence during a long and prosperous career. He here began a close friendship with the distinguished scholar, Antonio Beccadelli, through whose influence he gained admission to the royal chancery of Alphonso the Magnanimous. Alphonso discerned the singular gifts of the young scholar, and made him tutor to his sons. Pontano's connection with the Aragonese dynasty as political adviser, military secretary, and chancellor was henceforth a close one; and the most doubtful passage in his diplomatic career is when he welcomed Charles VIII. of France upon the entry of that king into Naples in 1495, thus showing that he was too ready to abandon the princes upon whose generosity his fortunes had been raised. Pontano illustrates in a marked manner the position of power to which men of letters and learning had arrived in Italy. He entered Naples as a penniless scholar. He was almost immediately made the companion and trusted friend of its sovereign, loaded with honors, lodged in a fine house, enrolled among the nobles of the realm, enriched, and placed at the very height of social importance. Following the example of Pomponio Leto in Rome and of Cosimo de' Medici at Florence, Pontano founded an academy for the meetings of learned and distinguished men. This became the centre of fashion as well as of erudition in the southern capital, and subsisted long after its founder's death. In 1461 he married his first wife, Adriana Sassone, who bore him one son and three daughters before her death in 1491. Nothing distinguished Pontano more than the strength of his domestic feeling. He was passionately attached to his wife and children; and, while his friend Beccadelli signed the licentious verses of *Hermaphroditus*, his own Muse celebrated in liberal but loyal strains the pleasures of conjugal affection, the charm of infancy, and the sorrows of a husband and a father in the loss of those he loved. Not long after the death of his first wife Pontano took in second marriage a beautiful girl of Ferrara, who is only known to us under the name of Stella. Although he was at least sixty-five years of age at this period, his poetic faculty displayed itself with more than usual warmth and lustre in the glowing series of elegies, styled *Eridanus*, which he poured forth to commemorate the rapture of this union. Stella's one child, Lucilio, survived his birth but fifty days; nor did his mother long remain to comfort the scholar's old age. Pontano had already lost his only son by the first marriage; therefore his declining years were solitary. He died in 1503 at Naples, where a remarkable group of terra cotta figures, life-sized and painted, still adorns his tomb in the church of Monte Oliveto. He is there represented together with his patron Alphonso and his friend Sanazzaro in adoration before the dead Christ.

As a diplomatist and state official Pontano played a part of some importance in the affairs of southern Italy and in the Baron's War, the wars with Rome, and the expulsion and restoration of the Aragonese dynasty. But his chief claim upon the attention of posterity is as a scholar. His writings divide themselves into dissertations upon such topics as the "Liberality of Princes" or "Ferocity," composed in the rhetorical style of the day, and poems. He was distinguished for energy of Latin style, for vigorous intellectual powers, and for the faculty, rare among his contemporaries, of expressing the facts of modern life, the actualities of personal emotion, in language sufficiently classical yet always characteristic of the man. His prose treatises are more useful to students of manners than the similar lucubrations of Poggio. Yet it was principally as a Latin poet that he exhibited his full strength. An ambitious didactic composition in hexameters, entitled *Urania*, embodying the astronomical science of the age, and adorning this high theme with brilliant mythological episodes, won the admiration of Italy. It still remains a monument of fertile invention, exuberant facility, and energetic handling of material. Not less excellent is the didactic poem on orange trees, *De Hortis Hesperidum*. His most original compositions in verse, however, are elegiac and hendecasyllabic pieces on personal topics—the *De Conjugali Amore, Eridanus, Tumuli, Næniæ, Baiæ*, etc.—in which he uttered his vehemently passionate emotions with a warmth of southern coloring, an evident sincerity, and a truth of painting from reality which make the reader pardon an erotic freedom that is alien to our present taste. These lyrical compositions breathe the atmosphere of Naples, reproduce its scenery with wonderful brilliancy, and introduce us to the customs of its pleasure-loving pagan people. Yet, in spite of their excessive voluptuousness, we rise from their perusal convinced that their author was essentially a good man, a loving husband and father, and an attached friend.

Pontano's prose and poems were printed by the Aldi at Venice. For his life see Ardito, *Giovanni Pontano e i suoi Tempi*, Naples, 1871; for his place in the history of literature, Symonds, *Renaissance in Italy*. (J. A. S.)

PONTECORVO, a city of Italy in the province of Caserta, on the left bank of the Garigliano, with a population of 5172 in 1881 (commune 10,191), answers to the ancient Fregellæ, a Volscian city, colonized in 323 B.C. by the Romans, who thus occasioned the Second Samnite War. The principality of Pontecorvo (about 40 square miles in extent), which Napoleon bestowed on Bernadotte in 1806, was in 1810 incorporated with the French empire.

PONTEFRACT, or POMFRET, a market town and municipal and parliamentary borough in the West Riding of Yorkshire, England, finely situated on an eminence near the junction of the Calder and Aire, and on three railway lines, 13 miles southeast of Leeds, and 14 northwest of Doncaster. The streets are wide and regular, and there are many good houses and shops. A park over 300 acres in extent is used as a public recreation ground. The most important of the antiquarian remains are the ruins of the famous castle situated on a rocky height, originally covering with its precincts an area of over 8 acres, and containing in all eight round towers. The principal feature remaining is the keep. The castle is said to occupy the site of a fortress erected by Ailric, a Saxon thane. It was founded by Ilbert de Lacy shortly after the Conquest, and probably nearly completed by Ilbert de Lacy the Second, who died about 1141. From that time to its demolition in 1649 it was the great stronghold of South Yorkshire. It was the cradle of the dukes of Lancaster, and in it Richard II. was, after his deposition, "kept secretly" till his death. Many persons of rank and influence have been confined in it as political prisoners. During the wars of York and Lancaster it was a centre of intrigue and conspiracy. In 1536 it surrendered to Aske, the leader of the "pilgrimage of grace." At the beginning of the Civil War it was garrisoned for Charles, and it underwent four sieges, three of them by the Parliamentary forces, and one by the Royalists. After its capitulation to Lambert in March, 1649, it was dismantled. Below the castle is All Saints church, which suffered severely during the siege of the castle, but still retains some work of the 12th century. In 1837 the tower and transepts were fitted up for divine service. The church of St. Giles, formerly a chapel of ease to All Saints, but made parochial in the 18th century, is of Norman date, but most of the present structure is modern. The 17th-century spire was removed in 1707, and replaced by a square tower, which was rebuilt in 1797; the chancel was rebuilt in 1869. In Southgate is an ancient hermitage and oratory cut out of the solid rock, which dates from 1396. On St. Thomas's Hill, where Thomas, earl of Lancaster, was beheaded in 1322, a chantry was erected in 1373, the site of which is now occupied by a windmill built of its stones. At Monkhill there are the remains of a Tudor building called the Old Hall, probably constructed out of the old priory of St. John's. A grammar school of ancient foundation, renewed by Queen Elizabeth and by George III., is now in abeyance. The town-hall was built in 1796 on the site of one erected in 1656, which succeeded the old moot-hall, dating from Saxon times. Among other buildings are the court-house, the market-hall, the assembly rooms (a handsome building adjoining the town-hall), and the dispensary. The principal alms-house, that of St. Nicholas, dates from Saxon times. Trinity Hospital was founded in the 14th century by the celebrated Sir Robert Knolles. There are extensive gardens and nurseries in the neighborhood, and liquorice is largely grown for the manufacture of the celebrated Pomfret cakes. The town possesses iron foundries, sack and matting manufactories, tanneries, breweries, corn mills, and brick and terra-cotta works. The population of the municipal borough (extended in 1875) in 1871 was 6432, and in 1881 it was 8798, the population of the parliamentary borough (area 7316 acres) in the same years being 11,563 and 15,322. The increase is mainly due to the fact that Pontefract is now a military centre.

There are indications that the Romans were stationed near the present town, which adjoins the Ermine Street. In Domesday it is called Tateshale, and is said previously to have been held by the king (Edward the Confessor). It then possessed a church and priest, one fishery, and three mills. Subsequently it is mentioned as Kirkby. Of the cause of the change of the name to Pontefract various unsatisfactory explanations are given. According to one account it was because when William advanced to the conquest of the north his passage was delayed by a broken bridge (but this was at Ferrybridge, 3 miles off); according to a second the name was bestowed on it by its Norman possessor from Pontfrete in Normandy (which, however, never existed); and according to a third the name perpetuates the remarkable preservation from drowning of those who fell into the river when the concourse of people made the bridge give way on the arrival of St. William of Canterbury in 1153 (although all contemporary historians call the place Pontefract when Archbishop Thurstan died there in 1140). The town received a charter from Roger de Lacy in 1194, and was incorporated in the time of Richard III. As early as 1297 it returned two members to parliament; but there was a long discontinuance in the 14th, 15th, and 16th centuries. The practice was revived under James I. The "redistribution" measure of 1885 deprives it of one of its members. The municipal borough is divided into three wards, and is governed by six aldermen and eighteen councillors.

PONTEVEDRA, a maritime province of Spain, is bounded on the N. by Coruña, on the E. by Lugo and Orense, on the S. by Portugal (Entre Douro e Minho), and on the W. by the Atlantic, and has an area of 1739 square miles. The general character of the province is hilly, with a deeply indented coast; its products are those common to all GALICIA (*q.v.*), of which historical province it formed a part. The population in 1877 was 451,946, the municipalities with a population over 10,000 being La Estrada (23,528), Lalin (16,217), Lavadores (13,658), PONTEVEDRA (noticed below), Puentearéas (14,566), Redondela (10,073), Silleda (13,346), Tomiño (11,150), Tuy (11,710), and Vigo (13,416). Vigo is connected by rail with Tuy and Orense, and the line from Santiago to Vigo is open as far as to Carril.

PONTEVEDRA, capital of the above province, and an episcopal see, is a picturesque old granite-built town, pleasantly situated at the head of the Ria de Pontevedra, where the Lerez is spanned by the old Roman bridge (whence the name—*pons vetus*). The inhabitants engage in agriculture, sardine fishing, and the manufacture of cloth and hats. The population of the municipality in 1877 was 19,857.

PONTIANAK. See BORNEO.

PONTIFEX. The principal college of priests in ancient Rome consisted of the *pontifices*, the *rex sacrorum*, and the *flamines*, under the headship of the *pontifex maximus*. The *rex sacrorum* was the functionary who under the republic succeeded to the sacrificial duties which in old time had been performed by the king; the *flamines* were sacrificial priests of particular gods, the most important being the *flamen Dialis*, or priest of Jupiter, whose wife, the *flaminica Dialis*, was priestess of Juno. The *pontifices* on the other hand were not assigned to the service of particular gods, but performed general functions of the state religion; and their head, the *pontifex maximus*, was the highest religious authority in the state. For, while the *rex sacrorum* succeeded to the liturgical functions of the king, it was the *pontifex maximus* who inherited the substance of power in sacred things; the other members of the college were his counsellors and helpers, but no more. It is probable that there was no supreme pontifex under the kings, but that in accordance with the general rule that sacred officers went in threes, following the number of the old tribes, the king sat as sixth and chief among the five pontifices whom Numa is said to have instituted. The functions of *pontifex maximus* were indeed too weighty to be discharged by a subject in a monarchical government, and from Augustus to Gratian (382 A.D.) this supreme priesthood was held by the emperors in person. The original idea of the pontificate is as obscure as the name; it is by no means certain that *pontifex* means bridge-maker (as the commonest etymology has it) with reference to the duty of maintenance of the sacred Sublician bridge, for there were *pontifices* from of old in other parts of Italy. Marquardt conjectures that the name originally denoted atoning functions, from the same root as appears in *purus*, *pœna*. In historical times the *pontifices* had a very extended sphere of duties, and claimed to possess professional "knowledge of things human and divine." The supreme pontiff was in the religion of the state what the father was in the religion of the family. His dwelling was in the *regia* close to the altar of Vesta, the sacred hearth of the state; and the most sacred objects of national worship, the *penates publici* and the mysterious palladia of Roman sovereignty, were his special care. The flamens and vestal virgins were appointed by him and stood under his paternal power, and the stated service of their cults, as well as those exercises of public religion for which no special priests were provided, were under his charge or that of the college in which he presided. The pontiffs, moreover, supplied technical guidance and help in those religious functions in which the senate or magistrates had the first part; while the charge of the calendar with its complicated intercalation and system of feast days gave them an important influence on affairs of civil life. The control of the calendar is closely connected with the duties pertaining to the pontifical archives, which, besides a mass of ritual directions and the like, embraced the calendars of past years (including the *fasti consulares*) and the *annales maximi* or annual chronicle of public events. Further the pontiffs had the weighty function of declaring and interpreting the laws of religion, which involved such important social matters as marriage and testamentary dispositions; but this function was declaratory and not magisterial; the state gave no executive power to the pontiffs, save only that the *pontifex maximus* exercised disciplinary authority over those priestly persons who stood under his paternal power. The pontiffs, who held office for life, originally filled up the vacancies in their number by cooptation, but as early as 212 B.C. the head of their college was named by the voice of the people, and in 104 B.C. the choice of the members of the priestly colleges was also transferred to *comitia* of a peculiar constitution. The number of *pontifices* was gradually enlarged, first to nine, and then, under Sulla, to fifteen, and the emperors exercised the right of adding supernumeraries at will.

PONTINE MARSHES. See LATIUM, vol. xiv. p. 343.

PONTOISE, a commercial town of France, at the head of an arrondissement of the department Seine-et-Oise, 18 miles by rail northwest of Paris, picturesquely situated on the right bank of the Oise where it is joined by the Viosne, and at the intersection of the railway from Paris to Dieppe by Gisors with that of the valley of the Oise. The traffic on the main river is large, and the tributary drives numerous mills. Of the many convents and churches that used to exist in the town two only remain: St. Maclou, a church of the 12th century, was altered and restored in the 15th and 16th centuries by Pierre Lemercier, the famous architect of St. Eustache at Paris; and Notre Dame, of the close of the 16th century, contains the tomb of St. Gautier (13th century). Grain and flour are the principal staples of the trade of Pontoise; the population in 1881 was 6675.

Pontoise existed in the time of the Gauls as Briva Isaræ (*i.e.*, Bridge of the Oise). The Romans made it the seat of forges dedicated to Vulcan, and thus the district came to be distinguished as Pagus Vulcanius or the Vexin. Pontoise was destroyed by the Normans in the 9th century, united with Normandy in 1032, and acquired by Philip I. in 1064. Lying on the borders of the two states it often passed from one to the other. The English took it in 1419, and again in 1436. In 1441 Charles VII. took it by storm after a three months' siege. After belonging to the count of Charolais down to the treaty of Conflans, it was given as a dowry to Jeanne of France when she was divorced by Louis XII. The parlement of Paris several times met in the town; and in 1561 the states-general convoked at Orleans removed thither after the death of Francis II. During the Fronde it offered a refuge to Louis XIV. and Mazarin. Henry III. made it an apanage for his brother the duke of Anjou. At a later period it passed to the duke of Conti. Down to the Revolution it remained a monastic town. Philip the Bold, founder of the house of Burgundy, the architects Pierre and Jacques Lemercier, and Tronson-Ducoudray, one of the defenders of Marie Antoinette, are among the natives of Pontoise.

PONTOON. Pontoons are vessels employed to support the roadway of floating bridges. They may be either open or closed, heavy and only movable when floated, or light enough to be taken out of the water and transported overland, as when required to form part of the equipment of an army in the field.

From time immemorial floating bridges of vessels bearing a roadway of beams and planks have been employed to facilitate the passage of rivers and arms of the sea. Xerxes crossed the Hellespont on a double bridge, one line supported on three hundred and sixty, the other on three hundred and fourteen vessels, anchored head and stern with their keels in the direction of the current. Darius threw similar bridges across the Bosphorus and the Danube in his war against the Scythians, and the Greeks employed a bridge of boats to cross the river Tigris in their retreat from Persia. Floating bridges have been repeatedly constructed over rivers in Europe and Asia, not merely temporarily for the passage of an army, but permanently for the requirements of the country; and to this day many of the great rivers in India are crossed, on the lines of the principal roads, by floating bridges, which are for the most part supported on boats such as are employed for ordinary traffic on the river.

But light vessels which can be taken out of the water and lifted on to carriages are required for transport with an army in the field. Alexander the Great occasionally carried with his army vessels divided into portions, which were put together on reaching the banks of a river, as in crossing the Hydaspes; he is even said to have carried his army over the Oxus by means of rafts made of the hide tents of the soldiers stuffed with straw, when he found that all the river boats had been burnt. Cyrus crossed the Euphrates on stuffed skins. In the 4th century the emperor Julian crossed the Tigris, Euphrates, and other rivers by bridges of boats made of skins stretched over osier frames. In the 17th century the Germans employed timber frames covered with leather as pontoons, and the Dutch similar frames covered with tin; and the practice of carrying about skins to be inflated and employed for the passage of troops across a river, which was adopted by both Greeks and Romans, still exists in the East, and has been introduced into America in a modified form, india-rubber being substituted for skins.

Pontoons have been made of a variety of forms and of almost every conceivable description of material available for the purpose of combining the two essential qualities of transportability over land and power of support in water. As these qualities are not only distinct but conflicting, one of them has been frequently sacrificed to the other. Thus history records many instances of bridges having failed because incapable of supporting all the weight they were called on to bear, or of resisting the force of the current opposed to them; it also records instances of important strategical operations being frustrated because the bridge equipment could not be brought up in time to the spot where it was wanted. Numerous expedients for lightening the equipment have been suggested, in America more particularly; but the proposers have not always remembered that if a military bridge is intended to be carried *with* an army it is also intended to *carry* the army, with its columns of infantry and cavalry, its numerous wagons, and its ponderous artillery, and it ought to do so with certainty and safety, even though a demoralized rabble should rush upon it in throngs.

Pontoons have been made of two forms, open as an undecked boat, or closed as a decked canoe or cylinder. The advantage claimed for the closed pontoon is that it cannot be submerged by the river, but only by having to bear a greater load than its buoyancy admits of; the disadvantages are that it is difficult to make and keep water-tight, it requires special saddles for the support of the baulks which carry the roadway, and it cannot be conveniently used as a row-boat. During the Peninsular War the English employed open bateaus, as did and still do all the other European nations; but the experience gained in that war induced the English to abandon the open bateau; for if large it was very difficult to transport across country, and if small it was only suited for tranquil streams, being liable to fill and sink should the river rise suddenly or become disturbed by the wind. Thus closed pontoons came to be introduced into the British army. General Colleton devised the first substitute for the open bateau, a buoy pontoon, cylindrical with conical ends and made of wooden staves like a cask. Then General Pasley introduced demi-pontoons, like decked canoes with pointed bows and square sterns, a pair, attached sternwise, forming a single "pier" of support for the roadway; they were constructed of high timber frames covered with sheet copper and were decked with wood; each demi-pontoon was divided internally into separate compartments by partitions which were made as water-tight as possible, and also supplied with the means of pumping out water; when transported overland with an army, a pair of demi-pontoons and the superstructure of one bay formed the load for a single carriage weighing 3110 ℔ when loaded. The Pasley was superseded by the Blanshard pontoon, a tin-coated cylinder with hemispherical ends, for which great mobility was claimed, two pontoons and two bays' superstructure being carried on one wagon, giving a weight of about 5000 ℔, which was intended to be drawn by four horses. The Blanshard pontoon was long adopted for the British army, but it is now being discarded; experiments made with it in peace time showed that it would probably break down under the strain of actual warfare, and efforts were constantly made to improve on it; when immersed to a greater depth than the semidiameter it became very unstable and lively under a passing load, a defect which Serjeant-Major Forbes proposed to remedy by giving it a triangular instead of a circular section, thus increasing the stability by presenting a continually increasing area of bearing surface up to the level of total immersion; but the angles of these pontoons were found so liable to injury as to counterbalance any advantages over the cylinders. After many years' experience of the closed pontoon the English engineers came to the conclusion that it was desirable to return to the form of the open bateau to which the engineers of all the Continental armies had meanwhile constantly adhered. Captain Fowke[1], R. E., invented a folding open bateau, made of waterproof canvas attached to sliding ribs, so that for transport it can be collapsed like the bellows of an accordion and for use it can be extended by a pair of stretchers; it is very mobile, but it is also deficient in power of support, for whereas the buoyancy due to the outline form out of the water is 13,600 ℔ the actual buoyancy in the water is only 8640 ℔, because of the cavities in the canvas between the ribs which are formed by the pressure of the water outside; moreover, the surface irregularities cause the pressure exerted by a current upon a bridge formed of these collapsible pontoons to be about three times as much as upon one of equal power formed with Blanshard's or Pasley's pontoons; there is thus great risk of the bridge being carried away by a strong current.

The following table shows the powers of various pontoons at present or recently in use by different nations. The "working power of support" has been calculated in most instances by deducting from the "available buoyancy" one-fourth for open and one-tenth for closed vessels:

In the English and French equipment the pontoons were originally made of two sizes, the smaller and lighter for the "advanced guard," the larger and heavier for the "reserve"; in both equipments the same size pontoon is now adopted for general requirements, the superstructure being strengthened when necessary for very heavy weights. The Austrian and Italian pontoons are made in three pieces, two with bows and a middle piece without; not less than two pieces are ordinarily employed, and the third is introduced when great supporting power is required, but in all cases a constant interval is maintained between the pontoons. On the other hand in the Prussian, Russian, Dutch, and American and in the English Blanshard equipments greater sup-

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[1] [Francis (1823-65), architect of South Kensington Museum, and of other art and science institutions.—Am. Ed.]

The Powers of Various Pontoon Bridges.

Pontoon.	Length.	Displacement of Pontoon.	Actual Buoyancy of Pontoon.	Weight of Pontoon and One Bay of Superstructure.	Available Buoyancy.	Working Power of Support.	Central Interval in Bridge.	Power per Lineal Foot of Roadway.	Greatest Ordinary Load per Foot Lineal.	Width of Roadway.	Greatest Possible Load at 100 ℔ per Foot Superficial of Roadway.
	Ft.	Cub. Ft.	℔.	℔.	℔.	℔.	Ft.	℔.	℔.	Ft.	℔.
Gribeauval: open bateau, oak	36.3	593	45,044	8,044	37,000	27,750	22.8	1,215	840	15.6	35,568
Austrian: open, wooden, 1799	27.0	354	22,123	3,332	18,791	14,093	16.6	849	560	11.4	18,924
Aust.-Birago: open, wooden; two pieces	28.0	303	18,907	3,249	15,658	11,744	21.7	542	560	9.3	20,181
“ “ “ three “	39.4	445	27,791	3,884	23,907	17,930	21.7	827	560	9.3	20,181
“ “ iron; two pieces	28.0	353	22,090	3,698	18,392	13,794	21.7	636	560	9.3	20,181
“ “ “ three pieces	39.4	530	33,135	4,501	28,634	21,476	21.7	991	560	9.3	20,181
French: open, wooden; reserve	30.9	325	20,286	3,608	16,678	12,509	19.7	635	560	10.5	20,685
“ “ “ advanced guard	19.7	156	9,734	1,506	8,228	6,171	16.4	376	560	9.3	15,252
“ “ “ general	30.9	321	20,065	3,153	16,912	12,684	19.7	644	560	9.8	19,306
Prussian: open, wooden; open order	23.7	164	10,226	2,393	7,833	5,875	15.3	384	560	9.9	15,147
“ “ “ close “	23.7	164	10,226	2,213	8,013	6,010	11.2	535	560	9.9	11,088
“ “ iron; open order	24.7	214	13,385	2,209	11,176	8,382	15.3	561	560	9.9	15,147
“ “ “ close “	24.7	214	13,385	2,029	11,356	8,517	11.2	759	560	9.9	11,088
Italian: open, wooden; one piece	19.6	283	17,660	3,582	14,078	10,559	26.3	402	560	9.8	25,774
“ “ “ two pieces	39.2	565	35,320	4,572	30,748	23,061	26.3	878	560	9.8	25,774
“ modified; one piece	24.6	325	20,290	3,401	16,889	12,669	23.0	551	560	9.8	22,540
“ “ two pieces	49.2	649	40,580	4,489	36,091	27,068	23.0	1,178	560	9.8	22,540
Russian: open, canvas on wooden framework; open order	21.0	209	13,042	2,355	10,687	8,015	16.6	493	560	10.4	17,264
close order	21.0	209	13,042	2,083	10,959	8,219	11.7	705	560	10.4	12,168
Belgian: open, iron; one piece	24.8	297	18,584	3,336	15,248	11,436	19.7	580	560	9.5	18,715
“ “ “ two pieces	49.2	595	37,168	4,548	32,620	24,465	19.7	1,244	560	9.5	18,715
American: india-rubber, three cylinders connected; open order.	20.0	130	8,125	1,980	6,145	5,530	18.0	307	580	11.0	19.800
close order.	20.0	130	8,125	1,824	6,301	5,761	14.7	393	560	11.0	18,370
English Pontoons.											
Peninsular equipment: open, tin; reserve	18.9	209	13,092	2,374	10,718	8,039	16.8	477	560	10.0	16,800
“ “ advanced guard	15.1	120	7,520	1,654	5,866	4,400	14.0	314	560	9.0	12,600
Pasley: closed demi-canoe; copper	25.0	141	8,781	2,103	6,678	6,010	12.5	481	560	10.0	12,500
Blanshard: cylinder, tin; open order	22.5	109	6,785	1,600	5,185	4,667	12.5	373	560	10.0	12,500
“ “ “ close order	22.5	109	6,785	1,408	5,377	4,839	8.3	581	560	10.0	8,300
“ “ “ infantry pattern	15.5	26	1,640	340	1,300	1,170	5.3	220	280	7.0	3,710
Fowke: open, collapsible, canvas; open order	22.0	134	8,460	1,246	7,214	5,411	10.0	541	560	10.0	10,000
Forbes: closed, spherangular, tin; open order	24.2	128	7,977	1,689	6,288	5,659	11.0	514	560	10.0	11,000
Blood: open, wooden; general	21.6	280	17,500	2,300	15,200	13,350	15.0	890	560	10.0	15,000

porting power is obtained not by increasing the number of supports but by diminishing the central interval between the pontoons. Within certain limits it does not matter whether the buoyancy is made up of a large number of small or a small number of large vessels, so long as the water-way is not unduly contracted and the obstruction offered to a swift current dangerously increased; but it is to be remembered that pontoon bridges have failed as frequently from being washed away as from insufficient buoyancy.

On comparing the "available buoyancy" with the "greatest possible load at 100 ℔ per foot superficial of roadway" for each of the bridge equipments in the preceding table, it will be seen that very few of the bridges are really capable of carrying the maximum load they may be called on to bear. Strictly speaking the roadway superficies should in all instances be proportioned to the buoyancy of the pontoon, or, as the central interval between the pontoons cannot be reduced below certain limits, the width of the roadway should be proportioned to the buoyancy; in other words the "chesses" or planks which form the roadway should be made of a shorter length for a bridge which is designed for light traffic than for one which is designed for heavy traffic. The employment of chesses of different lengths for the pontoon equipment of an army would, however, be very inconvenient and troublesome, and this has led to the adoption of a constant breadth of roadway, on the understanding that the traffic will always be controlled by the officer in charge of the bridge.

The latest form of pontoon for the English army is one with which the name of Colonel Blood, R.E., is mainly associated. Its powers are given in the lowest line of the preceding table. It is an open bateau with decked ends and sides partly decked where the rowlock blocks are fixed. It consists of six sets of framed ribs connected by a deep kelson, two side streaks, and three bottom streaks. The sides and bottom are of thin yellow pine with canvas secured to both surfaces by india-rubber solution, and coated outside with marine glue. The central interval between the pontoons in forming a bridge is invariably maintained at 15 feet; for the support of the roadway five baulks are ordinarily employed, but nine for the passage of siege artillery and the heaviest loads; they fit on to saddles resting on central saddle beams. The pontoons are not immersed to within 1 foot of the tops of their "coamings" when carrying ordinary loads, as of infantry in marching order "in fours" crowded at a check, or the 16-pounder gun, which weighs 4800 ℔; nor are they immersed to within 6 inches when carrying extraordinary loads, such as disorganized infantry, or the 64-pounder gun weighing 11,100 ℔. In designing this pontoon the chief points attended to were—(1) improvement in power of support, (2) simplification in bridge construction, (3) reduction of weight in transport, and (4) adaptation for use singly as boats for ferrying purposes. One pontoon with the superstructure for a single bay constitutes a load for one wagon, with a total weight behind horses of about 4500 ℔.

For the British army in India the standard pontoon for many years was the Pasley; it was seldom used, however, for boats could almost always be procured on the spot in sufficient numbers wherever a floating bridge had to be constructed. Of late years an equipment has been prepared for the Indian army of demi-pontoons, similar to the Blood pontoon cut in half, and therefore more mobile; each has a bow and a square stern, and they are joined at the sterns when required to form a "pier"; they are fitted with movable covers and can therefore be used in much rougher water than pontoons of the home pattern, and their power of support and breadth of roadway are the same.

For the British army there is a light form of the Blanshard pontoon suitable for infantry uncrowded, guns unlimbered, and cavalry in single file. The Berthon collapsible boat, for infantry in single file, is also employed; when open it is 9 feet long and 4 feet wide; it weighs 109 ℔ with a pair of oars and a removable thwart or seat (to enable it to be used as a boat), and can be slung on to a bamboo and carried by two men; the superstructure for one bay weighs 97 ℔, and is also carried by two men; the width of roadway is 18 inches; twelve boats are required to bridge a stream 100 feet in width.

The india-rubber pontoon does not appear to have been generally employed even in America, where it was invented. The engineer officers with the army of the Potomac, after full experience of the india-rubber pontoon and countless other inventions of American genius, adopted the French equipment, which they found "most excellent, useful, and reliable for all military purposes." The Russians in crossing the Danube in their war with Turkey in 1878 employed the Austrian equipment.

Authorities.—Colonel Lovell, R.E., *Prof. Papers Royal Engineers*, vol. xii., 1863; Brig-Gen. Cullum, U.S.A. Engineers, *System of Military Bridges in use by the United States Army*, 1863; Gen. Barnard, U.S.A., *Report on Army of Potomac*, 1863; Lord Wolseley, *Pocket-Book for Field Service*, 1882; *Military Bridges*, Chatham, 1879. (J. T. W.)

PONTOPPIDAN, Erik (1698–1764), a learned Danish author, was born at Aarhuus on August 24, 1698, and studied divinity at the university of Copenhagen. On finishing his education he was appointed travelling tutor to several young noblemen in succession, and in 1735 he became one of the chaplains of the king. In 1738 he was made professor extraordinarius of theology at Copenhagen, and in 1747 bishop of Bergen, Norway, where he died on December 20, 1764.

His principal works are—*Theatrum Daniæ veteris et modernæ* (4to, 1730), a description of the geography, natural history, antiquities, etc., of Denmark; *Gesta et Vestigia Danorum extra Daniam* (2 vols. 8vo, 1740), of which laborious work it is enough to remark that it was written before the rise of the modern historical school; *Annales Ecclesiæ Danicæ* (4 vols. 4to); *Marmora Danica Selectiora* (2 vols. fol., 1739–41); *Glossarium Norvegicum* (1749); *Det forste Forsög paa Norges naturlige Historie* (4to, 1752–54; Eng. trans., *Natural History of Norway*, 1755), containing curious accounts, often referred to, of the Kraaken, sea-serpent, and the like; *Origines Hafnienses* (1760). His *Danske Atlas* (7 vols. 4to) was mostly posthumous.

PONTORMO, Jacopo da (1494–1557), whose family name was Carucci, a painter of the Florentine school, was born at Pontormo in 1494, son of a painter of ordinary ability, was apprenticed to Leonardo da Vinci, and afterwards took lessons from Pier di Cosimo. At the age of eighteen he became a journeyman to Andrea del Sarto, and was remarked as a young man of exceptional accomplishment and promise. Later on, but still in early youth, he executed, in continuation of Andrea's labors, the Visitation, in the cloister of the Servi in Florence—one of the principal surviving evidences of his powers. The most extensive series of works which he ever undertook was a set of frescos in the church of S. Lorenzo, Florence, from the Creation of Man to the Deluge, closing with the Last Judgment. By this time, towards 1546, he had fallen under the dangerous spell of Michelangelo's colossal genius and superhuman style; and Pontormo, after working on at the frescos for eleven years, left them incomplete, and the object of general disappointment and disparagement. They were finished by his leading pupil Angelo Bronzino, but have long since vanished under whitewash. Among the best works of Pontormo are his portraits, which include the likenesses of various members of the Medici family; they are vigorous, animated, and highly finished. He was fond of new and odd experiments both in style of art and in method of painting. From Da Vinci he caught one of the marked physiognomic traits of his visages, smiles, and dimples. At one time he took to direct imitation or reproduction of Albert Dürer, and executed a series of paintings founded on the Passion subjects of the German master, not only in composition, but even in such peculiarities as the treatment of draperies, etc. Italian critics, both contemporary and of later date, have naturally regarded this as a very perverse aberration. Pontormo died of dropsy on 2d January, 1557, mortified at the ill success of his frescos in S. Lorenzo; he was buried below his work in the Servi. He was a man of solitary self-neglectful habits, a slow worker, receiving comparatively little aid from scholars, indifferent to gain or distinguished patronage, and haunted by an instinctive horror of death.

PONTUS was the name given in ancient times to an extensive tract of country in the northeast of Asia Minor, bordering on Armenia and Colchis (see vol. xv. Plate II.). It was not, like most of the divisions of Asia, a national appellation, but a purely territorial one, derived from its proximity to the Euxine, often called simply Pontus by the Greeks. Originally it formed part of the extensive region of Cappadocia, which in early ages extended from the borders of Cilicia to the Euxine; but afterwards it came to be divided into two satrapies or governments, of which the northernmost came to be distinguished as "Cappadocia on the Pontus," and thence simply as "Pontus." The term is not, however, found either in Herodotus or Xenophon, though the latter traversed a considerable part of the region, and it is probable that it did not come into general use until after the time of Alexander the Great. Under the Persian empire the province continued to be governed by a satrap, nominally subject to the great king, but apparently enjoying virtual independence, as no mention occurs in Xenophon of the Persian authorities in this part of Asia. The first of these local satraps who assumed the title of king was Ariobarzanes, about the beginning of the 4th century B.C., who was reckoned the founder of the dynasty; but its history as an independent monarchy really begins with Mithradates II., who commenced his reign in 337 B.C. From this time Pontus continued to be ruled by a succession of kings of the same dynasty, mostly bearing the name of Mithradates, whose independence was respected by the Macedonian sovereigns of Asia, and who were able gradually to extend their power along the shores of the Euxine. The capture of the important city of Sinope by Pharnaces I. (about 183 B.C.) led to the extension of their frontier to that of Bithynia; while under Mithradates VI., commonly known as the Great, their dominion for a time comprised a large part of Asia Minor. The history of the reign of that monarch and his wars with the Romans will be found under the heading Mithradates. After his final defeat by Pompey in 65 B.C., Pontus was again confined within its original limits, but was united with Bithynia as a Roman province, and this union generally continued to subsist, though not without interruption, under the Roman empire. A portion of the original dominion of the kings of Pontus was, however, separated from the rest by Antony in 36 B.C., and placed under the government of a Greek rhetorician named Polemon, whose descendants continued to rule it till the reign of Nero, when it was finally annexed to the Roman empire (63 A.D.). Hence this part of the country come to be known as Pontus Polemoniacus, by which epithet it was still distinguished as a Roman province. The interior district in the southwest, adjoining Galatia, hence came to be known as Pontus Galaticus.

Pontus, in the proper sense of the term, as defined by Strabo, who was himself a native of the country, was bounded by the river Halys on the west, and by Colchis and the Lesser Armenia on the east. Its exact frontier in this direction is not specified, but it may be taken as extending as far as the mouth of the river Acampsis. The region thus limited may be considered as divided into two portions, differing much in their physical characters. The western half presents considerable plains and upland tracts in the interior, stretching away till they join the still more extensive uplands of Cappadocia and Galatia. Besides the great river Halys that forms its boundary on the west, this region is traversed by the river Iris, and its tributary the Lycus, both of which have their rise in the highlands on the frontiers of Armenia, and are very considerable streams, flowing through fertile valleys. The Thermodon, which enters the Euxine a little to the east of the Iris, is a much less important stream, though celebrated from its connection with the fable of the Amazons. On the other hand the eastern portion of Pontus, between Armenia and the Euxine, is throughout a very rugged and mountainous country, furrowed by deep valleys descending from the inland range of mountains, known to the ancients as Paryadres, which has a direction nearly parallel to the sea-coast, and is continued to the frontiers of Colchis under the name of Scydises and various other appellations. These mountains have in all ages been almost inaccessible, and even in the time of Strabo were inhabited by wild tribes who had never been really reduced to subjection by any government. But the coast from Trebizond westward is one of the most beautiful parts of Asia Minor, and is justly extolled by Strabo for its wonderful productiveness in fruits of every description.

The population of the greater part of Pontus was undoubtedly of the same race with that of Cappadocia, of which it originally formed a part, and was therefore clearly of Semitic origin.[1] Both nations were frequently comprised by the Greeks under the term Leucosyri or White Syrians. But the rugged mountain districts in the northeast, towards the frontiers of Colchis and Armenia, were occupied by a number of semi-barbarous tribes, of whose ethnical relations we are wholly ignorant. Such were the Chaldæans or Chalybes (identified by the Greeks with the people of that name mentioned by Homer), the Tibareni, the Mosynœci and the Macrones. Some light is thrown on the manners and condition of these people by Xenophon, who traversed their country on his march from Trapezus to Cotyora (*Anab.*, v.) but we have otherwise hardly any information concerning them.

The sea coast of Pontus, like the rest of the south shore of the Euxine, was from an early period studded with Greek colonies, most of them of Milesian origin, though in many cases deriving their settlement directly from Sinope, itself a colony of Miletus. Next to that city, between the mouth of the Halys and that of the Iris, stood Amisus, originally a colony direct from Miletus, but which subsequently received a body of Athenian settlers. It was one of the most flourishing of the Greek colonies on this coast, and is still a considerable town under the name of Samsun. Proceeding eastward from thence, we find Side, called in later times Polemonium; Cotyora, a colony of Sinope, where Xenophon embarked with the ten thousand Greeks; Cerasus, afterwards named Pharnacia; and Trapezus, also a colony of Sinope, which was a flourishing and important town in the days of Xenophon, but did not attain till a later period to the paramount position which it occupied under the Roman and Byzantine empire, and which it still retains under the name of TREBIZOND (*q.v.*).

But, besides these Greek settlements, there were in the interior of Pontus several cities of considerable importance, which were of native origin, though they had gradually received a certain amount of Greek culture. The principal of these were Amasia, on the river Iris, the birth-place of Strabo, which was made the capital of his kingdom by Mithradates the Great, but had previously been the burial-place of the earlier kings, whose tombs are still extant, and have been described by Hamilton and other travellers; Comana, higher up the valley of the same river, which, like the place of the same name in Cappadocia, was consecrated to a native goddess named Ma, identified by Strabo with the Greek Enyo, and derived great celebrity from its sacred character, having a large fixed population under the direct government of the priests, besides being the resort of thousands of pilgrims; Zela, nearer the frontier of Galatia, which was in like manner consecrated to a goddess named Anaitis; and Cabira, in the valley of the Lycus, afterwards called Neocæsarea, a name still retained in the abbreviated form of the modern Niksar. Several smaller towns are mentioned by Strabo as giving name to the surrounding districts, of which he has left us the names of not less than fifteen; but these obscure appellations of local divisions are in themselves of little interest, and for the most part not mentioned by any other writer.

(E. H. B.)

PONTUS DE TYARD (c. 1521–1605), one of the famous Pleiade who helped to reform French literature in the 16th century, was the highest in rank and the most affluent in fortune of the seven. He was indeed in some sort an anticipator of Ronsard and Du Bellay, for his *Erreurs Amoureuses* preceded their work. He was seigneur of Bissy in Burgundy, was born at the seignorial house in or about 1521, and died at a great age at Bragny on the Saône, another seat of his, on September 25, 1605. He was thus the last survivor as well as one of the eldest of the group. His early poems, the *Erreurs Amoureuses*, originally published in 1549, were augmented with other works in successive editions till 1573. Pontus de Tyard published *Discours Philosophiques* in 1587, and appears to have been a man of extensive knowledge and just thought. He was, moreover, a courtier and official of some standing for many years, and, entering the church, was made count-bishop of Châlons-sur-Saône. In this high position he bore a character for political and religious moderation. On the whole his poetry is inferior to that of his companions, but he was one of the first to write sonnets in French (the actual priority belongs to Mellin de St. Gelais); and one of these, the beautiful Sonnet to Sleep (it has been noted that the poetical name of his mistress in the *Erreurs* is, oddly enough, Pasithea, the name of the nymph beloved classically by the god of sleep), is a very notable and famous piece. It is also said that Pontus de Tyard introduced the sestine into France, or rather reintroduced it, for it is originally a Provençal invention.

PONTYPOOL, a town and urban sanitary district of Monmouthshire, England, situated on an acclivity above the river Avon Lwyd, on the Monmouthshire Canal, and on the Great Western and Monmouthshire Railways, 8 miles north of Newport. The town-hall, in the Doric style, dates from 1856, the market-house from 1846, and the Baptist theological college from 1856. At one period Pontypool was famed for its japanned goods, invented by Thomas Allwood, a native of Northampton, who settled in the town in the reign of Charles II., but the manufacture has long been transferred altogether to other towns. The present prosperity of Pontypool is due to its situation on the edge of the great Pembrokeshire coal and iron basin. The earliest record of trade in iron is in 1588, but it was developed chiefly in the beginning of the 18th century by the Hanburys, the proprietors of Pontypool Park. The town possesses large forges and iron-mills for the manufacture of iron-work and tin-plate. The population of the urban sanitary district (area 800 acres) in 1871 was 4834, and in 1881 it was 5244.

PONTYPRIDD, sometimes also called **NEWBRIDGE**, a market town of Glamorganshire, Wales, situated on the Taff at its junction with the Rhondda, and on the Glamorganshire Canal, 12 miles north-northwest from Cardiff and 12 south from Merthyr-Tydfil. It receives its name from a remarkable bridge of one arch spanning the Taff, erected by William Edwards, a self-taught mason. The bridge is a perfect segment of a circle, the chord being 140 feet, and the height at low water 36 feet. A three-arched bridge was erected close to it in 1857. The principal buildings are the court-house, St. Catherine's church, the masonic hall, and the town-hall. Near the town is a far-famed rocking stone 9½ tons in weight, surrounded by so-called Druidical remains. In the beginning of the century Pontypridd was an insignificant village, and it owes its progress chiefly to the coal and iron in the neighborhood. It possesses anchor, chain, and cable works, chemical works, and iron and brass foundries. The population in 1881 was 12,317.

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[1] Such at least was the general opinion of Greek writers. The Semitic or Aramæan origin of the Cappadocians has, however, in modern times been questioned by Nöldeke and other authorities on Semitic ethnology.

PONZA, the principal island of a small volcanic group, the Pontian, Pontine, or Pontinian Islands (*Insulæ Pontiæ*, *Isole Ponze*), which lie 20 miles off the Circeian promontory (Monte Circello), the northern end of the Gulf of Gaeta, on the west coast of Italy. The two smaller islands are Palmarola (ancient *Palmaria*) and Zannone (*Simonia*), neither inhabited. Ponza is 5 miles long and very irregular in outline; its soil is fertile; and in 1881 it had 3828 inhabitants. The old fortress is used as a penal establishment.

A Roman colony with Latin rights was settled on Pontia in 313 B.C. Under the empire the island was a place of banishment for political offenders. Nero, the eldest son of Germanicus, here perished by command of Tiberius; here the sisters of Caligula were confined; and here, or in Palmaria, Pope Sylverius died. A Benedictine monastery was built on Ponza, and in 1572 Cardinal Farnese, as commendatory of the monastery, claimed to exercise lordship over the island. From the duke of Parma, who obtained possession in 1588, the feudal authority passed with Elizabeth to Philip V. of Spain. Ferdinand IV. attracted the inhabitants of Torre del Greco to the island by gifts of land and money. During the first French empire it was occupied and fortified by the English and Sicilian forces.

See Tricoli, *Monografia per le isole del gruppo Ponziano*, Naples, 1855; Mattei, *L'Archipelago Ponziano*, Naples, 1857; and Doelter, *Vorläufige Mittheilung über den geol. Bau der Pontinischen Inseln*, Vienna, 1875.

POOLE, a market town, municipal borough, county in itself, and seaport of Dorsetshire, on the south coast of England, is picturesquely situated on a peninsula between Holes Bay and Poole Harbor, 30 miles east from Dorchester and 120 southwest of London. The churches are modern, and possess no features of special interest. Among the principal public buildings are the town-house, 1721; the guild-hall, formerly the market-house, 1761; the old town-hall, built in 1572; the custom-house; and the mechanics' institute. On Brownsea Island in the middle of Poole Harbor is a small castle erected as a fortress by Elizabeth and strengthened by Charles I. At low water Poole Harbor is entirely emptied except a narrow channel, but at full tide the water covers an area about 7 miles long by about 4½ broad. The quays lined with warehouses are about one mile in length, and can be approached by vessels of very large tonnage. There is a large general trade with the British colonies and the United States, and an important coasting trade, especially in corn to London, and Purbeck clay to the Staffordshire potteries. In 1883 the number of vessels that entered the harbor was 933 of 81,003 tons, the number that cleared 874 of 77,948 tons. Some shipbuilding is carried on, and there are manufactures of cordage, netting, and sailcloth. The town also possesses large potteries, decorative tile works, iron-foundries, engineering works, agricultural implement works, and flour-mills. The area of the borough is 5111 acres, with a population in 1871 of 10,129, and in 1881 of 12,310 (5820 males and 6490 females).

Poole derives its name from being nearly surrounded by a sheet of water. There was a Roman road between it and Wimbourne. It is not mentioned in Domesday, being included in Canford, but it enjoyed certain immunities before 1248, when it received a charter from William Longsword. In the reign of Edward III. it supplied four ships and 94 men for the siege of Calais. Much of its succeeding prosperity was due to the presence of Spanish merchants, and after the outbreak of war with Spain in the reign of Elizabeth its trade for a time declined. Its charter was extended by Elizabeth, who reincorporated it, and erected it into a county in itself. It has a sheriff elected annually, and a separate court of quarter sessions. It is divided into two wards, and is governed by a mayor, six aldermen, and eighteen councillors. It returned two members to Parliament as early as the reign of Edward III., but one only from 1868 to 1885.

See Hutchins, *History of Poole*, 1788; Sydenham, *History of Poole*, 1839; Hutchins, *History of Dorset*, 3d ed.

POOLE, Matthew (1624–1679), author of a learned though now almost wholly antiquated *Synopsis Criticorum Biblicorum*, was born at York in 1624, was educated at Emmanuel College, Cambridge, and from 1648 till the passing of the Act of Uniformity held the rectory of St. Mary le Querne, London. Subsequent troubles led to his withdrawal to Holland. He died at Amsterdam in 1679.

Besides the work with which his name is principally associated (*Synopsis Criticorum Biblicorum*, 5 vols. fol., 1669–76), he wrote *Annotations on the Holy Bible*, as far as to Isa. lviii.; the work was subsequently completed by several of his Nonconformist brethren, and published in 2 vols. fol. in 1683. He was also the author of numerous controversial tracts.

POOLE, Paul Falconer (1806–1879), an eminent English painter was born at Bristol in 1806. He was self-taught in the strictest sense, and to this deficiency in art training must be ascribed the imperfect drawing of the human figure which is to be observed in most of his work. But, in spite of this drawback, his fine feeling for color, his poetic sympathy, and his dramatic power have gained for him a high position among British artists. Gifted with an imagination of a high order he boldly attempted lofty historical themes, and, if the result is not always equal to the vigor of his conception, we can easily see that the shortcoming was due to his imperfect education in art. His pictures show him to belong to that comparatively small class of English painters who are keenly sensitive to the influence of beauty and of passion, rising on occasion to ambitious flights of fancy, and dominated by strong dramatic impulse. A keen observer of nature, but generally viewing it in a broad comprehensive aspect, he was truly a poet-painter, using the effects of a summer sky or of angry clouds to harmonize with the subject of his picture and to enforce its story. In his early days Poole worked along with T. Danby, and it is easy to trace the bond of sympathy between the two painters.

Poole's life was the simple uneventful record of the career of the artist. He exhibited his first work in the Royal Academy at the age of twenty-five, the subject being the Well—a scene in Naples. There was an interval of seven years before he again exhibited his Farewell, Farewell, in 1837, which was followed by the Emigrant's Departure, Hermann and Dorothea, and By the Waters of Babylon. This last picture attracted much attention from the fine poetic imagination which it displayed. In 1843 his position was made secure by his Solomon Eagle, and by his success in the Cartoon Exhibition, in which he received from the Fine Art Commissioners, a prize of £300 sterling [$1,458]. After his exhibition of the Surrender of Syon House he was elected an Associate of the Royal Academy in 1846, and was made an Academician in 1861. In 1855 he received a medal of the third class at the Paris Universal Exhibition. His enthusiasm for his art was rewarded by success in life, though like many artists he passed through much hardship in his early days. He died in 1879, in his house at Hampstead, in his seventy-third year. In person he was tall and well built, with a lofty forehead, gray eyes, and short beard. The portrait sketch by Frank Holl, R. A., gives a very good idea of him in his last days—a shy man but genial to his friends, fond of conversation and well read, especially in his favorites Shakespeare, Shelley, Spencer, and Chaucer, who were the sources of inspiration of many of his works.

Poole's subjects easily divide themselves into two orders—one, without doubt the earlier, idyllic, the other dramatic. Of the former his May Day is a typical example. A rustic beauty crossing a brook, or resting on a hill side under bushes flecked with the light and shade of a bright sun and with *cirrus* clouds floating in a blue sky, is the frequent motive of these works, which are full of simple enjoyment of a beautiful country life. But in his later style he rises to loftier subjects and treats them powerfully. Of both styles there were excellent examples to be seen in the small collection of his works shown at Burlington House in the Winter Exhibition of 1883–84. These collected pictures recalled the attention of the public to a painter who had suffered neglect for some years, alike from his own deficiencies as a draughtsman and also from a want of sympathy with the poetical character of his paintings, which never could have been popular with the ordinary public. His reputation will stand or fall by the criticism of this gathering of his pictures, small though it was. There was to be seen one of his early dramatic pictures, painted in 1843, Solomon Eagle exhorting the People to Repentance during the Plague of 1665, terrible in its ghastly force. Though exaggerated in the expression of horror and agony, weak in drawing, and defective in color, it is clearly the work of a powerful imagination. To this class belong also the Messenger announcing to Job the Irruption of the Sabeans and the Slaughter of the Servants (exhibited in 1850), and Robert, Duke of Normandy and Arletta (1848). Finer examples of his more mature power in this direction are to be found in his Prodigal Son, painted in 1869; the Escape of Glaucus and Ione with the blind girl Nydia from Pompeii (1860); and Cunstaunce sent adrift by the Constable of Alla, King of Northumberland, painted in 1868. Here Poole rises to a lofty height, and succeeds fully in realizing the impression he aims at. The expression of anguish and of resignation as Cunstaunce clasps her child to her bosom and turns her moon-lit face to heaven is rendered with great power, while the effect is heightened by the stormy sky, the dark rocks, and the angry sea.

More peaceful than these are the Song of Troubadours (painted 1854) and the Goths in Italy (1851), the latter an important historical work of great power and beauty. It represents the easy luxurious insolence of the barbarian conquerors, lying stretched on the grass in the gardens of Lucullus and Cicero; while the captive daughters of proud senators wait on them and offer wine in golden goblets. In the background is a circular temple overhanging the sea, while overhead is a beautiful sky—altogether a bold feat to attempt, yet Poole has succeeded in giving a great representation of a striking page in history.

Of a less lofty strain, but still more beautiful in its workmanship, is the Seventh Day of the Decameron, painted in 1857. In this picture Poole rises to his full height as a colorist. "In the fore-ground is Philomena, seated on the shore of a lake surrounded by high mountains, playing on a harp; eleven figures are grouped round her in various positions," as described in the catalogue. The chief beauty of this work lies in its fine color and quiet repose. The amphitheatre of rocky mountains reflected in the lake gives us a splendid example of Poole's power in landscape, which is large and broad in style. His treatment corresponded with his choice of subject. In his pastorals he is soft and tender, as in the Mountain Path (1853), the Water-Cress Gatherers (1870), the Shepston Maiden (1872). But when he turns to the grander and more sublime views of nature his work is bold and vigorous. Fine examples of this style may be seen in the Vision of Ezekiel of the National Gallery, Solitude (1876), the Entrance to the Cave of Mammon (1875), the Dragon's Cavern (1877), and perhaps best of all in the Lion in the Path (1873), a great representation of mountain and cloud form. This wild rocky landscape had a great fascination for him; every aspect of nature which showed the action of mighty force attracted him; hence his love of mountain sides scarred by ravines, and of trees torn and twisted by hurricanes. Caverns are a frequent theme; indeed he used to say that he had been haunted all his life by them, and that he would travel far to see a new one.

POONA, a district in the Deccan, Bombay, situated between the 17° 54′ and 19° 23′ N. lat., and 73° 24′ and 75° 13′ E. long. It has an area of 5347 square miles, and is bounded on the N. by the districts of Nasik and Ahmednagar, on the E. by those of Ahmednagar and Sholapur, on the S. by the Níra river, separating it from Satara and Phaltan, and on the W. by the Bhor state and Sahyadri Hills. Towards the west the country is extremely undulating, and numerous spurs from the hills enter the district. To the east it opens out into plains; but a considerable area is now being put under forest. Poona is watered by many streams which, rising in the Sahyadri range, flow eastwards until they join the Bhima, a river which intersects the district from north to south. The Great Indian Peninsula Railway runs through it, and affords an outlet for its produce through the Bhor Ghat to Bombay; another railway is about to be commenced which will put the district into communication with the southern Mahratta country. The Khadakvasla Canal, about 10 miles southwest of Poona, which it supplies with water, is one of its most important works. Although the district is not rich in minerals, trap rock suitable for road-making and stone for building purposes are found. Only in the west are wild animals met with, chiefly tigers, leopards, bears, and *sambhar* deer. The climate is dry and invigorating; the average annual rainfall is about 30 inches.

The population of the district in 1881 was 900,621, (455,101 males and 445,520 females), of whom 834,843 were Hindus, 42,036 Mohammedans, 1574 Parsis, 10,880 Jains, 9500 Christians, and 1788 of other religions. The only towns with a population exceeding 10,000 are POONA (*q. v.*) Poona cantonment (30,129), and Junnar (10,373).

Agriculture supports about half the population. Of a total area of Government culturable land of 1,924,630 acres, 1,775,583, were cultivated during 1882–83. Of these 181,395 acres were fallow land and occupied waste, leaving 1,594,188 acres under actual cultivation, of which 28,035 were twice cropped. The chief products are cereals (chiefly jowari and bajri) and pulse, and the principal manufactures of the district are silk robes, coarse cotton cloth, and blankets; its brass and silver work is much admired. The gross revenue in 1882–83 was £180,736, [$878,376.96], of which the land tax yielded £111,740, [$543,056.40] stamps £18,790, [$91,319.40], and excise £31,160, [$151,437.60.]

History.—The district passed from the last Hindu dynasty which reigned at Deogiri to the Mohammedans between 1294 and 1312, and under the Bahmani kings the Ghat country was thoroughly subdued. On the disruption of the Bahmani kingdom after the revolt of the governors of the provinces, the district fell to the share of the Ahmednagar kings and from them it passed to the Moguls, when the Nizamshahi dynasty finally came to an end in 1637. The country north of the Bhima, including Junnar, was annexed to the Mogul territory, and that south of it was made over to Bijapur. The power of the latter was, however, declining, and gave an opportunity to the Mahratta chiefs to unite and assert themselves, and ended in their establishing a Mahratta kingdom at Satara. Intrigues at the palace led to the supremacy of the peshwas and the removal of the capital to Poona, where many stirring scenes in Mahratta history have been enacted. Holkar defeated the peshwa under its walls, and his flight to Bassein led to the treaty by which he put himself under British protection; he was reinstated in 1802, but, unable to maintain friendly relations, he attacked the British at Kirkee in 1817, and his kingdom passed from him.

POONA, the chief town of the above district, is situated in 18° 31′ N. lat. and 73° 55′ E. long., in a treeless plain about 2000 feet above the sea and overlooked by the Ghats, which rise 1000 feet above the plain. Its area is about 4 square miles, with a population in 1881 of 99,622—males 50,814, females 48,808. The town stands on the right bank of the Muta river, and is about 80 miles southeast of Bombay. Until the year 1817, when it was taken by the British, the city was the residence of the peshwas of the Mahrattas.

POOR LAWS. Without embarking on an inquiry as to the causes of pauperism or the primary right of any persons to have their wants, however pressing, met by the state, it is sufficient to say that in Great Britain "there is no man so indigent or wretched but he may demand a supply sufficient for all the necessaries of life from the more opulent part of the community, by means of the several statutes enacted for the relief of the poor" (Blackstone). Moreover, apart from statute, by the common law of England the poor were sustainable "by parsons, rectors of the church, and the parishioners, so that none of them die for default of sustenance" (*Mirror*).

The great importance of the subject of relief of the poor is evinced, apart from other considerations, by the number of persons immediately affected, either as recipients of relief or as ratepayers, and by the sums expended in that relief. The number of paupers of all classes now in receipt of relief in England and Wales approaches 800,000, equivalent to a thirty-fourth part of the entire population and relieved at a yearly cost of considerably more than £8,000,000, representing a charge of between six and seven shillings per head of the estimated population.

Of existing legislation a statute of the beginning of the 17th century (43 Eliz. c. 2, 1601) is the earliest, under which, by parochial taxation, parish officers are directed to provide a stock of materials for "setting the poor on work" (that is to say, persons "married or unmarried having no means to maintain them [and that] use no ordinary and daily trade of life to get their living by"), and further for setting to work their children; "and also competent sums of money for and towards the necessary relief of the lame, impotent, old, blind, and such others among them being poor and not able to work." The same statute enacts "that the father and grandfather and the mother and grandmother and the children of every poor old, blind, lame, and impotent person, or other poor person not able to work, being of a sufficient ability, shall at their own charges relieve and maintain every such poor person."

Early legislation.

Although the statute of Elizabeth is spoken of as the principal foundation of existing legislation relating to the poor, it is an error to say that the relief of the poor originated at that period. The common law of England has been already cited, and traces of poor laws, however far removed from a system, are found in all civilized states. An approximation to the principle may be discerned in the legislation of England at a very early period; and before the Norman Conquest laws of Athelstane, establishing a responsibility over households and landowners, although intended for good order and calculated to prevent the growth of vagabondage and violence, had also the effect of establishing reciprocal relations between the landless man and the landowner, between property and poverty, between the householder and the houseless,—casting upon one the duty of supervising the conduct and providing for the wants of the other, in some respects similar to the poor law of the present day. "The results of this legislation were likewise, it may be presumed, not very dissimilar, for the improvident and the indolent would endeavor, with the smallest amount of labor, to obtain the largest amount of assistance from the householder who was liable for their support and responsible for their conduct, whilst the householder would as certainly endeavor to obtain the largest amount of labor in return for the cost and responsibility to which he was subject." Again, so long as serfdom and villenage prevailed, whether to be traced to the Norman Conquest or not, there could be no call for any special provision for the destitute. "The persons who might, if free agents and in a destitute state, have been properly relieved out of a common stock, would as serfs or villeins have a claim on their masters, to whom they belonged, and who were bound to provide for them" (Nicholls). As those old ties became more relaxed the change to freedom was accompanied by some evils, and led to a great increase of vagrancy, and from a period commencing before the close of the 14th century there was a stream of legislation on the subject. An Act of 12 Richard II., after providing for labor to persons able to work (see LABOR AND LABOR LAWS, vol. xiv. p. 167), enacts "that beggars impotent to serve shall abide in the cities and towns where they may be dwelling at the time of the proclamation of this statute, and, if the people of the cities and towns will not, or may not suffice to find them, that these, the said beggars, shall draw them to other towns within the hundred, rape, or wapentake, or to the towns where they were born, within forty days after the proclamation made, and there shall continually abide during their lives." This is the first enactment in which the impotent poor are directly named as a separate class, and on that account it has been mistakenly regarded as the origin of the English poor laws; but it makes no provision for their relief, and the chief characteristic of the statute is the fact of its having openly recognized the distinction between "beggars able to labor" and "beggars impotent to serve." Passing over intermediate legislation, by an act passed in 1530, "directing how aged, poor, and impotent persons compelled to live by alms, shall be ordered, and how vagabonds and beggars shall be punished," justices of the peace were required to give licenses under their seals to such poor, aged, and impotent persons to beg within a certain precinct as they should think to have most need; "and if any do beg out of his precinct he shall be set in the stocks two days and nights; and if any beg without such license he shall be whipped, or else be set in the stocks three days and three nights, with bread and water only. And persons being whole and mighty in body, and able to labor, who shall beg, or be vagrants and not able to account how they get their living, shall be whipped, and sworn to return to the place where they were born, or last dwelt by the space of three years, and there put themselves to labor" (22 Hen. VIII. c. 12).

Six years later an important and very interesting Act was passed reciting that, although it had been ordained that aged, poor, and impotent people should repair to the hundred where they were born or had dwelt for three years before, no provision had been made how they should be ordered at their coming thither, nor how the hundred should be charged for their relief. It was therefore enacted that the mayors, sheriffs, constables, householders, and all other head officers of every city, shire, town, and parish, at the repair and coming thither of such poor creature should most charitably receive them, and all the governors and ministers of every such place should succor, find, and keep them by way of voluntary and charitable alms, as should be thought meet in their discretion, in such wise as none of the poor persons of very necessity should be compelled to go openly in begging, on pain of every parish making default forfeiting 20s. a month. The head officers and churchwardens, or two others of every parish in the realm, were required to gather and procure such voluntary and charitable alms of the good Christian people, by means of boxes every Sunday, holiday, and other festival, in such good and discreet ways as the poor, impotent, lame, feeble, sick, and diseased people, being not able to work, may be provided, holpen, and relieved, so that in no wise none of them be suffered to go openly in begging, and such as be lusty may be kept in continual labor. Every preacher, parson, vicar, and curate, as well in their sermons, collections, bidding of the beads, as in time of confessions, and at the making of the wills or testaments of any persons, at all times, of the year shall exhort, move, stir, and provoke people to be liberal. Certain of the poor people were themselves appointed to collect and gather broken meats and fragments and the refuse drink of every householder in the parish, to be distributed equally among the poor at discretion. The overplus of collections in rich and wealthy parishes was distributable towards the sustentation of other poor parishes. The Act provided that, where the voluntary and unconstrained alms and charity, together with any moneys added or given from any monasteries or persons or bodies, proved insufficient, the officers and inhabitants should not incur the penalty nor be constrained to any contribution other than at their free will, provided that what was collected was justly distributed. Provision was made for duly accounting and for the punishment of embezzlement. Constables, churchwardens, and collectors of alms had, however, allowance for their loss of time and their travelling expenses (27 Hen. VIII. c. 25).

A number of statutes were passed after the dissolution of the monasteries for further providing for the poor and impotent, who had increased in great numbers. Many of these statutes were specially directed against vagrancy, and have been referred to in the article already mentioned, as closely connected with compulsory labor.

At the commencement of the reign of Edward VI. (1547) a statute also affecting laborers and vagrants and dealing very harshly with them (see vol. xiv. p.

168), reciting that there are many maimed and otherwise lamed, sore, aged, and impotent persons which, resorting together and making a number, do fill the streets or highways of divers cities, towns, markets, and fairs, who, if they were separated, might easily be nourished in the towns and places wherein they were born, or have been most abiding for the space of three years, enacted that the mayor, constable, or other head officer of any city, town, or hundred shall see all such idle, impotent, and aged persons, who otherwise cannot be taken for vagabonds, which were born within the said city, town or hundred, or have been most conversant there by the space of three years and now decayed, bestowed and provided for of tenantries, cottages, or other convenient houses to be lodged in, at the cost of the place, there to be relieved and cured by the devotion of good people, and suffer no others to remain and beg there, but shall convey them on horseback, cart, chariot, or otherwise to the next constable, and so from constable to constable, till they be brought to the place where they were born, or most conversant as aforesaid; provided that, if they were not so lame or impotent but that they might do some manner of work, work was to be provided either in common, or place them with such persons as would find them work for meat and drink. For the furtherance of the relief of such as were in "unfeigned misery," the curate of every parish was required on every Sunday and holiday, after reading the gospel of the day, to make (according to such talent as God hath given him) a godly and brief exhortation to his parishioners, moving and exciting them to remember the poor people, and the duty of Christian charity in relieving of them which be their brethren in Christ, born in the same parish, and needing their help. There was a proviso that all leprous and poor bedridden creatures were at liberty to remain in houses appointed for such persons, and for their better relief such persons were allowed to appoint one or two persons for any one such house to gather the alms of all inhabitants within the compass of four miles (1 Edw. VI. c. 3). This statute, however, was of brief duration.

Subsequently, in the same reign, further legislation took place, having for its main object the restraint of vagrancy, providing that every vagabond and beggar being born in any other nation or country should be conveyed from place to place, or to the place or borders next adjoining to his native country or to the nearest port if there was a sea between, there to be kept of the inhabitants until they could be conveyed over, and then at the cost of the inhabitants of the port, if the vagrants had not themselves wherewith to defray the cost. The same statute made provision for children, reciting that many men and women going begging, impotent and lame, and some able enough to labor, carried children about with them, which, being once brought up in idleness, would hardly be brought afterwards to any good kind of labor or service, and authorizing any person to take such child between the ages of five and fourteen to be brought up in any honest labor and occupation till such child, if a woman, attained the age of fifteen or was married, and if a man child until eighteen, if the master so long lived (3 & 4 Edw. VI. c. 16).

Two years later the mayor or head officer of every city, borough, and town corporate, and in every other parish of the country the parson and churchwardens, having in a book as well the names of inhabitants and householders as of needy persons, were required yearly "one holiday in Whitsunweek openly in the church and quickly after divine service to call the householders and inhabitants together and select two or more able persons to gather charitable alms for the relief of the poor, and directing such gatherers the week after their election, when the people are at the church, and have heard God's holy word, to gently ask and demand of every man and woman what they of their charity would be content to give weekly towards the relief of the poor, and write the result in the book, to gather and distribute the alms weekly to the poor and impotent persons without fraud or covin, favor or affection, in such manner as the most impotent had the most help, and such as could get part of their living to have the less, and by the discretion of the collectors to be put in such labor as they were fit and able to do, but none to go or sit openly a-begging." It is noteworthy that, except a penalty of 20s. imposed on a person refusing the office of gatherer, duties were enforced by ecclesiastical censure. The gatherers were required to account for the money; and if they refused the bishop of the diocese or ordinary was to compel them by censures of the church to account before such persons as he appointed. Further, if any person, being able to further the charitable work, "do obstinately and frowardly refuse to give towards the help of the poor or do wilfully discourage others from so charitable a deed," the parson, vicar, or curate, and churchwardens should "gently exhort him, and if he will not be so persuaded" then on certificate the bishop should send for him "to induce and persuade him by charitable ways and means, and so according to his discretion to take order for the reformation thereof" (5 & 6 Edw. VI. c. 2).

This statute was recognized in part after the accession of Mary, by altering the time of choosing collectors to Christmas and doubling the penalty for refusing to fill the office of collector, and moving wealthy parishes in cities and towns to contribute towards the relief of the poor in the less wealthy parishes. At the same time a material modification of the spirit of earlier legislation was effected by enabling justices to license the poor of parishes having more poor than they could relieve, to go begging into specified parishes, wearing a badge "both on the breast and back of their outermost garment" (2 & 3 P. & M. c. 5).

Elizabethan legislation.

Early in Elizabeth's reign the spiritual persuasion towards obstinate and froward persons withholding contributions was strengthened by the aid of the civil power, by directing the bishop or ordinary to bind all obstinate persons by recognizance to appear at the next sessions; and then, the charitable and gentle persuasions of the justices failing, the latter could tax the obstinate person in a weekly sum according to good discretion, and in default commit him to jail until payment. A corresponding power was given to deal with collectors refusing to account (5 Eliz. c. 3). A few years later (1572) legislation took a more vigorous turn "for the punishment of vagabonds and for relief of the poor and impotent." The Act 14 Eliz. c. 5, reciting that "all the parts of this realm of England and Wales be presently with rogues, vagabonds, and sturdy beggars exceedingly pestered, by means whereof daily happeneth in the same realm horrible murders, thefts, and other great outrages, to the high displeasure of Almighty God, and to the great annoy of the common weal, and for avoiding confusion by reason of numbers of laws concerning the premises standing in force together," repealed the before-mentioned statutes of 22 Hen. VIII., 3 & 4 Edw. VI., and 5 Eliz. c. 3, and made provision for various matters, "as well for the utter suppressing of the said outrageous enemies to the common weal as for the charitable relieving of the aged and impotent poor people." Persons above fourteen and being rogues, vagabonds, or sturdy beggars, and "taken begging in every part of this realm, or taken vagrant, wandering and misordering themselves," were upon their apprehension to be committed to prison to the next sessions or jail delivery without bail, and on conviction "shall be adjudged to be grievously whipped, and burnt through the gristle of the right ear with a hot iron of the compass of an inch about, manifesting his or her roguish kind of life and his or her punishment received for the same." This judgment was not to be executed if after imprisonment "some honest person, valued at the last subsidy next before that time to five pounds in goods or twenty shillings in lands, or else some such honest householder as by the justices of the peace of the same county, or two of them, shall be allowed, will of his charity take such offender before the same justices into his service for one whole year," under recognizance to keep this poor person for that period and to bring him, if still living, before the justices at the year's end; on the other hand the pauper departing within the year against the will of his master was to be whipped and burnt as above provided. The offender was absolved from a second punishment for a short time, but if after threescore days, and being of the age of eighteen or more, he "do eftsoons fall again to any kind of roguish or vagabond's trade of life," then the said rogue, vagabond, or sturdy beggar, from thenceforth was "to be taken, adjudged, and deemed in all respects as a felon," and should suffer as a felon—subject, however, to like redemption as on the first charge, conditioned for two years' service; but offending a third time he was to "be adjudged a felon" and suffer pains of death and loss of lands and goods as a felon, without allowance or benefit of clergy or sanctuary. Offenders under fourteen were punishable by whipping or stocking as provided by the repealed statutes.

A clause defining persons subject to the above punishment throws a light on the manners of the age, and is, as well as its exceptive provisions, of considerable interest; but, as relating to vagrancy, and only indirectly to the relief of the really poor, it is not given here. It is to be observed, however, that the statute provided that it should be still lawful to masters and governors of hospitals to lodge or harbor impotent or aged persons by way of charity according to their foundation, and to give money in alms as provided by the terms of their foundation. Harsh as was the treatment of rogues, vagabonds, and sturdy beggars, it was not so cruel as the short-lived legislation of the reign of Edward VI. imposing slavery in its worst form on wandering serving men (see vol. xiv. p. 168).

Exceptional provision was made for persons provided with passes and safe conducts, as in former Acts. The statute goes on to say that, "forasmuch as charity would that poor, aged, and impotent persons should as necessarily be provided for as the said rogues, vagabonds, and sturdy beggars repressed," and that the former should have "convenient habitations and abiding places throughout this realm to settle themselves upon, to the end that they nor any of them should hereafter beg or wander about," and enacts that justices of the peace in their different divisions "make diligent research and inquiry of all aged, poor, impotent, and decayed persons born within their said divisions and limits, or which were there dwelling within three years next before this present parliament, which live, or of necessity be compelled to live by alms of the charity of the people that be or shall be abiding within the limits of their commissions and authorities," and to register in a book the names of the poor persons, and devise and appoint meet and convenient places at their discretion "to settle the same poor people for their habitations and abidings, if the parish within the which they shall be found shall not or will not provide for them." The justices were also to number the poor people and "set down what portion the weekly charge towards their relief and sustentation would amount to;" and, that done, the justices, mayors, and other officers should "by their good discretions" tax the inhabitants dwelling within these limits to such weekly charge, and appoint collectors and also overseers of the poor for one year. Much as by a previous statute of 1547, compulsory removal of poor people from parish to parish (except the leprous and bed-ridden), not born or not having dwelt in the place, was provided for. Poor people refusing to "be bestowed in any of the said abiding places, but coveting still to hold on their trade of begging," or afterwards departing, were for the first offence to suffer as rogues or vagabonds in the first degree of punishment, and for a second offence to suffer the last degree of punishment already mentioned. The provisions as to putting out children of beggars contained in the statute of Edward VI. already noticed were repeated in nearly the same terms, but the age of male children was extended from eighteen to twenty-four for the duration of service.

The Act provided for justices' licenses for poor to beg, ask, and receive relief in other parishes under similar circumstances as badges had been granted under an earlier and repealed statute. The Act also contained many provisions and exceptions as to places and corporate bodies, and any person "able to further the charitable work" contemplated by the statute, and obstinately refusing to give towards the help and relief of the poor, or wilfully discouraging others from so charitable a deed, was to be summoned before justices to abide their order, and on refusal to be committed to jail, and "there to remain until he be contented with their said order, and to perform the same."

There is extant a letter addressed to Lord Burghley by a justice of the peace for Somerset, which shows that the great evils arising from habits of idleness amongst the poor began then to be understood, and strengthens the idea that one great object of the legislative provisions for the poor made about that time was to prevent able-bodied men from remaining unemployed. The writer advocated building houses of correction adjoining jails, to which vagrants, after conviction, should be transported, "to be kept in work, except some person would take any of them into service,"—adding, "I dare presume to say the tenth felony will not be committed that now is" (Strype, *Annals of Church and State*).

In 1576 the statute 14 Eliz. c. 5 was explained and materially extended. "To the intent youth may be accustomed and brought up in labor, and then not like to grow to be idle rogues, and to the intent also that such as be already grown up in idleness, and so rogues at this present, may not have any just excuse in saying that they cannot get any service or work, and that other poor and needy persons being willing to labor may be set on work," it was ordained that within every city and town corporate, by appointment of the mayor and other head officer, and in every other market town or other place where the justices in their general sessions yearly shall think meet, shall be provided a stock of wool, hemp, flax, iron, or other stuff, as that country is most meet for, and being wrought to be delivered to collectors and governors of the poor. Any person refusing to work, or begging, or living idly, or, taking such work, spoiling or embezzling it in such wise that after monition given the minister and church-wardens and the collectors and governors think such person not meet to have any more work delivered to him, was to be taken, "in convenient apparel meet for such a body to wear," to the "house of correction" established by the Act, and under the government of overseers of such houses, called censors and wardens, "there to be straitly kept, as well in diet as in work, and also punished from time to time." To the houses of correction were also taken and set on work not only the persons mentioned but also such "as be inhabitants in no parish or taken as rogues, or who had been once punished as rogues, or by reason of the uncertainty of their birth or of their dwelling by the space of three years, or for any other cause, ought to be abiding and kept in the county." An additional clause of the Act, reciting that by the earlier Act of 14 Eliz. no "pain" was incurred by any impotent person who having a competent allowance provided within his parish wandered abroad without license "loitering and begging," enacted that he was to be whipped, and for a second offence to "suffer as a rogue and vagabond" (18 Eliz. c. 3). The "stock" for work and the houses of correction were provided "of all the inhabitants to be taxed;" but, "because it is to be hoped that many well-disposed persons, understanding the good success which will grow by setting people on work and avoiding of idleness, would from time to time give towards the sustentation and maintenance of that good purpose," persons were empowered during the next twenty years to give lands for the purposes without any license of mortmain. A later Act, reciting that this power to erect hospitals or other abiding and working houses for the poor had not its due effect by reason that no person could erect such house without special license from the crown by letters patent, dispensed with such license for twenty years (39 Eliz. c. 5).

The numerous charities and endowments and foundations of almshouses by will and otherwise of the 16th and 17th centuries, still extant in numerous buildings throughout the country, are illustrations of the spirit of the legislation here referred to. It is not improbable that legislation sometimes prompted the donors, but more probable that such legislation was a reflex of the general disposition prevalent for generations after the ordinary channels of voluntary charity were obstructed.

In 1597 considerable progress was made towards establishing a system of poor laws, not so much by introducing novelties as by entering more specifically into details, and especially by defining the legislation of some twenty years earlier (18 Eliz. c. 3) in the same reign. The appointment of overseers first mentioned in the earlier statute was provided for by enacting that the church-wardens of every parish and four subsidy men or other substantial householders nominated yearly in Easter week by justices should be called overseers of the poor of the same parish. The majority of the overseers were required with the consent of justices to set to work the children of persons unable to maintain them, and also all persons married or single and having no means of maintenance and no ordinary and daily trade of life to get their living by. The taxation weekly or otherwise of inhabitants and occupiers for providing a stock of flax, hemp, wool, thread, iron, and other necessary wares and stuff to set the poor on work, and also competent sums for the necessary relief of the lame, impotent, old, blind poor, unable to work, and the cost of erection, by leave of the lords of manors, of places of habitation on waste or common lands, was gathered according to the ability of the parish (or, if the parish was unable, then of other parishes in the hundred and county), and was enforceable by warrant of distress against everyone refusing to contribute, but with a power of appeal against the cess or tax. Parents and children being of sufficient ability were required to maintain their poor children or parents. Any person whatsoever wandering abroad and begging in any place, by license or without, was punishable as a rogue, with a proviso exempting poor persons asking relief in victuals only in the parishes where they dwelt (39 Eliz. c. 3).

Statute of 1601.

Four years after came "the famous statute" of 1601 (43 Eliz. c. 2) already mentioned, out of which, Dr. Burn observes, "more litigation and a greater amount of revenue have arisen, with consequences more extensive and more serious in their aspect than ever were identified with any other Act of Parliament or system of legislation whatever." It was the permanent establishment of the main provisions of the Act more than their novelty at the time the Act was passed that has fixed it as a kind of epoch in legislation for the maintenance of the poor. The Act re-enacts, verbatim for the most part, the above-mentioned statute of 1597 (39 Eliz. c. 3). The material alterations were defining the ratable property, and extending and defining the family obligation of support, and also the formal apprenticing instead of placing out of children. The Act contains provisions for the rendering of accounts by the overseers.

The foregoing short review of legislation exhibits the very gradual change by which the maintenance of the poor became much more a temporal than a spiritual concern. So gradual was this change that in some places the law was neglected and in others abused. The material changes in legislation subsequent to the reign of Elizabeth must now be briefly alluded to.

James I.

The efforts culminating in the statute of 1601 were not altogether attended with satisfactory results. At the end of eight years the Act 7 James I. c. 4 recited various defects. "Many wilful people finding that they, having children, have some hope to have relief from the parish wherein they dwell, and being able to labor, and thereby to relieve themselves and their families, do nevertheless, run away out of their parishes and leave their families upon the parish." Again, and more prominently, "heretofore divers good and necessary laws and statutes have been made and provided for the creation of houses of correction for the suppressing and punishing of rogues, vagabonds, and other idle, vagrant, and disorderly persons; which laws have not wrought so good effect as was expected, as well for that the said houses of correction have not been built according as was intended, as also for that the said statutes have not been duly and severely put in execution, as by the said statutes were appointed."

It was also convenient that the masters or governors of the houses of correction should have some fit allowance and maintenance "for their travel and care" to be had in the service, and also "for the relieving of such as shall happen to be weak and sick in their custody, and that the subjects of this realm should in no sort be overcharged, to raise up money for stocks to set such on work as shall be committed to their custody," and that there "shall be the more care taken by all such masters of the houses of correction that, when the country hath been at trouble and charge to bring all disorderly persons to their safe keeping, then they shall perform their duties in that behalf." Another grievance related to bastard children chargeable to the parish, of which more below.

The remedy for these and other grievances was putting in execution "all laws and statutes now in force made for the creating and building of houses of correction, and for punishing of rogues, vagabonds, and other wandering and idle persons," and providing restraints in the same direction, and for the efficient discharge of duties of treasurers, constables, and other officers in rendering accounts.

In 1630 a royal commission was issued to inquire into the neglect of the poor laws, and directions given for their enforcement.

Commonwealth.

By a Commonwealth statute of 1656, reciting that "the number of wandering, idle, loose, dissolute, and disorderly persons is of late much increased by reason of some defects in the laws, and statutes heretofore made and provided for the punishment of rogues, vagabonds, and sturdy beggars (they being seldom taken begging), by means whereof divers robberies, burglaries, thefts, insurrections, and other misdemeanors have been occasioned, all and every idle, loose, and dissolute persons found and taken within the commonwealth of England, vagrant and wandering from their usual place of living or abode, and [who] shall not have such good and sufficient cause or business for such his or their travelling or wandering" as justices of the peace or mayors or other chief officers approved, were adjudged rogues, vagabonds, and sturdy beggars, within the statute 39 Eliz. c. 4, although not found begging; at the same time fiddlers and minstrels were also adjudged rogues, vagabonds, and sturdy beggars; and by a statute of the same year persons having no visible estate, profession, or calling answerable to their rate of living expenses were indictable.

Charles II.

Soon after the Restoration attention was directed to the existing state of the law and some of its defects. In 1662 the statute 13 & 14

Charles II. c. 12 recites that "the necessity, number, and continued increase of the poor, not only within the cities of London and Westminster, with the liberties of each of them, but also through the whole kingdom of England and dominion of Wales, is very great and exceeding burthensome, being occasioned by reason of some defects in the law concerning the settling of the poor, and for want of a due provision for the regulations of relief, and employment in such parishes or places where they are legally settled, which doth enforce many to turn incorrigible rogues, and others to perish for want, together with the neglect of the faithful execution of such laws and statutes as have formerly been made for the apprehending of rogues and vagabonds, and for the good of the poor." "For remedy whereof and for the preventing the perishing of any of the poor, whether young or old, for want of such supplies as may be necessary," numerous additional provisions were enacted. In the first place, "by reason of some defects in the law, poor people are not restrained from going from one parish to another, and therefore do endeavor to settle themselves in those parishes where there is the best stock, the largest commons or wastes to build cottages, and the most woods for them to burn and destroy, and, when they have consumed it, then to another parish, and at last become rogues and vagabonds, to the great discouragement of parishes to provide stocks, where it is liable to be devoured by strangers." Justices of the peace, upon complaint by the parish officers, within forty days after any such person's coming to settle as before mentioned in any tenement under the yearly value of £10, were empowered by warrant to remove such person to the parish where he was last legally settled either as a native, householder, sojourner, apprentice, or servant for not less than forty days, unless he gave sufficient security for the discharge of the parish.

In this way the law of settlement arose, with its numerous complications and modifications engrafted by subsequent legislation on this its original trunk. The statute of Charles, however, allowed (§ 3) any person "to go into any county, parish, or place to work in the time of harvest, or any time to work at any other work," provided he took with him "a certificate from the minister of the parish and one of the parish officers, that he or they have a dwelling house or place in which he or they inhabit, and have left wife and children or some of them, there (or otherwise, as the condition of the persons shall require), and is declared an inhabitant or inhabitants there." In such case, if the person did not return to his parish when his work was finished, or if he fell sick, it was not "counted a settlement," and he was therefore removable, and wilfully refusing, was punishable as a vagabond by being sent to the house of correction, or to a public workhouse, provision for which and for corporate bodies in relation to the poor in London and Westminster, and places within the so-called bills of mortality, was made at the same time. Funds raised for the relief of the poor in the city of London were, however, previously in the hands of a corporate body for that purpose.

The same statute, reciting that "the inhabitants of the counties of Lancashire, Cheshire, Derbyshire, Yorkshire, Northumberland, the bishopric of Durham, Cumberland, and Westmoreland, and many other counties in England and Wales, by reason of the largeness of the parishes within the same," could not reap the benefit of the Act 43 Eliz., extended the powers of the Act to townships and villages within these counties.

Power was given to justices at quarter sessions, to transport rogues, vagabonds, and sturdy beggars, in some cases with the approval of the privy council, or without such approval, if convicted and adjudged to be incorrigible, to any of the English plantations beyond the seas, "there to be disposed in the usual way of servants for a term not exceeding seven years."

This Act, which, except as to the corporate bodies before mentioned, was limited to three years' duration, was continued by various Acts, and made perpetual in the reign of Anne. One of the Acts continuing the former provisions, and containing some minute provisions affecting settlements, affords strong evidence of want of care of the funds, and even of the frauds practiced by parochial officers. Many inconveniences arose "by reason of the unlimited power of the churchwardens and overseers of the poor, who do frequently upon frivolous pretences (but chiefly for their own private ends) give relief to what persons and number they think fit; and such persons, being entered into the collection bill, do become after that a great charge to the parish, notwithstanding the occasion or pretence of their receiving collection oftentimes ceases, by which means the rates for the poor are daily increased." This grievance was sought to be remedied by means of a register with names and dates, to be examined by the vestry, and those only to be relieved who were allowed by a justice, except in certain urgent cases. The Act mentions more direct frauds. "Many churchwardens and overseers of the poor, and other persons intrusted to receive collections for the poor and other public moneys relating to the churches and parishes whereunto they do belong, do often misspend the said moneys and take the same to their own use, to the great prejudice of such parishes, and the poor and other inhabitants thereof," owing to the law by which persons in any way interested in the funds, as parishioners, although the only persons who could prove the facts, could not give evidence on the trial of actions against the parish officers to recover the misspent money; and therefore parishioners, excepting almsmen, were rendered competent witnesses in such actions (3 Will. & Mary c. 11).

Restraint on removal of the poor.

The injurious effects of the restraint placed on the free removal of the laboring classes is evinced by a statute towards the close of the 17th century. To make this intelligible it is necessary to say that by the statute 1 James II. c. 17 (one of the Acts continuing the Act of Charles II.) it was enacted that, as poor persons "at their first coming to a parish do commonly conceal themselves," the forty days continuance in a parish intended by the Act of Charles to make a settlement were to be accounted from the time of the person's delivering a notice in writing of the house of abode and number of the family to the parish officer. Hence persons coming to work under a certificate, on its production, were removed back again, lest they gained a settlement at the end of forty days. The statute now to be noticed recited that, "forasmuch as many poor persons chargeable to the parish, township, or place where they live, merely for want of work, would, in any other place where sufficient employment is to be had, maintain themselves and families without being burthensome to any parish, township, or place, but not being able to give such security as will or may be expected and required upon their coming to settle themselves in any other place, and the certificates that have been usually given in such cases having been oftentimes construed into a notice in handwriting, they are for the most part confined to live in their own parishes, townships, or places, and not permitted to inhabit elsewhere, though their labor is wanted in many other places, where the increase of manufactures would employ more hands." This mischievous result of previous legislation was sought to be avoided by a certificate of acknowledgment of settlement, and then and not before, on becoming chargeable to another parish, the certificated person could be sent back to the parish whence it was brought (8 & 9 Will. III. c. 30). This provision led to additional legislation, complicating the law of settlement. It was not until towards the close of the 18th century that an important inroad on the law relating to the removal of the poor was made by requiring actual chargeability before removal to their place of settlement (35 Geo. III. c. 101); and at the same time justices were empowered to suspend removal in the case of sickness.

By the statute of William III. (8 & 9 Will. III. c. 30), "to the end that the money raised only for the relief of such as are as well impotent as poor may not be misapplied and consumed by the idle, sturdy, and disorderly beggars," persons receiving parochial relief and their wives and children were required (under the punishment for refusal of imprisonment and whipping, or of having the reliefs abridged or withdrawn) to wear a badge on the shoulder of the right sleeve—that is to say, a large "P" together with the first letter of the name of the parish or place, cut in red or blue cloth; and a penalty was imposed on churchwardens and overseers relieving poor persons not wearing such badge. The provision (a revival of a much earlier law) continued down to 1810, when it was abolished.

Passes.

In 1744 provision was made reviving rather than introducing a system of magisterial "passes" for passing persons apprehended as rogues and vagabonds to their place of settlement (17 Geo. II. c. 5). Great abuses in conveying persons by passes, attributed to the neglect of this Act, led to its amendment nearly half a century later. Although these statutes fell into disuse they were not finally repealed until after the introduction of the present poor-law system.

Farming the poor.

In 1722 the system of farming the poor was introduced. By 9 Geo. I. c. 7, "for the greater ease of parishes in the relief of the poor," parish officers with the consent of the parishioners or inhabitants in vestry were authorized to purchase or hire houses, "and to contract with any person or persons for the lodging, keeping, maintaining, and employing any or all such poor in their respective parishes, townships, or places, as shall desire to receive relief or collection from this same parish, and there to keep, maintain, and employ all such poor persons, and take the benefit of the work, labor, and service of any such poor person or persons who shall be kept or maintained in any such house or houses, for the better maintenance and relief of such poor persons who shall be there kept or maintained." Any poor persons refusing to be so lodged were not to be entitled to relief. Small parishes could unite or contract with another parish for the maintenance of the poor.

Gilbert's Act.

A few years sufficed to develop the injurious effects of this mode of dealing with the poor, and the accumulated evils of the working of the poor laws led, in 1783, to the passing of the statute 22 Geo. III. c. 83, known as "Gilbert's Act," the principle of which was extensively adopted in subsequent legislation. The Act significantly recited that, notwithstanding the many laws now in being for the relief and employment of the poor, and the great sums of money raised for those persons, their sufferings and distresses are nevertheless very grievous, and by the incapacity, negligence, or misconduct of overseers, the money raised for the relief of the poor is frequently misapplied, and sometimes expended in defraying the charges of litigations about settlements indiscreetly and inadvisably carried on, and also recited the provisions of the 9 Geo. I. c. 7, relating to contracts for the maintenance of the poor, and that such provisions, from the want of proper regulations and management in the poorhouses or workhouses that have been purchased or hired under the authority of the said Act and for want of due inspection and control over the persons who have engaged in those contracts, have not had the desired effect, "but the poor in many places, instead of finding protection and relief, have been much oppressed thereby." "For the remedy of these grievances and inconveniences, and in order to make better and more effectual provision for the relief and employment of the poor, and to introduce a prudent economy in the expenditure of the parish money," much legislative machinery was introduced, which, although not compulsory, was very extensively adopted, and with many amendments remained on the statute book long after the Poor Law Amendment Act of 1834. Although the Act has now disappeared, having been expressly repealed (as it was by implication previously) in 1871, Gilbert's Act is memorable as having first introduced the representation of the poor by guardians, although not by the present system of election. The Act repealed 9 Geo. I. c. 7, as regarded the farming of the poor where Gilbert's Act was adopted, but agreements for the diet and clothing and work of poor in poorhouses, subsequently termed "houses of industry," were expressly sanctioned. The limits of this article do not admit even of an analysis of this important statute. In many respects a double system of administration sprang up in parishes, single or united, adopting Gilbert's Act, and in parishes not under that Act. In both, the conflict between the administration of relief in and out of the poorhouse arose, and continued from the time of the establishment of places of work whether termed workhouses, poorhouses, or houses of industry, and whether under special local or under general Acts.

Relief in and out of the workhouse.

In 1795 the 36 Geo. III. c. 23, reciting that a provision of the 9 Geo. I. c. 7, prohibiting relief to persons refusing to go into poorhouses, "has been found to have been and to be inconvenient and oppressive, inasmuch as it often prevents an industrious poor person from receiving such occasional relief as is best suited to the peculiar case of such poor person, and inasmuch as in certain cases it holds out conditions of relief injurious to the comfort and domestic situation and happiness of such poor persons," gave power to the overseers, with the approbation of the parishioners in vestry or of a justice of the peace, to distribute and pay collection and relief to industrious poor persons at their homes under certain circumstances of temporary illness or distress, and in certain cases respecting such poor persons or their families, or respecting the situation, health, or condition of any poorhouse, in any place wherein houses shall have been hired or built and a contract made with any person for lodging, maintaining, and employing the poor, although the poor persons refused to be so lodged and maintained. Justices had besides a "just and proper discretion" for special cause stated in writing to order relief for a time not exceeding a month. This Act, however, did not extend to places where houses of industry or other places were provided under Gilbert's Act or under any special Act.

The evils arising from farming the poor under the 9 Geo. I. c. 7 nevertheless continued in places not adopting Gilbert's Act. Contractors were often nonresident and not of sufficient responsibility to insure performance of their undertaking. In 1805 these special defects were sought to be met by requiring residence, sureties, and the approval of the contract by two justices (45 Geo. III. c. 54). But these remedies did not touch the whole extent of the evil of neglect of the poor. The laws for regulating workhouses and poorhouses were found deficient and ineffectual, especially when the poor in such houses were "afflicted with contagious or infectious diseases, in which cases particular attention to their lodging, diet, clothing, bedding, and medicine is requisite." A statute passed in 1790 (30 Geo. III. c. 49) enabled justices, or medical men authorized by them or the officiating clergyman of the parish, to visit workhouses, and on finding cause for complaint to certify to the quarter sessions, and thereupon the court was authorized to make orders for removing any cause of complaint; and, moreover, without waiting for this dilatory process, if on the visitation any of the poor were found afflicted with any contagious or infectious disease, or in want of immediate medical or other assistance, or of sufficient food, or requiring separation or removal, justices of the division were empowered to make an order for immediate relief according to the ature of the application. There can be no doubt that he legislation of five years later already noticed (36 Geo. III. c. 23) had reference to cases of this kind as well as to the hardships inherent in the rigid applica-ion of the practice of confining relief to the work-ouse.

elect estries.

In 1819 an Act (59 Geo. III. c. 12) was passed, the result of the report of a committee appointed two years before, containing a variety of provisions relating to the poor, mpowering the establishment of select vestries "for he concerns of the poor" and regulating their pro-eedings. Where these were established overseers ere prohibited from giving relief other than that rdered by the vestries, except temporary relief in cases f sudden emergency or urgent necessity. Justices had he power, as under earlier provisions, to order tem-orary relief in such cases, but they were prohibited rom ordering relief in parishes where select vestries ere established or in which the relief of the poor was nder the management of guardians, governors, or irectors, unless relief had been refused by such odies.

agrants.

An amelioration of the harsher features of the law, and the separation of that branch of it relating to vagrancy, are found in the leg-slation of the 18th and early part of the 19th century. n early times, as has been pointed out legislation ffecting labor and vagrancy was blended. Very radually labor was left to run a freer course. Provi-ions as to vagrancy and mendicity, including stringent aws in relation to constructive "sturdy beggars," "rogues," and "vagabonds," still formed a prominent eature of poor-law legislation.

In 1713 an Act was passed for reducing the laws elating to rogues, vagabonds, sturdy beggars, and agrants into one Act, and for more effectually pun-shing them and sending them to their homes, the manner of conveying them including whipping in very county through which they passed (12 Anne, st. 2, c. 23). This Act was in turn repealed in 1740; and he substituted Consolidation Act (13 Geo. II. c. 24), mbracing a variety of provisions, made a distinction etween idle and disorderly persons, rogues and vagabonds, and incorrigible rogues. Four years later a statute reciting that the "number of rogues, vagabonds, beggars, and other idle and disorderly persons daily increases, to the great scandal, loss, and annoyance of the kingdom," deals with a great variety of offences, continuing the rough classification already mentioned, and including among "idle and disorderly persons" punishable with hard labor in the house of correction "all persons who shall run away and leave their wives or children to the parish" and "all persons who shall unlawfully return to the parish or place from whence they have been legally removed by order of justices, without bringing a certificate," and also "all persons who, not having wherewith to maintain themselves, live idly without employment and refuse to work for the usual and common wages given to other laborers on the like work, in the parishes or places where they then are," and also all persons begging alms (17 Geo. II. c. 5).

The laws relating to idle and disorderly persons, rogues and vagabonds, incorrigible rogues, and other vagrants in England were again consolidated and amended in 1822 (3 Geo. IV. c. 40), but the Act being temporary and requiring amendment, was superseded two years later by the present Act, 5 Geo. IV. c. 83, commonly spoken of as the Vagrant Act, which with some additions and amendments includes the law relating to mendicity and some provisions concerning persons deserting or neglecting to support their families. Mendicity in the popular sense is now considered as appertaining to police rather than to poor laws. It must suffice here to note the change from former inhuman laws denoted by the fact that corporal punishment is confined by the Vagrant Act to the permissive infliction of whipping on male persons imprisoned as incorrigible rogues.

Irregularities of poor-law officers.

The misdoings of the "vagrant train," so often paraded by statute and so severely treated in former times, seem to have been trifling compared with the iniquities of some of those engaged in the administration of poor-law relief. In 1769 it was found necessary to prevent churchwardens and overseers from wilfully and knowingly making payments to or for the use of the poor in base and counterfeit money (9 Geo. III. c. 37). For this heinous offence a penalty limited to twenty shillings was imposed. The curious may compare this mild punishment with that inflicted on a wanderer from his home; for as recently as 1816 it was thought right to declare that it should not be lawful for any governor, guardian, or master of any house of industry or workhouse on any pretence to chain or confine by chains or manacles any poor person of sane mind, a provision significant of what passed within the walls by its prohibition as well as by the limitation.

Such were the most salient features of the legislation respecting the relief of the poor previous to the reform of parliament itself in 1832.

Evils and suggested remedies.

It had long been seen that there was something wrong which legislation had failed to set right. Sir Matthew Hale framed a scheme which was written soon after the middle of the 17th century, although not printed until after his death. The chief feature of his plan was "that the justices of the peace at the quarter sessions do set out and distribute the parishes in their several counties into several divisions, in each of which there may be a workhouse for the common use of the respective divisions wherein they are respectively placed,—to wit, one, two, three, four, five, or six parishes to a workhouse according to the greatness or smallness and accomodation of the several parishes," and that providing "a stock" for work in and out of the workhouses should be made compulsory. His views are thus stated:

> "At this day, it seems to me that the English nation is more deficient in their prudent provision for the poor than any other Christian state . . . . . In some other countries a beggar is a rare sight. Those that are unable to maintain themselves by age or impotency are relieved. And those that are able to supply their wants by their labor are furnished with employments suitable to their condition. And by this means there is not only a good and orderly education and a decent face of the public, but the more populous the state or country is the richer and the more wealthy it is. But with us in England, for want of a due regulation of things, the more populous we are the poorer we are; so that wherein the strength and wealth of a kingdom consists renders us the weaker and the poorer; and, which is yet worse poor families which daily multiply in the kingdom, for want of a due order for their employment in an honest course of life, whereby they may gain subsistence for them and their children, do unavoidably bring up their children either in a trade of begging or stealing or such other idle course, which again they propagate over to their children; and so there is a successive multiplication of hurtful or at least unprofitable people, neither capable of discipline nor beneficial employment.

He further remarks that the continuance of the evils he depicted "must in time prodigiously increase and overgrow the whole face of the kingdom, and eat out the heart of it." In lamenting the want of an industrious education he observes that a "man that has been bred up in the trade of begging will never, unless compelled, fall to industry; and on the other side, it is a wonderful necessity indeed that shall bring one bred up in civility or industry to beg." Almost all subsequent schemes looked up to Hale as their model; but all either were not accepted or did not succeed, although in some of the legislation of the 18th century imperfect attempts seem to have been made in this direction. Among other schemes Sir Josiah Child, in the reign of Charles II., who speaks of the poor in England having always been "in a most sad and wretched condition," proposed to abolish all settlements and receive every poor person that applied to incorporated societies or "fathers of the poor." John Cary, writing about 1700, having for the burden of his tract, and the cure of existing evils, to "provide work for those who are willing, and force them to work that are able," makes some pithy remarks.

> "He that walks the streets of London, and observes the fatigues used by the beggars to make themselves seem objects of charity, must conclude that they take more pains than an honest man doth at his trade, and yet seem not to get bread to eat. Beggary is now become an art or mystery, to which children are brought up from their cradles. Anything that may move compassion is made a livelihood, a sore leg or arm, or for want thereof a pretended one. The tricks and devices I have observed to be used by those people have often made me think that those parts, if better employed, might be made useful to the nation." "Licenses for alehouses were at first granted for good ends, not to draw men aside from their labor by games and sports, but to support and refresh them under it; whereas alehouses are now encouraged to promote the income of excise,—not considering withal that the labor of each man, if well employed, whilst he sits in an alehouse, would be worth much more to the nation than the excise he pays." "Our laws to set the poor at work are short and defective, tending rather to maintain them so than to give them to a better way of living. 'Tis true, those laws design well; but, consisting only in generals, and not reducing things to practicable methods, they fall short of answering their ends, and thereby render the poor more bold when they know the parish officers are bound either to provide them work or to give them maintenance."

In 1735 Mr. Hay, a member of the House of Commons, introduced a bill, which, however, was not passed, appointing guardians of a district, chosen by divers occupiers out of a list of persons qualified by estate in land, with power to purchase land, and build and furnish workhouses, and provide stock to set the poor to work, to be paid for by rate,—"every person to be deemed to be legally settled where he continued a year without being chargeable, and if he gained no such settlement then at the place of his birth, and if not born in the kingdom then where he should happen to want relief,"—parochial settlement to be abolished, and a county settlement substituted.

In 1753 bills were introduced into parliament by the earl of Hillsborough and Sir Richard Lloyd, but neither was passed. Lord Hillsborough proposed to repeal all existing Acts, re-enacting much, but getting rid of the notion of settlements and removals, and establishing a county board as governors of the poor with officers to carry out their by-laws, and hospitals for the impotent and the aged and their children, and for no other kind of poor. In the same year Fielding printed *A Proposal for making an effectual Provision for the Poor, for amending their Morals, and for rendering them useful Members of the Society*. His plan embraced county houses of correction, and places of work, maintenance, and punishment, including a "fasting room." It may be regarded as supplementary to schemes of the same period. Although all that fell from this author is worthy of attention, his plan cannot be examined closely here; but what he says of the state of things at the period, evidently the result of his daily observations as a magistrate and inhabitant of Westminister, is too striking to be passed over.

> "That the poor are a very great burden and even a nuisance to the kingdom, that the laws for relieving their distress and restraining their vices have not answered their purposes, and that they are at present very ill provided for and much worse governed are truths which every man will acknowledge. Every person who hath any property must feel the weight of that tax which is levied for the use of the poor; and every person who hath any understanding must see how absurdly it is applied. So very useless, indeed, is the heavy tax, and so wretched its disposition, that it is a question whether the poor or rich are actually more dissatisfied; since the plunder of the one serves so little to the real advantage of the other. For while a million yearly is raised among the rich many of the poor are starved; many more languish in want and misery; of the rest, numbers are found begging or pilfering in the streets to-day, and to-morrow are locked up in jails and bridewells. If we were to make a progress through the outskirts of the metropolis, and look into the habitations of the poor, we should there behold such pictures of human misery as must move the compassion of every heart that deserves the name of human. What indeed must be his composition who could see whole families in want of every necessary of life, oppressed with hunger, cold, nakedness and filth, and with diseases the certain consequence of all these! The sufferings indeed of the poor are less known than their misdeeds; and therefore we are less apt to pity them. They starve, and freeze, and rot among themselves; but they beg, and steal, and rob among their betters. There is not a parish in the liberty of Westminster which doth not swarm all day with beggars and all night with thieves."

The observations of Dr. Burn, a name known to every one who has considered the poor laws, whether as legislator, magistrate or lawyer, followed in 1764. Although the suggestions and observations in his *History of the Poor Laws* are worthy of the highest attention to any one entering into an historical retrospect, it must suffice here to say that the result of his experience and knowledge was that the laws then in force should "stand as to the main" but be rectified on two points—begging and the management of the poor by overseers. Dr. Burn says:

> "But how shall begging be restrained? which by a kind of prescriptive claim hath so long been accustomed to triumph above the laws. All sorts of severities, it appears, have been enacted against vagrants; and yet they wander still. Nevertheless, one would hope the disease is not past all remedy. If it is, let us cease the unequal contention, and submissively give up our fortunes to the next that comes with a pass, and tells us a justice of the peace hath so ordered it; but let beggars and vagrants be doing. There is one infallible way to put an end to all this, and the easiest in the world, which consists merely in a nonfeasance. Give them nothing. If none were to give, none would beg; and the whole mystery and craft would be at an end in a fortnight. Let the laws continue if you please to apprehend and punish the mendicants; but let something also be done effectually against those who encourage them. If the principal is punished, it is not reasonable the accessory should go free. In order to which, let all who relieve a common beggar be subject to a penalty."

As to the other "fundamental defect," as Dr. Burn styles the leaving the management of the poor to overseers, the position of overseers and their action are so admirably painted, and the description so applicable to the mode of administration down to the reform of 1834, that the observations, written in a happy strain of irony, must be inserted.

> "As to overseers of the poor, it is true the law provides that they shall be substantial householders. But many a man may be a substantial householder who is not fit to be an overseer of the poor. And in fact the office goes by rotation from one householder to another—some perhaps tenants at rack rent, whose lease expires the next year, others ignorant and unexperienced, others not willing to charge themselves to disoblige their neighbors; and all of them wanting to get over the office with as little trouble to themselves as possible; and if any, wiser than the rest, projects anything for the common good his office expires at the end of the year and his labor is frustrated, and in practice the office of an overseer of the poor seems to be understood to be this: To keep an extraordinary look-out to prevent persons coming to inhabit without certificates, and to fly to the justices to remove them; and if a man brings a certificate then to caution all the inhabitants not to let him a farm of £10 a year, and to take care to keep him out of all parish offices; to warn them, if they will hire servants, to hire them half-yearly or by the month, by the week or by the day, rather than by any way that shall give them a settlement, or if they do hire them for a year then to endeavor to pick a quarrel with them before the year's end, and so to get rid of them. To maintain their poor as cheap as possibly they can; at all events not to lay out two-pence in prospect of any future good, but only to serve the present necessity; to bargain with some sturdy person to take them by the lump, who yet is not intended to take them, but to hang over them *in terrorem* if they shall complain to the justices for want of maintenance. To send others out into the country a begging (for why cannot they go as well as others they will mention, who are less able in body?) and

the feebler they are the more profitable will be their peregrination. To bind out poor children apprentices, no matter to whom or to what trade, but to take especial care that the master live in another parish. To move heaven and earth if any dispute happens about a settlement, and in that particular to invert the general rule, and stick at no expense. To pull down cottages. To drive out as many inhabitants and admit as few as possibly they can; that is to depopulate the parish in order to lessen the poor rate. To be generous, indeed, sometimes, in giving a portion with the mother of a bastard child to the reputed father, on the condition that he will marry her; or with a poor widow (for why should she be deprived of the comforts of matrimony?) —always provided that the husband is settled elsewhere. Or if a poor man with a large family appears to be industrious they will charitably assist him in taking a farm in some neighboring parish, and give him £10 to pay his first year's rent with; and if any of their poor has a mercantile genius they will purchase for him a box, with pins, needles, laces, buckles and such like wares, and send him abroad in the quality of a petty chapman, with the profits whereof, and a moderate knack of stealing, he can decently support himself, and educate his children in the same industrious way. But to see that the poor shall resort to church, and bring their children there to be instructed; to contract with a master that he shall procure his apprentice at proper times to be taught to read and write; to provide a stock of materials to set the poor on work, to see the aged and impotent comfortably sustained, the sick healed, and all of them clothed with neatness and decency—these and such like it is to be feared are not so generally regarded as the laws intended and the necessity of the case requires."

Dr. Burn's remedy was not to abolish overseers altogether, but, that while they or a permanent overseer should collect the rate, a general superintendent over a certain number of parishes should be appointed by the justices at sessions, and the disposal of the rate directed accordingly.

How far the criticism and suggestions made, from those of Sir Matthew Hale downwards from time to time, influenced the legislation already indicated of the 18th century and the early part of the 19th, it is impracticable to discover. One thing is certain, that evils grew apace: ratepayers on the one hand, the poor on the other, political economists and philanthropists, magistrates and jurists, and observers of every kind were dissatisfied. For the general state of the poor in the beginning of the 19th century as presented to the accurately observant eye and ear of our English Juvenal, we glean more from his *Borough* than from a pile of statistics. Of the poor who were chargeable to the parish Crabbe says:

> "To the most we give
> A weekly dole, and at their homes they live."

Of the workhouse or house of industry, "the pauper palace which they hate to see," he speaks mournfully. In prose he wrote of the poor who "must be considered in every place as a large and interesting protion of its inhabitants," condemning the workhouse system, alike the pauper palace and the house rented for the poor—the

> "House that holds the parish poor,
> Whose walls of mud scarce bear the broken door."

Enumeration and classification of evils.

A closer examination of the system of maintaining the poor than could be obtained by casual visitors, or even constant residents having no special duty to examine or inquire, showed, in full accord with the public criticism already examined, and in spite of it, that the fund which the famous statute of Elizabeth directed to be employed in setting to work children and persons capable of labor, but using no daily trade, and in the necessary relief of the impotent, was by degrees applied to purposes opposed to the letter and still more to the spirit of that law, and destructive to the morals of the most numerous class and to the welfare of all. The great source of abuse was the relief afforded out of the workhouse to able-bodied persons,—a class never intended by the legislation as fit objects. The description of relief was also very objectionable. Its most usual form was that of relieving the applicants either wholly or partially from the expense of obtaining house room. Partial relief from that expense was given or professed to be given by exempting the occupants of a cottage or apartment from the payment of rates on the ground of poverty, and in a great number of cases by paying the rent out of the parish fund. Relief afforded in money to the able-bodied on their own account or on that of their families was still more prevalent. This was generally effected by one of the five following expedients: (1) relief without labor, (2) the allowance system, (3) the roundsman system, (4) parish employment, (5) the labor-rate system. (1) The relief without labor was by the parish giving to those who were or professed to be without employment a daily or weekly sum, without requiring from the applicant any labor. (2) "Allowance" sometimes comprehended all parochial relief afforded to those who were employed by individuals at the average rate of wages of the district, and was sometimes confined to the relief which a person so employed obtained on account of his children, in that case any relief obtained on his own account being termed "payment of wages out of rates." In some places allowance was given only occasionally or to meet occasional wants, for instance, to buy clothing or food or to pay the rent of a cottage or apartment. Sometimes the income of the poor was regulated by the name of "scales"—giving in money the price of so many loaves of bread or of a specific measure of flour, according to the number of the family. (3) The roundsman (or, as it was sometimes termed, the billet, or ticket, or item) system was the parish paying the occupiers of property to employ the applicants for relief at a rate of wages fixed by the parish, and depending, not on the services but on the wants of the applicants, the employer being repaid out of the poor rate all that he advanced in wages beyond a certain sum. According to this plan the parish in general made some agreement with a farmer to sell to him the labor of one or more paupers at a certain price, paying to the pauper out of the parish funds the difference between that price and the allowance which the scale, according to the price of bread and the number of his family, awarded to him. It received the local name of billet or ticket system from the ticket signed by the overseer which the pauper in general carried to the farmer as a warrant for his being employed, and afterwards took back to the overseer, signed by the farmer, as a proof that he had fulfilled the conditions of relief. In other cases the parish contracted with a person to have some work performed for him by the paupers, at a given price, the parish paying the paupers. In many places the roundsman system was carried out by means of an auction, all the unemployed men being put up to sale periodically, sometimes monthly or weekly, at prices varying according to the time of year, the old and infirm selling for less than the able-bodied. (4) As for parish employment, although work is made by the statute of Elizabeth a condition precedent to relief otherwise than in the case of the impotent, and it is a duty of the parish officers to provide it, payment by them for work was the most unusual form in which relief was administered. Scarcely more than one-twentieth part of the sum yearly expended for the relief of the poor at the period immediately preceding the inquiry that led to the amendment of the law in 1834 was paid for work, including work on the roads and in the workhouses. This was easily accounted for "by many causes, including the trouble and difficulty attendant upon superintendence on the part of parish officers." (5) An agreement among the ratepayers that each of them should employ and pay out of his own money a certain number of the laborers settled in the parish, in proportion not to his real demand for labor but to his rental or to his contribution to the rates, or to the number of horses that he kept for tillage, or to the number of acres that he occupied, or to some other fixed standard, has been denominated the labor-rate system. This system was generally enforced by an additional voluntary rate on those who did not employ their full proportion.

As illustrating the difficulties attendant upon providing for the poor, a temporary Act passed in 1832, which has disappeared from the statute book (as founded on vicious notions), may be noticed, applying to parishes where the poor rates exceeded 5d. in the pound. It recited that, notwithstanding the many laws in force for the relief and employment of the poor, many able-bodied laborers are frequently entirely destitute of work or unprofitably employed, and in many instances receive insufficient allowance for their support from the poor rates, and "the mode of providing employment for the poor which may be expedient in some parishes may be inexpedient in others, and it may therefore be desirable to extend the powers of parish vestries in order that such a course may be pursued as may be best adapted to the peculiar circumstances of each parish," and enabled vestries (without interfering with Gilbert's Act), with the approval of justices at petty sessions, to make special agreements solely for the purpose of employing or relieving the poor of the parish.

Growth of the poor-rate.

The following table exhibits the growth of the poor rate from the middle of the last century to a date immediately preceding the reforms effected in 1834:

Years.	Estimated Population of England and Wales.	Expended on the Relief of the Poor.	Per Head of the Population.	
		£	s.	d.
1750	6,467,000	689,000	2	2
1760	6,736,000	965,000	3	0
1770	7,428,000	1,306,000	3	6
1780	7,953,000	1,774,000	4	5
1790	8,675,000	2,567,000	5	11
1800	9,140,000	3,861,000	8	5
1810	10,370,000	5,407,000	10	3
1818	11,702,000	7,890,000	13	4
1820	12,046,000	7,329,000	12	2
1830	13,924,000	6,829,000	9	9
1832	14,372,000	7,036,000	9	9

It will be observed that subsequent to 1818 there was an apparent diminution in the whole sum expended for the relief of the poor, making a difference of between 11 and 12 per cent.; but the decline in the prices of the necessaries of life (wheat alone had fallen considerably,—more than one-half in one of the intermediate years) was more than equivalent to the difference.

Commission of inquiry.

The conviction, arising principally from the increase of the poor rates, that a change was necessary either in the poor law as it then existed or in the mode of its administration led to the issuing of a commission in 1832 "to make diligent and full inquiry into the practical operation of the laws for the relief of the poor in England and Wales, and into the manner in which those laws were administered, and to report their opinion as to what beneficial alterations could be made." The result of this inquiry was laid before parliament in 1834. The commissioners reported "fully on the great abuse of the legislative provision for the poor as directed to be employed by the statute of Elizabeth," finding "that the great source of abuse was the outdoor relief afforded to the able-bodied on their own account or on that of their families, given either in kind or in money." They also reported that "great maladministration existed in the workhouses." To remedy the evils they proposed considerable alterations in the law, and the principal portion of their suggestions was embodied in the Poor-Law Amendment Act, 1834 (4 & 5 Will. IV. c. 76).

Poor-Law Amendment Act, 1834.

The Act was based on the principle that no one should be suffered to perish through the want of what is necessary for sustaining life, but at the same time that if supported at the expense of the public he must be content to receive such support on the terms most consistent with the public welfare; and the objects of the Act were first, to raise the laboring classes, that is to say, the bulk of the community, from the idleness, improvidence and degradation into which the maladministration of the laws for their relief had thrown them, and, secondly, to immediately arrest the progress and ultimately to diminish the amount of the pressure on the owners of lands and houses.

Poor-Law Commissioners.

Under the Act three commissioners were appointed (originally for five years, but subsequently continued from time to time) styled "the Poor-Law Commissioners for England and Wales," sitting as a board and appointing assistant commissioners and other officers. The administration of relief according to the existing laws was subject to their direction and control and to their orders and regulations for the government of workhouses and the guidance and control of guardians and vestries and the keeping and allowing of accounts and contracts, without interfering with ordinary relief in individual cases.

Formation of districts and poor-law unions.

The favorable state of the country at the time presenting many facilities for the introduction of the law which it was important to render available with as little delay as possible, the whole of England and Wales was divided into twenty-one districts, to each of which an assistant commissioner was appointed. The commissioners under their powers (gradually put into operation—a circumstance which beneficially affected legislation of the period, as for example, the commutation of tithes and the introduction of police) formed poor-law unions by uniting parishes for general administration and building workhouses, guardians elected by the rate-payers (or *ex officio*) having the general government and administration of relief. The expense was apportioned to each parish on settled principles and rules, with power, however, to treat the united parishes as one for certain purposes. Outdoor relief might be given, on the order of two justices, to poor persons wholly unable to work from old age or infirmity. No rule appears to have been more fully sanctioned by practical results as of an advantageous nature than that under which the country was by degrees parcelled out into unions. In parishes no adequate power existed for carrying into effect the rules and regulations of the amended system. No principle of classification could be adopted within the workhouses, and the law was liable to be thwarted in its most material objects by petty interests of a local and personal character. With the aid of boards of guardians and their subordinate officers these interests were neutralized and the law was rendered uniform in its operation. The economical advantages derived from acting on a large scale are self-evident. Waste unavoidably takes place when the purchase of supplies for a single parish forms a separate transaction.

Cost of administration.

The second report of the commissioners showed that of one hundred and ten unions which had been in operation more than a year, the saving in forty-three of the largest was 46 per cent.; in twenty-four of the smallest unions the rate of saving was not more than 29 per cent.: and in twenty-six unions of intermediate size a saving of 42 per cent. was effected. Even in many parishes not then included in a union the wide promulgation of the principles of the amending act gave an impulse to improvement in the administration of the poor laws, which was attended by a marked reduction in the expenditure.

The total amount of money expended in the relief of the poor in England and Wales during the twelve years prior to the passing of the Poor-Law Amendment Act (1823 to 1834) amounted to upwards of £76,096,000 [$369,826,560], and during the twelve subsequent years to less than £57,247,000 [$278,220,420]. As the commissioners early remarked:

> "It could not be expected that an Act which so materially disturbed the distribution of as large a sum of money as £7,000,000 [$34,020,000] per annum, which of necessity changed the source from which a large portion of the inhabitants of the country derived their customary means of subsistence and which in so doing opposed itself not only to the interests, the prejudices, and the fears of a large portion of the population, but pressed hardly on the sincere though mistaken notions of charity which were established in the hearts of others, could possibly be carried into effect without difficulty and resistance."

The metropolis.

The obstacles which the Act had to contend with in the metropolis chiefly arose from the confusion and perplexity of jurisdiction which existed in the one hundred and seventy parishes comprised within the city of London and the metropolitan district, some of these containing governing bodies of their own; in some the parish business was professedly managed by open vestries, in others by select vestries, and, in addition to these, there were elective vestries, under Sturges Bourne's Act, Sir John Hobhouse's Act and other Acts; and the majority of the large parishes were managed under local Acts by boards of directors, governors and trustees. These governing bodies executed a great variety of functions besides regulating the management of the poor. The power, patronage and the indirect advantages which arose from the administration of the local funds were so great that much opposition took place when it was proposed to interfere by constituting a board to be annually chosen and freely elected by the ratepayers, on which the duty of regulating the expenditure for the relief of the poor was to depend. The general management of the poor was, however, on a somewhat better footing in London than in the country.

The old system and the new.

Some opposition was experienced to the introduction of the full benefits of the Act into the unions incorporated under Gilbert's Act, many provisions of which conflicted with the new system. On the early dissolution of seventeen of those incorporations by the commissioners under their powers, it was found, however, that the rates were sensibly diminished. Much resistance of a general nature was encountered. Not only was the economical working of the new principles of management disputed, but a strong feeling was aroused against what was thought to be the inhumanity of the rigorous rules to which paupers had to submit in workhouses. While many proofs existed of the necessity for the introduction of a new system—such as that, while wheat was rotting in pauperized, and as yet unreformed, districts of the south of England for want of reapers at 21s. and 24s. an acre, at the very same time able-bodied healthy men were lying under the hedges in another part of the same county with a parish allowance of 3s. a week—on the other hand it was felt as a grievance that old couples were refused relief at their own houses, and that if they entered the workhouse the sexes were separated. Throughout the country the reproachful name of "Bastille" was attached to the workhouse, and this is in many districts still retained, though no longer as an intended censure. In part of Devonshire prejudice was carried to the extent of a rumor leading poor persons to believe that the bread distributed by the relieving officers was mixed with poisonous ingredients.

Both Houses of Parliament were inundated for years with petitions against the new system, meetings were held at which inflammatory language was used, and in some instances riotous proceedings marked the opposition. It was remarked that the acts of violence were in the most pauperized districts, which had been conspicuous for the maladministration of the poor rates. The work, however, went forward, although three parliamentary committees (one of the Lords and two of the Commons) instituted a searching and severe scrutiny before the organization of the system was completed. Notwithstanding adverse circumstances, including stagnation of trade, cold weather and an epidemic of great severity, by the end of 1837 nearly the whole of England had been formed into unions, the benefits of the new system were gradually recognized, and a poor law was introduced into Ireland (see IRELAND). As to poor-law administration in Scotland see SCOTLAND.

Medical attendance.

The reform of the poor laws affected a variety of persons besides paupers and ratepayers. No question was more widely discussed than that of medical attendance on the sick poor. The outdoor relief of the sick was usually effected by a contract with a surgeon, which, however, in general only included those who were parishioners. When non-parishioners became chargeable from illness, an order for their removal to their place of settlement was obtained, which was suspended until they could perform the journey; in the meantime they were attended by the local surgeon, but at the expense of the parish to which they belonged. The poor-law commissioners in their report of 1834 stated that on the whole medical attendance seemed in general to be adequately supplied and economically, considering only the price and the amount of attendance. Great good was effected by the establishment of dispensaries promoted by Mr. Smith of Southam to enable the laboring classes to defray, from their own resources, the expense of medical treatment. While stating that the country was much indebted to him for his exertions, the commissioners were not prepared to suggest any legislative measures for their encouragement; but dispensaries have been recently applied to the relief of the poor in the metropolis. The medical and surgical association (now the British Medical Association), of which Sir Charles Hastings was president, took up the subject, and a committee, over which Dr. Davis (of Presteign) presided, made an inquiry and report,—by no means in hostility to, but in full accord with, the chiefs of the new poor-law administration. The present mode of giving medical relief is noticed below.

Local Government Board.

After an intermediate transfer in 1847 of the powers of the poor-law commissioners, and the constitution of a fresh board styled "commissioners for administering the laws for relief of the poor in England," it was found expedient to concentrate in one department of the Government the supervision of the laws relating to the public health, the relief of the poor, and local government; and this concentration was in 1871 carried out by the establishment (by Act of Parliament 34 & 35 Vict. c. 70) of the Local Government Board.

In the subsequent part of this article the governing board, whether the original poor-law commissioners or commissioners for administering the laws for relief of the poor, or the present local government board, is spoken of as the central board, as the orders at present in force are of various dates, and chiefly issued before the existence of the present local government board.

By numerous Acts of Parliament passed subsequent to the Amendment Act of 1834 the administration of relief has been affected in various ways. It would be an unprofitable task, and inconsistent with the objects and limits of this article, to give a chronological summary of those Acts down to the present time, but they are taken into account in treating of various heads of poor-law administration.

It is to be observed that the relief of the poor of every union governed by a local Act is administered by a board of guardians elected according to the Poor-Law Acts.

Although containing very important provisions, the Act of 1834 was rather to restore the scope and intention of the statute of Elizabeth by placing its administration in the hands of responsible persons chosen by the ratepayers, and themselves controlled by the orders of a central body, than to create a new system of poor laws.

The agents and instruments by which the administration of relief is afforded are the following.

Guardians.

The guardians of the poor regulate the cases and description of relief within the union; a certain number of guardians are elected from time to time by the ratepayers. The number is determined by the central board, by whom full directions as to the mode of election are given. In addition to those elected there are *ex officio* guardians, principally local magistrates. The guardians hold their meetings frequently, according to the exigencies of the union. Individual cases are brought to their notice,—most cases of resident poor by the relieving officer of the union, the case of casual paupers by him or by the workhouse officers by whom they were admitted in the first instance. The resident poor frequently appear in person before the guardians. The mode of voting which the guardians follow in respect to any matter they differ on is minutely regulated, and all their proceedings as well as those of their officers are entered in prescribed books and forms. They have a clerk, generally a local solicitor of experience, who has a variety of responsible duties in advising, conducting correspondence and keeping books of accounts, and carrying out the directions of the guardians, who in their turn are subject to the general or special regulations of the central board. The various officers of the union from the medical officer to workhouse porters, including masters and matrons of workhouses, are generally appointed by the guardians; and the duties of all the officers are specifically prescribed by the regulations issued by the central board.

Among a multitude of miscellaneous duties and powers of the guardians apart from the ordinary duties of ordering or refusing relief in individual cases and superintending the officers of the union, the duties devolve on them of considering the adjustment of contributions to the common fund whether of divided or added parishes, and matters affecting other unions, the building of workhouses and raising of money for that and other purposes, the taking of land on lease, the hiring of buildings, special provisions as to superannuation and allowances to officers, the maintenance and orders as to lunatics apart from individual instances, and the consideration of questions of settlement and removal. A paramount obligation rests on the guardians to attend to the actual visitation of workhouses, schools, and other institutions and places in which the poor are interested, and to call attention to and report on any irregularity or neglect of duty. Guardians may charge the rates with the expenses of attending conferences for the discussion of matters connected with their duties (Poor-Law Conferences Act, 1883). In relation to expenditure the guardians have very considerable but restricted powers. Among other officers they appoint a treasurer for the union.

Overseers.

Overseers of the poor are still appointed under the statute of Elizabeth, and the guardians cannot interfere with the appointment. As, however, the relief of the poor is now administered by boards of guardians, the principal duties of overseers relate to the making and collecting of rates and payments. The guardians, by order of the central board, may appoint assistant overseers and collectors.

Inspectors.

Inspectors appointed by the central authority assist in the execution of the poor laws by periodically visiting and inspecting every workhouse and place wherein any poor person in receipt of relief is lodged, attending meetings of boards of guardians and every local meeting at which general questions may be raised or discussed, and taking part in meetings but not voting at them. The inspectors have great powers in calling before them and examining persons and books and proceedings. Besides the usual inspectors, persons may be appointed by the central authority to act in conducting special inquiries.

Provisions relating to expenditure and the audit of accounts are noticed in a subsequent part of this article.

Some principles connected with the system of poor-law administration call for concise notice.

Principles involved in the administration of relief.

As the right to relief exists, the law recognizes the obligation to afford it to persons unable to maintain themselves. The refusal of the officers whose duty it is to give it is an indictable offence; and, although a means of punishment does not constitute a remedy, it seems a mandamus to guardians of the poor will, in extreme and exceptional cases, be granted. The liability to summary proceedings now, however, operates as a preventive to neglect of duty. If, by reason of the neglect of overseers to collect rates or to pay the guardians of the poor, any relief directed by the guardians to be given to any poor person is delayed or withheld, or if overseers disobey a justice's order to give temporary relief, or if any officer wilfully neglects or disobeys the orders of the central board, penalties are incurred. The control of the central board is, except in very rare cases, found effective to secure the due administration of the law.

The recognition of the right to relief as a legal claim allows and indeed necessitates the imposition of restraints, apart from provisions connected with the law of settlement and removal, more fully noticed hereafter. Persons, however poor, wandering abroad to beg or gather alms, or placing themselves in any public place for that purpose, become subject to the vagrancy laws.

Private relief, pecuniary or otherwise, may be asked for and obtained so long as it does not involve any false pretence or dishonest or prohibited means of gaining a livelihood. Any person able by work or other means to maintain himself or his family, who, by wilful refusal or neglect to do so, becomes chargeable for any part of his family, commits an offence. Poverty or idleness short of this, and apart from the case of liability in respect of children under elementary and industrial school Acts, is not an offence against the law.

Obligation to make use of public provision.

There are circumstances, however, where relative liabilities make it a duty for persons to avail themselves of the public provision for relief. The culpable neglect of a person to provide another under his control and in his legal custody, who is actually helpless, as an infant or lunatic, with the means of life constitutes a crime, and by the express provision of a poor-law Act any parent wilfully neglecting to provide adequate food, clothing, medical aid, or lodgings for his child, being in his custody under the age of fourteen, whereby the health of such child is or is likely to be seriously injured, may be summarily convicted (31 & 32 Vict. c. 122), in analogy to the law making it an indictable misdemeanor for a master or mistress who is legally liable to provide any apprentice or servant with necessary food, clothing, or lodging, wilfully and without lawful excuse to refuse or neglect so to provide (24 & 25 Vict. c. 100). Something more than the mere abstention from seeking parochial relief without any intentional neglect is necessary to lay a criminal as distinguished from a moral responsibility on destitute persons.

Private relief not an offence.

Although under the vagrancy laws public begging is an offence, the giver of such unlawful charity is not subject to legal restraint. In early times attempts were made to impose such restraints. An Act of 1349 (23 Edw. III. c. 7) provided that none on pain of imprisonment should under color of piety or alms give anything to a beggar who was able to labor, and nearly two centuries later an Act (22 Hen. VIII. c. 12) already noticed, relating to poor compelled to live by alms, and the punishment of vagabonds and beggars, provided that any person giving any harbor, money, or lodgings to any strong beggar who violated the statute should make such fine to the king as the justices in sessions should appoint; and as late as the commencement of the 17th century givers to beggars were subject to a penalty (1 Jas. I. c. 7). These Acts, however, eventually disappeared from the statute book.

Dr. Burn advocated, as has been seen, the infliction of a penalty for relieving a common beggar; but, although aiders and abettors in the commission of even petty offences are now punishable, it is not attempted to apply the law to bestowers of charity, whether in the streets and highways or elsewhere.

It is in vain to impose the doctrines of political economy in restraint of natural instincts. Such doctrines are scattered as chaff before the wind when opposed by the teachings of the nursery rhymes of "The Beggar's Petition," or to the fascinating description where the beggar figures as "a well-remembered guest," or to the sympathy enlisted by Charles Lamb's essay "A Complaint of the decay of Beggars in the Metropolis."

Relief by way of loan.

Although in most cases the relief given to the poor is practically a gift, and does not constitute an available debt, the plan of giving relief by way of advance as a loan was introduced early in the present century, and the Poor-Law Amendment Act (1834) enacted that any relief, or the cost thereof, which shall be given to or on account of any poor person above the age of twenty-one or to his wife or any part of his family under the age of sixteen, and which the said commissioners shall by any rule, order, or regulation declare or direct to be given or considered as given by way of loan, and whether any receipt for such relief, or engagement to pay the same, or the cost price thereof, or any part thereof, shall have been given or not by that person to or on account of whom the same shall have been so given, shall be considered, and the same is hereby declared to be, a loan to such poor person (4 & 5 Will. IV. c. 76, § 58). By the same Act power was given to enforce payment by means of a summons before justices to attach wages. A subsequent statute gives power to the guardians to recover loans to paupers in the county court (11 & 12 Vict. c. 110). By order of the central board, guardians may, in the cases within the provision of the Poor-Law Amendment Act above set out, give relief by way of loan, but no relief contrary to the regulations can be given in this way. The restriction was necessary, as formerly some guardians granted outdoor relief by way of loan contrary to the recent principles of administration of relief.

Liability of relations.

The criminal liability of parents and others *in loco parentis* to provide sustenance has been considered. The purely civil liability for necessaries under implied contracts is of course outside the scope of this article, but there is an express liability created by the poor laws. The liability of the father and grandfather and the mother and grandmother and the children of poor persons under the statute of Elizabeth has been set out in an earlier part of this article. The statute extends only to natural relations. The liability is enforced by orders of magistrates after chargeability, who adjudicate as to the amount after hearing the facts and taking into consideration the ability of the relative. The relief of actual destitution should always precede investigation as to the liability of other persons than the parish to contribute to it. Indeed actual chargeability to the union is in general a condition precedent to an order upon the relative.

In treating of the persons entitled to relief it may be mentioned that, in accordance with the general law, a wife is to be treated as one with her husband who is compellable to maintain her; and, as on the one hand the wife is entitled under ordinary circumstances to relief equally with the husband, the latter is the person to apply for and to receive relief.

With respect to children, they form part of the father's family until they become "emancipated." During the minority of a child there can be no emancipation, unless he marries and so becomes himself the head of a family, or contracts some other relation so as wholly and permanently to exclude the parental control.

By the amendment of the poor laws in 1834 all relief given to or on account of the wife, or children under sixteen, not being blind or deaf and dumb, is considered as given to the husband or father as the case may be; and any relief given to children under that age of a widow is considered as given to her (4 & 5 Will. IV. c. 76, § 56); but this provision does not interfere with the liability imposed by the statute of Elizabeth. Further a man marrying a woman having legitimate or illegitimate children is liable to maintain them as part of his family, and is chargeable with all relief on their account until they attain sixteen or until the death of the mother (*ibid.*, § 57). A married woman having separate property is liable for the maintenance of her husband and children on their becoming chargeable (45 & 46 Vict. c. 75).

The position of illegitimate children and their parents stands on a distinct foundation. By a statute of 1576 (18 Eliz. c. 3) justices were empowered at discretion to charge the mother and reputed father of bastards with their maintenance on the pain of imprisonment in default. The principle of this statute, renewed and not expressly repealed until recently, is carried out now, after receiving repeated attention, especially on the great reform of the poor laws and administration of relief in 1834, by an order of maintenance on the reputed father, at the instance of the mother, or where the child is actually chargeable to a union or parish at the instance of the guardians. Such order is in force until the child is thirteen, and in some instances until sixteen. The main features of the Acts are concisely stated in the article BASTARDY.

The exigencies necessitating relief.

The conditions of persons entitled to relief are indicated by the terms of the statute of Elizabeth. If they fall within the definitions there given they have right to relief. A fundamental principle with respect to legal relief of the poor is that the condition of the pauper ought to be, on the whole, less eligible than that of the independent laborer. The pauper has no just ground for complaint, if, while his physical wants are adequately provided for, his condition is less eligible than that of the poorest class of those who contribute to his support.

Although a fund has become a practical necessity, it should be always borne in mind that he who claims it is not honest if his own labor and work can suffice to provide for his wants. It is as immoral and unjust to take unnecessarily from the industrious and saving by force of a law made and a tax raised for other objects as it would be for a laborer of equal means to pillage and take from the pocket of his fellow laborer.

If a state of destitution exists, the failure of third persons to perform their duty, as a husband, or relative mentioned in the statute of Elizabeth, neglecting those he is under a legal obligation to support, is no answer to the application. The relief should be afforded, and is often a condition precedent to the right of parish officers to take proceedings against the relatives or to apply to other poor unions. The duty to give immediate relief must, however, vary with the circumstances. The case of wanderers under circumstances not admitting of delay may be different from that of persons resident on the spot where inquiry as to all the circumstances is practicable. The statute of Elizabeth contemplated that the relief was to be afforded to the poor resident in the parish, but it is contrary to the spirit of the law that any person shall be permitted to perish from starvation or want of medical assistance. Whoever is by sudden emergency or urgent distress deprived of the ordinary means of subsistence has a right to apply for immediate relief where he may happen to be. Persons comprehended within this class are called "casual poor," although the term "casuals" is generally used in reference to vagrants who take refuge for a short time in the "casual wards" of workhouses.

Various tests are applied to ascertain whether applicants are really destitute. Labor tests are applied to the able-bodied, and workhouse tests are applied to those to whom entering a workhouse is made a condition of relief.

Nature and kind of relief.

As to the nature and kind of relief given under the poor laws the great distinction restored rather than introduced by the amendment of the poor-law system in 1834 was giving all relief to able-bodied persons or their families in well-regulated workhouses (that is to say, places where they may be set to work according to the spirit and intention of the statute of Elizabeth), and confining outdoor relief to the impotent—that is, all except the able-bodied and their families. Although workhouses formed a conspicuous feature in legislation for the poor from an early period, the erection of those buildings for unions throughout the country where not already provided followed immediately on the amendment of the system in 1834. Since that time there has been a constant struggle between the pauper class and the administrators of the law, the former naturally wishing to be relieved at their own homes, and in many instances choosing rather to go without aid than to remove within the walls of the workhouse.

Relief given in a workhouse is termed "in (or indoor) maintenance" relief, and when given at the homes of the paupers is termed "outdoor relief." The regulations, accounts, and returns to parliament, as well as the principles governing relief, are based on these distinctions. It is impossible, however, to apply rigid principles very closely, or rather the exceptions in practice are so numerous that the majority of resident poor are relieved at their own homes by being supplied with necessaries in kind, or by payment either wholly or in part in coin, as circumstances are held to demand or warrant. The general order is that every able-bodied person, male or female, requiring relief shall be relieved only in the workhouse, together with such of the family as may be resident with such able-bodied person, and not in employment, including his wife, residing with him. The exceptions made are where the person requires relief on account of sudden and urgent necessity, or on account of any sickness, accident, or bodily or mental infirmity affecting such person or any of his family; where relief is required for the purpose of defraying the expenses of burial of any of the family; in the case of widows, relief in the first six months of her widowhood when she has legitimate children dependent upon her incapable of earning a livelihood, and has no illegitimate children born after her widowhood. Further relief in or out of the workhouse may be given by guardians in their discretion to a wife or children of an able-bodied man not resident within the union.

By the Industrial School Act any child found begging or receiving alms (whether actually or under the pretext of selling or offering for sale anything), or being in any street or public place for the purpose of begging or receiving alms, or found wandering and not having any home or settled place of abode or proper guardianship or visible means of subsistence, or found destitute, either being an orphan or having a surviving parent who is undergoing penal servitude or imprisonment, or that frequents the company of reputed thieves (as also in some other cases recently added), may be sent to a certified industrial school, and while a school is being found justices may order detention for a week in the workhouse.

In the metropolis justices have power to cause inmates of dangerous structures to be received into a workhouse.

Asylums.

Besides workhouses, district asylums are provided for the destitute poor in certain places. Under the Poor-Law Amendment Act, 1844, reciting that it was expedient that more effectual means should be provided for the temporary relief of poor persons found destitute and without lodgings within the district of the metropolitan police or the city of London, and in Liverpool, Manchester, Bristol, Leeds, and Birmingham, district boards were established, by which provision is made for such temporary relief and setting to work therein of any poor person found destitute within any such district, not professing to be settled in any parish included in it and not known to have any place of abode there and not charged with any offence under the Vagrant Act.

In 1867 under the Metropolitan Poor Act of that year unions and parishes in the metropolis were by order of the board formed into asylum districts, in each of which there is one asylum or more for the reception and relief of the sick, insane, or infirm, under a body of managers partly elective and partly nominated by the board, who build or hire asylums and furnish them, and appoint committees. The attendance at the asylum of a special commissioner of lunacy is provided for. Special provision is made as well for outdoor as indoor medical relief by providing dispensaries and the dispensing of medicines, with regulations for the appointment of medical officers in the district.

The necessarily large expenditure for the asylums is principally defrayed by a fund called the metropolitan common poor fund, by contributions from the several unions, parishes, and places in the metropolis. The amount of the respective assessments is determined by the local government board according to the valuation lists (noted hereafter) or on such other basis as the board directs, the contribution being enforced by a precept of the board; and the bodies called on to pay levy the amount by a rate on occupiers of ratable property in the nature of a poor rate.

Workhouse rules.

Admission to a workhouse may be by a written order of the board of guardians, or by the master or matron (or in their absence by the porter) without an order in any case of sudden or urgent necessity, or provisionally by a relieving officer, or overseer, or churchwarden. Any person who is brought by a policeman as having been found wandering in a state of destitution may be admitted. It is to be observed generally, with respect to all persons who may apply for admission into the workhouse under circumstances of urgent necessity, that their destitution, coupled with the fact of being within the union or parish, entitles them to relief, altogether independently of their settlement (see below), if they have one, which is a matter for subsequent inquiry.

The regulations for the government of workhouses fall under two classes: (1) those which are necessary for the maintenance of good order in any building in which considerable numbers of persons of both sexes and of different ages reside; (2) those which are necessary in order that these establishments may not be almshouses, but workhouses in the proper meaning of the term.

The inmates of a workhouse are necessarily separated into certain classes. In no well-managed institution of this sort, in any country, are males and females, the old and the young, the healthy and the sick, indiscriminately mixed together. The general classification of paupers in the workhouse so far as the structure admits is as follows: Class 1, men infirm through age or any other cause; Class 2, able-bodied men, and youths above the age of fifteen; Class 3, boys above the age of seven and under fifteen; Class 4, women infirm through age or any other cause; Class 5, able-bodied women, and girls above fifteen; Class 6, girls above seven and under fifteen; Class 7, children under seven. To each class is assigned that ward or separate building and yard which may be best fitted for the reception of such class, and each class is without communication with those of any other class. Guardians are required to divide the paupers into the seven classes, and to subdivide any one or more of these classes in any manner which may be advisable, and which the internal arrangements of the workhouse admit; and the guardians are required from time to time, after consulting the medical officer, to make necessary arrangements with regard to persons laboring under any disease of body or mind, and, so far as circumstances permit, to subdivide any of the enumerated classes with reference to the moral character or behavior or the previous habits of the inmates, or to such other grounds as may seem expedient.

For example, it is very desirable that females of dissolute and disorderly habits should be separated from those of a good character, for it is the duty of the guardians to take all reasonable care that the morals of persons admitted into the house be not corrupted by intercourse with inmates of this description; but this has reference to continued ill-conduct, and is not in any way to be a punishment for offences committed previous to entrance into the workhouse and discontinued before admission.

The separation of married couples was long a vexed question, the evils on the one hand arising from the former unrestricted practice being very great, while on the other hand the separation of old couples was felt as a great hardship, and by express statutory provision in 1847 husband and wife, both being above the age of sixty, received into a workhouse cannot be compelled to live separate and apart from each other (10 & 11 Vict. c. 109, § 23). This exemption was carried somewhat further by contemporaneous orders of the board, under which guardians were not compelled to separate infirm couples, providing they had a sleeping apartment separate from that of other paupers; and in 1876 guardians were empowered, at their discretion, to permit husband and wife where either of them is infirm, sick, or disabled by any injury, or above sixty years of age, to live together, but every such case must be reported to the local government board (39 & 40 Vict. c. 61, § 10).

Children under seven are placed in such of the wards appropriated to female paupers as may be deemed expedient, and their mothers are permitted to have access to them at all reasonable times; fathers or mothers who may be desirous of seeing any child who is in the same workhouse have a daily interview; and arrangements are made for permitting members of the same family who are in different workhouses of the union to have occasional interviews with each other at such times and in such manner as best suits the discipline of the several workhouses.

Casual and poor wayfarers admitted by the master and matron are kept in a separate ward and dieted and set to work in such manner as the guardians by resolution direct; and whenever any vagrants or mendicants are received into a workhouse they ought (as a precaution necessary for preventing the introduction of infectious or contagious diseases) to be kept entirely separate from the other inmates, unless their stay exceeds a single night.

The guardians may direct that any pauper inmate of the workhouse of any class, except casual paupers, shall be detained in the workhouse after giving notice to quit it, for limited periods. A casual pauper (that is, any destitute wayfarer or wanderer applying for or receiving relief) is not entitled to discharge himself from a casual ward before 9 A.M. of the second day following his admission, or of the fourth day if he has been previously admitted more than once within a month, nor before he has performed the work prescribed for him (Casual Poor Act, 1882).

Infirmaries are attached to many workhouses, especially in the metropolis, and also in some cases there are infirmaries for the poor distinct from the workhouse; all are governed and regulated under the orders of a central board.

Outdoor relief.

The outdoor labor test order of the local government board directs that every able-bodied male pauper who may receive relief within the union out of the workhouse shall be relieved in the following manner: half at least of the relief given to such pauper shall be given in food, clothing, and other articles of necessity, and no such pauper shall receive relief from the guardians of the union or any of their officers or any overseer while he is employed for wages or other hire or remuneration by any person; but every such pauper shall be set to work by the guardians. The kind of work is reported to the board. A departure from the order is, however, permitted if approved by the board.

To prevent the practice formerly prevailing in some parts whereby the poor rates were used for the payment of rents directly to the landlords, the guardians and parish officers are prohibited from paying the rent of the house or lodging of any pauper, or applying any relief in such payment directly or indirectly. This does not apply, however, to any shelter or temporary lodging procured in any case of sudden and urgent necessity, or mental imbecility; nor does it prevent the guardians, in regulating the amount of relief to be afforded to any particular person, from considering the expense to be incurred in providing lodging. This allows of supplying to the pauper the means of paying for a lodging instead of requiring him to come into the workhouse in such exceptional cases.

Modern remedial legislation and public efforts connected with improved dwellings for laborers and artisans, as well as for the poor generally, are distinct from the laws for the compulsory relief of the poor,—although, like education, the whole subject of amelioration of classes admits in some of its aspects of being viewed together. The allotment of land to industrious poor has been also of great service (Allotments Extension Act, 1882).

Guardians having greater provision for the reception of poor children in their workhouse than they require may with the consent of the board contract with the guardians of any other union or parish for the reception, maintenance, and instruction of any poor children under sixteen being orphans or deserted by their parents or whose parents consent (14 & 15 Vict. c. 105; 29 & 30 Vict. c. 113).

Education and schools.

A consolidated order comprising workhouse regulations prescribes that the boys and girls who are inmates of a workhouse shall, for three of the working hours at least every day, be instructed in reading, writing, arithmetic, and the principles of the Christian religion, and such other instruction shall be imparted to them as may fit them for service, and train them to habits of usefulness, industry, and virtue.

In relation to education of poor children out of the workhouse there has been much legislation. To go no farther back, the Act of 1855, providing for the education of children in the receipt of outdoor relief (18 & 19 Vict. c. 34, known as Denison's Act), was superseded in 1873 by the Elementary Education Act of that year (36 & 37 Vict. c. 86), containing a special clause for the education of children relieved out of the workhouse and the payment of school fees, but this clause was in turn repealed by the Elementary Education Act, 1876 (39 & 40 Vict. c. 79), making it the duty of every parent to cause a child to receive efficient elementary instruction in reading, writing, and arithmetic. See EDUCATION.

By this Act a provision substituted for that of 1873 enacts that where relief out of the workhouse is given by the guardians or by their order by way of weekly or other continuing allowance to the parent of any child above the age of five years who has not reached the standard in reading, writing, and arithmetic prescribed by a certain code, or who for the time being either is prohibited by the Act from being taken into full time employment, or who by any by-law under the earlier Elementary Education Act of 1870 is required to attend school, it shall be a condition for the continuance of such relief to the parent or child that elementary education in reading, writing, and arithmetic shall be provided for such child, and the guardians are required to give such further relief (if any) as may be necessary for that purpose. Such relief cannot be granted on condition of the child attending any public elementary school other than such as may be selected by the parent, nor refused because the child attends or does not attend any particular public elementary school. Moreover the guardians have no power under this provision to give any relief to a parent in order to enable such parent to pay more than the ordinary fee payable at the school which he selects, or more than the fee which under the provisions of the Act they can enable a parent to pay in any other case. All relief given by the guardians under this provision is deemed to be relief within the meaning of the poor laws and payable out of their common fund (39 & 40 Vict. c. 79, § 40; see also § 34). A child cannot, as a condition of the continuance of relief out of the workhouse under the above provision, be required to attend school further or otherwise than is obligatory by any by-law of a school board (43 & 44 Vict. c. 23, § 5).

Money given for the payment of school fees for any child of a parent who is not a pauper and is resident in any parish is charged by the guardians having jurisdiction to that parish with other parochial charges (39 & 40 Vict. § 35).

The education of poor children is closely connected with the system of "boarding out," as it is termed. The guardians of certain unions are empowered to board out pauper children in homes beyond the limits of the union, provided the guardians have entered into approved arrangements which include education (boarding-out order 1870); and by a statute of 1862 (still unrepealed, except so far as by implication provisions are superseded) the guardians of any parish or union may send any poor child to any school certified to the board as fit for their reception and charge the expenses in the same manner as other relief. Unless an orphan or deserted or having the consent of a parent, a child cannot be sent under this statute, and no child can be kept against its will if above fourteen. Such school is open to inspection (25 & 26 Vict. c. 43).

Under the last-mentioned statute, the amount which might be paid by a board of guardians for the maintenance of a child in an institution certified under that statute was limited to the cost of the maintenance of the child in the workhouse; but by the Divided Parishes and Poor-Law Amendment Act, 1882, the guardians may pay the reasonable expenses incurred in the maintenance, clothing, and education of the child to an amount sanctioned by the local government board. The board has accordingly sanctioned rates of payment, and in practice, when issuing a certificate, specifies the maximum amount which may be paid by the guardians as a reasonable allowance towards the maintenance of any pauper child sent to the institution.

It is to be observed that the provisions of the Elementary Education Acts as to the employment of children by employers in school districts not within the jurisdiction of a school board, consisting of a parish and not a borough, must be enforced by the school committee of guardians of the union (39 & 40 Vict. c. 79, § 7).

The daily average number of children of both sexes attending the schools of the union workhouses, etc., in

England and Wales during the half-year ended at Lady Day, 1883, was 26,170. Added to this total there is the average daily attendance at district schools, 7488, and 488 in the metropolitan asylum district, making a total of 34,146. The amount paid to boards of guardians and managers out of the parliamentary grant in respect of the salaries of workhouse and district school teachers for the year ending Lady Day, 1883, was £38,629, 11s. [$187,739.61].

Apprenticeships.

Various provisions relating to the apprenticeship of poor children have been noticed in tracing the progress of legislation. Guardians are not restricted from binding as apprentices children who are not actually in the receipt of relief or whose parents may not be in the receipt of relief as paupers at the time of the binding. Such children as may ordinarily be considered "poor children" are within the scope of the provisions respecting the apprenticeship of pauper children. But apprenticeship under the poor laws is a species of relief which can only be given subject to the general or special regulations on the subject.

The general orders direct that no child under the age of nine years and no child (other than a deaf and dumb child) who cannot read and write his own name shall be bound apprentice by the guardians, and no child is bound to a person who is under twenty-one or who is a married woman, or to a person who is not a housekeeper or assessed to the poor rate in his own name, or who is a journeyman or a person not carrying on trade or business on his own account. And no child can be bound, unless in particular cases, to a master whose place of business is more than 30 miles from the residence of the child at the time of binding. The term of apprenticeship is discretionary with the guardians, but no apprentice can be bound for more than eight years, and if the child is above fourteen his own consent is required. If under sixteen his father's consent (or, if his father is dead, his mother's if living) is necessary. Various preliminaries to the binding are requisite, affecting the health and strength of the child and all attendant circumstances. When any premium is given it must in part consist of clothes supplied to the apprentice and in part of money to the master. The duties of the master of a pauper apprentice are specially provided for both by statute and by the regulations adopted by the local government board.

Medical relief.

In the administration of medical relief to the sick, the objects kept in view are—(1) to provide medical aid for persons who are really destitute, and (2) to prevent medical relief from generating or encouraging pauperism, and with this view to withdraw from the laboring classes, as well as from the administrators of relief and the medical officers, all motives for applying for or administering medical relief, unless where the circumstances render it absolutely necessary.

Unions are formed into medical districts limited in area and population, to which a paid medical officer is appointed, who is furnished with a list of all such aged and infirm persons and persons permanently sick or disabled as are actually receiving relief and residing within the medical officer's district. Every person named in the list receives a ticket, and on exhibiting it to the medical officer is entitled to advice, attendance, and medicine as his case may require. Medical outdoor relief in connection with dispensaries is regulated in asylum districts of the metropolis by the Metropolitan Poor Act, 1867 (30 & 31 Vict. c. 6).

Pauper lunatics.

A lunatic asylum is required to be provided by a county or borough for the reception of pauper lunatics, with a committee of visitors who, among other duties, fix a weekly sum to be charged for the lodging, maintenance, medicine, and clothing of each pauper lunatic confined in such asylum. Medical officers of unions and parishes, having knowledge that any resident pauper is or is deemed to be a lunatic, give written notice to relieving officers or other officers, and such officers, having knowledge either by such notice or otherwise of the fact, must apply to a justice, who requires the relieving officer to bring the pauper before him, or some other justice, calling to his assistance a duly qualified medical man (physician, surgeon, or apothecary), and upon his certificate, and the justice upon view or examination or other proofs being satisfied that such pauper is a lunatic and a proper person to be taken charge of and detained under care and treatment, a written order is made out directing the pauper to be received into such asylum. That is the ordinary mode, but justices may act on their own knowledge, and police officers have power to apprehend wandering lunatics and take them before justices.

The Metropolitan Poor Act, 1867, already noticed, contains many provisions applicable to insane poor, including the right of the commissioners of lunacy to visit the asylums.

In some cases when duly authorized a lunatic may be received into a registered hospital or house duly licensed for the reception of lunatics. No lunatics can be kept in a workhouse more than fourteen days except under special circumstances; minute provisions are made for the care, visitation, and discharge of the lunatics. The central board has made regulations respecting the detention of harmless idiots and other insane persons.

The cost of removal and maintenance is borne by the common fund of the union, and justices sending the pauper, or the visiting justices of an asylum may draw upon the guardians for the amount of the pauper's maintenance in favor of the treasurer, officer, or proprietor of the asylum. Any property of the lunatic is applicable to his maintenance. Special provision is made for inquiry into the settlement and adjudicating it, and for payment of costs of maintenance in accordance with the adjudication (16 & 17 Vict. c. 97, and subsequent Acts). There are also special provisions as to pauper criminal lunatics and sending them to an asylum at the cost of the common fund of the union as in other cases, —to which expenses, however, the person's property, if he have any (Criminal Lunatics Act, 1884, and Acts there referred to), is applicable.

An increase has taken place for many years past in the number of lunatic paupers. The total number of this class of paupers relieved on 1st January, 1883, was larger by 1867 than it was on the corresponding day in 1882.

Settlement.

A settlement is the right acquired in any one of the modes pointed out by the poor laws to become a recipient of the benefit of those laws in that parish or place where the right has been last acquired.

No relief is given from the poor rates of a parish to any person who does not reside within the union, except where such person being casually within a parish becomes destitute by sudden distress, or where such person is entitled to receive relief from any parish where non-resident under justice's order (applicable to persons under orders of removal and to non-resident lunatics), and except to widows and legitimate children where the widow was resident with her husband at the time of his death out of the union in which she was not settled, or where a child under sixteen is maintained in a workhouse or establishment for the education of pauper children not situate in the union, and in some other exceptional cases.

The progress of the law of settlement may be gathered from the statutes already referred to; and, without again adverting to legislation already noticed, and much more not enumerated, it must be sufficient to point out that immediately before the passing of the Poor-Law Amendment Act, 1834, settlements were acquired by birth, hiring and service, apprenticeship, renting a tenement, estate, office, or payment of rates. In addition to these an acknowledgment (by certificate, of which mention has been made, by relief or acts of acquiescence) has practically the effect of a settlement, for, if unexplained, such an acknowledgment stops the parish from disputing a settlement in the parish acknowledging. The Poor-Law Amendment Act, 1834, abolished settlement by hiring and service (or by residence under it) and by serving an office, and by apprenticeship in the sea service. Moreover the guardians of a union might agree (subject to the approval of the commissioners) that all the parishes forming it should for the purposes of settlement be considered as one parish.

It is to be observed that, for the purposes of relief, settlement, and removal and burial, the workhouse of any parish is considered as situated in the parish to which each poor person is chargeable.

There may be a settlement by parentage, for legitimate children take the settlement of their father, or if he has no settlement they are entitled to the settlement of their mother; and it is only when both these sources fail discovery that their right of settlement by birth accrues; for until the settlement of the father or mother has been ascertained the settlement of a legitimate child, like that of a bastard, is in the place where the birth took place.

A settlement attaches to those persons who have a settlement of some kind. Foreigners born out of the country and not acquiring any in one of the modes pointed out must be provided for, if requiring relief, where they happen to be.

Irremovability.

As the burden of maintaining the poor is thrown on the parish of settlement, when the necessity for immediate relief arises in another parish the important question arises whether the pauper can be removed; for, although the parish where the pauper happens to be must afford immediate relief without waiting for removal, the parish of settlement cannot in general be charged with the cost unless the pauper is capable of being removed. The question of removability is distinct from settlement. A pauper often acquires a status of irremovability without gaining a settlement.

Irremovability is a principle of great public importance quite irrespective of the incident of cost as between one parish or another. Before the introduction of a status of irremovability removal might take place (subject to powers of suspension in case of sickness and otherwise) after any interval during which no legal settlement was obtained; mere length of residence without concurrent circumstances involving the acquisition of a settlement on obtaining relief gave no right to a person to remain in the parish where he resided.

In 1846 it was enacted that no person should be removed nor any warrant granted for the removal of any person from any parish in which such person has resided for five years (9 & 10 Vict. c. 66). In 1861 three years were substituted for five (24 & 25 Vict. c. 55); and only four years later one year was substituted for three (28 & 29 Vict. c. 79). Apart from these reductions of time in giving the status of irremovability, actual removals to the parish of settlement were narrowed by provisions giving to residence in any part of a union the same effect as a residence in any parish of that union (24 & 25 Vict. c. 55). On the other hand the time during which parish relief is received, or during which the person is in any poorhouse or hospital or in a prison, is excluded from the computation of time (9 & 10 Vict. c. 66).

The removability as well as the settlement of the family, i. e., of the wife and unemancipated children, are practically subject to one and the same general rule. Wherever any person has a wife or children having another settlement, they are removable where he is removable, and are not removable from any parish or place from which he is not removable (11 & 12 Vict. c. 211).

It is to be borne in mind that no person exempted from liability to be removed acquires, by reason of such exemption, any settlement in any parish; but a residence for three years gives a qualified settlement (39 & 40 Vict. c. 61).

The cost of relief of paupers rendered irremovable is borne by the common fund of the union (11 & 12 Vict. c 110, § 3) as union expenses (§ 6), and any question arising in the union with reference to the charging relief may be referred to and decided by the local government board (§ 4).

Accounts and expenditure.

The statute of Elizabeth required overseers to account to justices for all moneys received by them under rules or otherwise, and all expenditure for the relief of the poor, and to deliver over balances to their successors (43 Eliz. c. 2, § 2). By the amendment of the poor laws in 1834 the duty of making payments was thrown chiefly on the guardians, leaving the overseers to assess and collect the rates out of which such payments are chiefly made. The accounts of expenditure and receipts by all parties, including officers of union and treasurers, form a very important part of poor-law administration. The duties, including the forms of books of account, are minutely prescribed by orders of the central board, and the accounts are examined and audited half-yearly by auditors appointed by the board in auditory districts, the auditing by justices having ceased. Full powers are given to the auditors to make this examination effectual and to allow and disallow accounts and items in them (see the Poor-Law Amendment Act, 1868, and Acts there recited).

It is to be observed that by various provisions in the Poor-Law Acts power has been given to raise money by borrowing. The Poor-Law Amendment Act 1835 authorizes applications for advances under several earlier Acts for building or enlarging workhouses or for purchasing land, and a subsequent Act authorizes the borrowing of money for payment of debts generally (5 & 6 Vict. c. 15).

The principal items comprised in the total amount expended in the relief of the poor in England and Wales during the years ending at Lady Day, 1882, and1883 are these:

	1882.	1883.
1. Indoor maintenance....	£1,831,595	£1,869,505
2. Outdoor relief............	2,626,375	2,589,937
3. Maintenance of lunatics in asylums or licensed houses........	1,059,460	1,098,322
4. Workhouse and other loans repaid and interest.....................	351,203	430,185
5. Salaries and rations of officers, and superannuations............	1,087,641	1,117,705
6. Other expenses of, or immediately connected with, relief...	1,296,523	1,303,416
Total relief to the poor..................	£8,252,797 [$40,108,593.42]	£8,409,070 [$40,868,080.20]
Deductions[1]	20,325 [$98,779.50]	55,778 [$271,081.08]
Adjusted cost of relief.....................	£8,232,472 [$40,009,313.92]	£8,353.292 [$40,596,999.12]

The comparison between the two years shows that with the exception of the outdoor relief there has been an increase in each item of expenditure. In this respect the year 1882–83 forms no exception to its predecessors, for the out relief is the only item in which there has been any decrease of late years.

Bringing the expenditure down to a later period, the comparative cost of the half years ended at Lady Day, 1883 and 1884, stood thus: 1883, in maintenance £982,586 [$4,775,376.96], out relief £1,269,700 [$6,170,742], total £2,252,286 [$10,946,109.96]; 1884, in maintenance £978,287 [$4,754,474.82], out relief £1,226,730 [$5,961,907.80], total £2,205,017 [$10,716,382.62]. Therefore the cost for the half year 1884 had decreased—the in maintenance by £4299 [$20,893.14], and the outdoor relief by £42,970 [$208,874.20]. The average price of wheat per imperial quarter during the same half years was—1883, 40s. 11d. [$9.94]; 1884, 38s. 11d. [$9.45].

In the article **London** tables have been given of the system of poor relief there. It must suffice here to notice that the cost of relief in the metropolis, comprising thirty unions, has increased since 1875. On the other hand the proportion which the cost of outdoor relief bears to the cost of in maintenance in the metropolis is continually decreasing. In 1883 the in maintenance was £586,933 [$2,852,494.38] and the outdoor relief £199,013 [$967,203.18]. The expenditure for in and out relief in the metropolis for the Lady Day half years 1883 and 1884 stood thus—1883, £417,614 [$2,029,604.04]; 1884, £425,310 [$2,067,006.60], an increase of £7696 [$37,402.56]. In the parochial year 1883 the adjusted cost of relief was £2,172,294 [$10,557,248.84], being equal to a rate of 1s. 6¾d. [38 cents] on the ratable value.

It is satisfactory to find that the adult able-bodied paupers have been steadily diminishing in numbers during the last four years, both among indoor and outdoor paupers. Comparing 1883 with 1873, it appears that there has been a diminution of 25,775, or no less than 20.6 per cent., in the mean number of adult able-bodied persons receiving relief, and, if we take into account the increased population, we find that the diminution has been 30.0 per cent. In the parochial year 1883 the mean number of adult able-bodied paupers was—indoor 21,558, outdoor 77,592, total 99,150. The above numbers do not include vagrants.

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[1] To be made in consequence of the payments from the metropolitan common poor fund exceeding the payments made to that fund during each year.

Although for many reasons it is considered desirable that as far as practicable out relief should be given in kind rather than in money, it will be seen by the following table for the parochial year 1883 taken from the unaudited half-yearly statements (and exclusive of relief given by the guardians in respect of school fees) how much more is given in money:

Poor-Law Divisions.	Out-Door Relief.	
	In Money.	In Kind.
The metropolis	£156,272	£38,623
Southeastern	198,657	52,029
South-midland	193,353	34,606
Eastern	126,155	55,486
Southwestern	298,371	29,146
West-midland	254,989	36,378
North-midland	176,208	8,248
Northwestern	202,070	14,366
York	234,644	12,967
Northern	127,113	1,639
Wales	282,487	10,824
Total	£2,250,319 [$10,936,550.34]	£294,312 [$1,430,356.32]

The great difference which exists in the several divisions in the manner of administering out relief is apparent. In the eastern division (comprising Essex, Suffolk, and Norfolk) nearly one-third of the outdoor relief was given in kind; while in the northern division (comprising Northumberland, Durham, Cumberland, and Westmoreland) nearly the whole was given in money.

The cost per head of relief on the mean number was in 1883 £10, 13s. 6d. [$51.88]; in 1873 it was £8, 14s. 1d. [$42.30].

It may be stated here that, whilst in the metropolis the cost of outdoor relief was in 1883 little more than one third of that of the in maintenance, the expenditure on out relief in the remainder of England, with the exception of the northwestern division, was considerably in excess of that on in maintenance, being in Wales more than four and a half times as great.

The mean number of paupers relieved in 1883 was—indoor 182,932, and out paupers (inclusive of those chargeable to the poor rates who are in county and borough asylums or in licensed houses) 599,490, or a total mean number of 782,422, being a ratio of 29.6 per 1000 of the population. The mean number of paupers relieved in 1883 was smaller in proportion to the population by 101,266 (or 11.5 per cent.) than the mean number relieved in 1873, ten years before—a decrease, however, entirely owing to a reduction in the number of outdoor paupers.

Some remarkable fluctuations took place in the number of vagrants relieved during the ten years ending in 1883. In 1873 the mean number of this class of paupers was 2700. In 1881 it had risen to 6979, an increase of 158.5 per cent. In 1883 it had fallen to 4790. After the end of that parochial year it still further decreased owing to the operation of the Casual Poor Act, 1882, extending the periods for which vagrants may be detained in casual wards.

The increased cost of relief is attributable to some extent to the fact that the proportion which the mean number of paupers relieved in the workhouse bears to the mean number of paupers of all classes is larger than it formerly was; but it is also attributed partly to expenses incurred in the erection of improved buildings, the substitution of paid officers for pauper help, and other similar items of expenditure, incurred for the purpose of securing the more efficient administration of relief. The yearly cost per head on the mean number of outdoor paupers has diminished during the last few years, and was smaller during 1883 than in any other year since 1873 with the exception of the year 1880.

Poor rate.

The poor rate is the fund from which the cost of relief is principally derived. The parochial taxation for this purpose in the statute of Elizabeth has been already noticed. As regards the subject matter of taxation the only subsequent absolute interference is in relation to salable underwood, and also to rights of fowling, shooting, or taking game or rabbits, and of fishing, where severed from the occupation of lands, and to mines of every kind not mentioned in the Act (see the Rating Act, 1874). The statute of Elizabeth enforced what are called duties of imperfect obligation; for it was, as has been seen, a duty before that statute to relieve the poor and necessitous, and the provisions of that Act were adapted to the enforcing of those duties in the way in which they could be practically carried out by enabling the parish officers to tax the inhabitants, whose representatives those officers are, for the actual performance of the obligations.

The Act gives persons aggrieved by any such tax a right of appeal—a right which has been fully exercised as well as regulated and affected by much subsequent legislation. By the parochial Assessment Act, 1836 (6 & 7 Will. IV. c. 96), closely following the poor-law amendment of two years before, no rate for the relief of the poor is of any force which is not made upon an estimate of the net annual value of the several hereditaments rated, that is to say, of the rent at which the same might reasonably be expected to let from year to year free of all usual tenant's rates and taxes, and tithe commutation rent charge, if any, and deducting therefrom the probable average annual cost of the repairs, insurance and other expenses, if any, necessary to maintain them in a state to command such rent.

Nothing in the Act, however, altered or affected the principles of different relative liabilities according to which different kinds of hereditaments were previously liable. The statute of Elizabeth (extended in some respects as to places by 13 & 14 Charles II. c. 12) embraced two classes of persons subject to taxation—occupiers of real property and inhabitants in respect of personal property, although the ratability under the latter head was reluctantly conceded by the courts of law, and was in practice only partially acted upon. Inhabitants as such, in respect of ability derived from the profits of stock in trade or any other property, were, however, expressly relieved in 1840 by a temporary Act (3 & 4 Vict. c. 89), since continued from time to time. It is solely by expiring laws continuance Acts (the last Act extending to the end of 1885) that the vast amount of personal property is relieved from the poor rate. This exemption, and the principle on which it is based, of course forms an important element in all questions of local and in many of imperial taxation.

As regards occupiers of land and houses, the correct principles as to the persons liable to be rated were, after many erroneous views and decisions, established by the House of Lords in 1865 in the case of the Mersey docks. The only occupier exempt from the operation of the act of Elizabeth is the crown, on the general principle that such liabilities are not imposed on the sovereign unless expressly mentioned, and that principle applies to the direct and immediate servants of the crown, whose occupation is the occupation of the crown itself. If there is a personal private beneficial occupation so that the occupation is by the subject, that occupation is ratable. Thus for apartments in a royal palace, gratuitously assigned to a subject, who occupies them by permission of the sovereign but for the subject's benefit, the latter is ratable; on the other hand, where a lease of private property is taken in the name of a subject, but the occupation is by the sovereign or her subjects on her behalf, no rate can be imposed.

So far the ground of exemption is perfectly intelligible, but it has been carried a good deal further, and applied to many cases in which it can scarcely be said naturally, but only theoretically, that the sovereign or the servants of the sovereign are in occupation. A long series of cases have established that when property is occupied for the purposes of the government of the country, including under that head the police, and the administration of justice, no one is ratable in respect of such occupation. And this applies not only to property occupied for such purposes by the servants of the great departments of state and the post office, the Horse Guards, and the Admiralty, in all which cases the occupiers might strictly be called the servants of the crown, but to county buildings occupied for the assizes and for the judge's lodgings, to stations for the local constabulary, to jails, and to county courts where undertakings are carried out by or for the Government and the Government is in occupation; the same principles of exemption have been applied to property held by the office of works.

When the property is not *de facto* occupied by the crown or for the crown, it is ratable; and, although formerly the uses of property for public purposes, even where the crown was not constructively interested in the way above pointed out, was treated as a ground for exemption, it is now settled that trustees who are in law the tenants and occupiers of valuable property in trust for public and even charitable purposes, such as hospitals or lunatic asylums, are in principle ratable notwithstanding that the buildings are actually occupied by paupers who are sick or insane, and that the notion that persons in the legal occupation of valuable property are not ratable if they occupy in a merely fiduciary character cannot be sustained.

With respect to the particular person to be rated where there is a ratable occupation, it is to be observed that the tenant, as distinguished from the landlord, is the person to be rated under the statute of Elizabeth; but occupiers of tenements let for short terms may deduct the poor rate paid by them from their rents, or the vestries may order such owners to be rated instead of the occupiers; such payments or deductions do not affect qualification and franchises depending on rating (Poor-Rate Assessment and Collection Act, 1869, and Amendment Act, 1882).

To be rated the occupation must be such as to be of value, and in this sense the word beneficial occupation has been used in many cases. But it is not necessary that the occupation should be beneficial to the occupier; for, if that were necessary, trustees occupying for various purposes, having no beneficial occupation, would not be liable, and their general liability has been established as indicated in the examples just given.

As to the mode and amount of rating it is no exaggeration to say that the application of a landlord-and-tenant valuation in the terms already given in the Paróchial Assessment Act, with the deductions there mentioned, has given rise to litigation on which millions of pounds have been spent within the last half contury, with respect to the rating of railways alone, although, the established principle applied to them, after much consideration, is to calculate the value of the land as increased by the line.

The Parochial Assessment Act referred to (6 & 7 Will. IV. c. 96), comprising various provisions as to the mode of assessing the rate so far as it authorized the making of a valuation, was repealed in 1869, in relation to the metropolis, and other provisions made for securing uniformity of the assessment of ratable property there (32 & 33 Vict. c. 67).

The mode in which a rate is made and recovered may be concisely stated thus. The guardians appoint an assessment committee of their body for the investigation and supervision of valuations, which are made out in the first instance by the overseers according to specific regulations and in a form showing among other headings the gross estimated rental of all property and the names of occupiers and owners, and the ratable value after the deductions specified in the Assessment Act already mentioned, and as prescribed by the central board. This valuation list, made and signed by the overseers, is published, and all persons assessed or liable to be assessed, and other interested parties, may, including the officers of other parishes, inspect and take copies of and extracts from that list. A multitude of provisions exist in relation to the valuation and supplemental valuation lists. Objections on the ground of unfairness or incorrectness are dealt with by the committee, who hold meetings to hear and determine such objections. The valuation list, where approved by the committee, is delivered to the overseers, who proceed to make the rate in accordance with the valuation lists and in a prescribed form of rate book. The parish officers certify to the examination and comparison of the rate book with the assessments, and obtain the consent of justices as required by the statute of Elizabeth. This consent or allowance of the rate is merely a ministerial act, and if the rate is good on the face of it the justices cannot inquire into its validity.

The rate is then published and open to inspection. Appeals may be made to special or quarter sessions against the rate, subject to the restriction that, if the objection were such that it might have been dealt with on the valuation lists, no appeal to sessions is permitted unless the valuation list had been duly objected to and the objector had failed to obtain such relief in the matter as he deemed to be just (see Union Assessment Acts).

In the metropolis a common basis of value for the purposes of government and local taxation is provided, including the promotion of uniformity in the assessment of ratable property. Provision is made for the appointment of an assessment committee by guardians or vestries, and for the preparation of valuation lists, and the deposit and distribution of valuation lists, and for the periodical revision of valuation lists. Appeals against the valuation list are heard by justices in special sessions, upon whom special limited powers are conferred. General assessment sessions, principally for appeals affecting the total of the gross or ratable value of any parish as being too high or too low as compared with other parishes, are appointed for hearing and determining appeals, and the lists are altered in accordance with their decisions. Those decisions may be questioned as in the case of decisions by courts of general or quarter sessions.

The valuation lists as approved by the assessment committee, or as altered on appeal, last for five years, and are conclusive evidence of gross and ratable value for the purpose of various specified rates, including the poor rate; and the poor rate is made by the parish officers, in accordance with such valuation according to a form provided,—see Valuation (Metropolis) Act, 1869.

It is to be borne in mind that the amount raised by poor rates does not closely represent the amount actually expended on the relief of the poor. The rates are made in reference to the prospective amounts required, and various payments not connected with the maintenance of the poor are charged by various Acts of Parliament on the poor rate.

Payment of poor rates, and of the costs incurred, is enforced on complaints to justices, and by distress warrants and imprisonment in default. Special statutory provision is made for this mode of recovery.

Consolidation of English poor laws desirable.

In conclusion, while giving full credit to the admirable way in which the English poor-law system, and the principles on which it is based, have been and continue to be promulgated and explained by the central authority to the guardians and others concerned in the administration of the laws (an advantage in which poor-law administration stands out distinct from any other), we must add that a consolidation of the statute law relating to poor is much needed. Dr. Burn, writing a hundred and twenty years ago, spoke thus: "If it may be reasonable to advance further still in speculation, perhaps a time may come when it shall be thought convenient to reduce all the poor laws into one. The laws concerning the poor may not improperly be compared to their apparel. When a flaw is observed, a patch is provided for it, upon that another, and so on, till the original coat is lost amidst a variety of patchwork. And more labor and materials are expended (besides the clumsiness and motley figure) than would have made an entire new suit." Since that remote day the number of statutes has increased notwithstanding a multitude of repeals. At the present time the Acts of Parliament affecting the poor laws of England alone, exclusive of Scotland and Ireland, number upwards of one hundred and thirty, and by far the greater portion of them have originated since the amendment of the poor laws in 1834.

Poor-law systems of other countries.

As to poor laws in other countries, the articles devoted to those countries must be referred to. It is to be observed that legal provision is made for paupers in every part of the United States. The poor-law system which obtains in the States in its general features is similar to that which prevails in England so far as regards the mode of raising the fund (viz., by way of rate) and the class of people to whom relief is afforded. Each district (commonly a town, county, or city) provides for its own poor. In some of the States paupers having no legal settlement are relieved by the State Government (1834). The prevalence of slavery in the Southern States until its abolition modified the system of relief.

The searching inquiry into the administration of the poor laws in 1832–34 was not confined to the United Kingdom or to the States of America. Returns were obtained through the foreign ministers, and the result as to Europe is thus comprehensively stated by Nassau Senior in 1835: "A legal claim to relief exists in Norway, Sweden, Russia, Denmark, Mecklenburg, Prussia, Würtemburg, Bavaria, and the canton of Bern, but does not exist in the Hanseatic towns, Holland, Belgium, France, Portugal, the Sardinian states, Frankfort, Venice, Greece, or Turkey." In the north of Europe the great peculiarity of the system is stated to be "the custom of affording relief by quartering the paupers on the landholders in the country and on householders in the towns." Senior arrived at the conclusion that, in those portions of the Continent in which the English principle of acknowledging in every person a right to be supported by the public existed, the compulsory relief had not, except perhaps in the canton of Bern, produced evils resembling either in intensity or extent those then experienced in the United Kingdom, and that in the majority of the nations that had adopted it the existing system appeared to work well. The poor laws of Russia, however, if they could be called poor laws, were merely parts of her system of slavery.

The absence of poor laws in France, and the charitable establishments, many of them under state management, are noticed in the article France. Senior arrived at the conclusion that the comprehensive and discriminate system of public relief established in France in relation to these institutions was not so complete as in Belgium. For the poor there see Belgium, where benevolent and charitable institutions and hospitals, charity workshops and depôts of mendicity or workhouses, and the *bureaux de bienfaisance* are noticed. The power of expulsion *pour vagabondage* exercised as a matter of daily routine in France operates as a restraint on vagrancy, although having a wider range than the English vagrancy laws. The majority of the indigent who receive public relief in France are foreigners.

The beneficent, including eleemosynary, institutions of united Italy are treated of under that head in Italy.

The "pauper colonies" of Holland, established in the first quarter of the present century (the first idea of which seems to have been derived from a colony of Chinese in Java), attracted public attention in England and Europe generally about the time the provision for the poor and the administration of the poor laws were under consideration, immediately before their reform in 1834. The object of the institutions in Holland was to remove those persons who were a burden to society to the poorest waste lands, where under judicious regulations they were enabled to the number of many thousands to provide for their own subsistence. It is remarkable that various schemes put forth in the 17th and 18th centuries for the reform of the British poor laws already cited teem with comparisons favorable to Holland. Sir Matthew Hale refers to the industry and orderly management prevailing in Holland and Flanders. Sir J. Child and others do the like.

Among various works on poor laws see Burn's *History* and the modern work of Sir G. Nicholls; Nassau Senior's *Poor Laws of European States;* Const's and Davis's treatises; Glen's *Poor-Law Orders;* *Reports* of Poor-Law Commissioners; *Reports* of Poor-Law and Local Government Boards from 1834. (J. E. D.)

POPAYAN, a city of the republic of Colombia, capital of the state of Cauca, is situated in 2° 26′ N. lat. and 76° 49′ W. long., at a height of 5948 feet (E. André, 1876), on the banks of one of the head streams of the Cauca in the great plain in the heart of the cordilleras. It was founded by Belalcazar in 1538 on the site of an Indian settlement, and in 1558 it received a coat of arms from the king of Spain and the title of "Muy noble y muy leal." Pope Paul III. made it a bishop's see in 1547. By means of its gold mines and its share in the commerce between Quito and the valley of the Magdalena Popayan became a large and flourishing city; but political disturbances and earthquakes (1827 and 1834) have reduced it to a place of 7000 to 10,000 inhabitants (8485 in 1870). It has a cathedral built by the Jesuits, several considerable churches, two seminaries founded about 1870 by French Lazarists (who occupy and have restored the old Jesuit convent), a mint, and a bank. The university was at one time celebrated; and the city is the birthplace of Caldas the astronomer and Mosquera the geographer.

The volcano of Purace, 20 miles southeast of the town, had according to Caldas a height of 17,000 feet, but André's measurement gave only 16,102 feet. From a vent 6 feet across at a height of 14,970 feet (Boussingault, 1831) steam and gas are discharged with violence sufficient to blow a man away like a straw. On the flanks of the mountain are several hot sulphurous springs and those of Coconuco are frequented by the Colombians.

POPE is the name given in England to a small fresh-water perch (*Acerina cernua*), also called Ruffe, which is generally distributed in the rivers of central Europe and common in most fresh waters of England. It was first made known by Dr. Caius, a keen observer who lived in the middle of the 16th century, and is well known by his work *De Canibus Britannicis*. He found the fish in the river Yar, and figured it under the name of *Aspredo*, the Latin translation of ruffe, which name refers to the remarkable roughness of the scales with which it is covered. In general structure, shape, and habits the pope resembles much the common perch, but rarely exceeds a length of seven inches, and differs in its coloration, which is olive-brown with irregular darker spots on the body and numerous blackish dots on the dorsal and caudal fins. It is most destructive to the fry of other fish, but in many parts of the country is esteemed as food. It spawns generally in the month of April.

POPE, Alexander (1688–1744), was the most famous English poet of his century. His own century dwelt most upon his merits; the 19th century is disposed rather to dwell upon his defects, both as a poet and as a man, with a persistency and minuteness that more than counterbalance any exaggeration in the estimate formed when it was the fashion to admire his verse and treat his moral obliquity as a foible. Substantially, the best judgment of the two centuries is at one, only different sides are prominent in the bulk of current criticism. All are agreed that he was not a poet of the first rank, and nobody can deny that he did certain things in literature in a way that has been the despair of all who have since attempted the same kind of thing. The great point of difference lies in the importance to be assigned to such work as Pope's satires. The polemic against his title to the name of poet would be contemptible were it not that beneath the dispute about the name there is a desire to impress on the public a respect for the highest kinds of poetry. The 19th century takes the poet's mission more seriously than the 18th. Similarly with Pope's moral delinquencies. With the exception of some details recently brought to light with an industry worthy of a better subject, his contemporaries were as well aware of these delinquencies as we are now, only none but his bitter enemies were so earnest in denouncing them. "In this design," Johnson says in his comments on the *Dunciad*, "there was petulance and malignity enough, but I cannot think it very criminal." And this was the general verdict of his contemporaries about the poet's moral weakness. They knew that he was insincere, intriguing, touchy, and spiteful, but, as nobody was much harmed by his conduct, they could not think it very criminal. Perhaps his physical weakness made them more indulgent to his elfish and sprite-like temper. But, apart from this, intriguing was the way of his world, a fact too much kept out of sight when Pope is denounced for his crooked ways in little matters, as if he had lived in our own straightforward and virtuous age.

If we are to judge Pope, whether as a man or as a poet, with human fairness, and not merely by comparison with standards of abstract perfection, there are two features of his times that must be kept steadily in view—the character of political strife in those days, and the political relations of men of letters. As long as the succession to the crown was doubtful, and political failure might mean loss of property, banishment, or death, politicians, playing for higher stakes, played more fiercely and unscrupulously than in modern days, and there was no controlling force of public opinion to keep them within the bounds of common honesty. Hence the age of Queen Anne is pre-eminently an age of intrigue. The government was almost as unsettled as in the early days of personal monarchy, and there was this difference that it was policy rather than force upon which men depended for keeping their position. Secondly, men of letters were admitted to the inner circles of intrigue as they had never been before and as they have never been since. A generation later Walpole defied them, and paid the rougher instruments that he considered sufficient for his purpose in solid coin of the realm; but Queen Anne's statesmen, whether from difference of tastes or difference of policy, paid their principal literary champions with social privileges and honorable public appointments. Hence men of letters were directly infected by the low political morality of the unsettled time. And the character of their poetry also suffered. The most prominent defects of our Augustan age in 19th-century eyes—the lack of high and sustained imagination, the genteel liking for "nature to advantage dressed," the incessant striving after wit—were fostered if not generated by the social atmosphere. The works of the serious imagination could not thrive in a fashionable society, feverishly interested in the daily chances of intrigue for place and power.

Pope was peculiarly fitted by nature to take the impress of his surroundings—plastic, sensitive, eagerly covetous of approbation. Affection and admiration were as necessary to his life as the air he breathed. "Pope was from his birth," Johnson says, "of a constitution tender and delicate, but is said to have shown remarkable gentleness and sweetness of disposition. The weakness of his body continued through his life; but the mildness of his mind perhaps ended with his childhood." Perhaps; but certainly to a much less degree with the friends who loved and honored him. With them he was always more or less sweet and docile; his petulance and malignity were directed as by an instinct of self-preservation against those who baulked him in his craving for admiration, a spiritual food literally and physically essential to the sustenance of his fragile being.

If Pope had been a man of more robust and self-sufficing constitution, he had one great advantage for resisting the spirit of his age. He was cut off by the religion of his parents from all public employment. His father was a Roman Catholic, a merchant in Lombard Street,[1] London, who retired from business with a small fortune in the year of the Revolution, and fixed his residence at Binfield in Windsor Forest. Pope was born at Lombard Street on May 22, 1688, but his father's retirement to Binfield took place soon after his birth. The delicate child's book education was desultory and irregular. His father's religion excluded him from the public schools, if there was no other impediment to his being sent there. Before he was twelve he got a smattering of Latin and Greek from various masters, from a priest in Hampshire, from a schoolmaster at Twyford near Winchester, from another in Marylebone, from a third at Hyde Park Corner, and finally from another priest at home. "He thought himself the better," Spence says, "in some respects for not having had a regular education. He (as he observed in particular) read originally for the sense, whereas we are taught for so many years to read only for words." This helps to explain his attack on Bentley in the *Dunciad*. He afterwards learnt French and Italian, probably to a similar extent. As far as the sense was concerned, he could get a dilution of that at least in translations, for all poets of note—Greek, Latin, French, and Italian—had been translated into English verse in the course of the previous century. Of these translations the precocious boy availed himself voraciously, and by the age of twelve, when he was finally settled at home and left to himself, he was not only a confirmed reader, but an eager aspirant to the highest honors in poetry. When at school in London he had crept into Will's coffee-house to look at Dryden; he had lampooned his schoolmaster, and made a play out of Ogilby's *Iliad* for his schoolfellows; and, thinking himself the greatest genius that ever was, he retired to the solitude of the forest to write a great epic on a mythological subject, his hero being Alcander, a prince of Rhodes.

Nothing of Pope's was printed till 1709, when he was twenty-one. The detachment from contemporary life in London which his father's religion and retirement might have occasioned was prevented by one of the accidents of that position. Fortunately or unfortunately for him, there were among the Papist families near Binfield men capable of giving a direction to his eager ambition, men of literary tastes, and connections with the literary world. These families held together as persecuted sects always do, and the family priests were mediums of communication.

Through some such medium the retired merchant's precocious son was brought under the notice of Sir William Trumbull, a retired diplomatist living at Easthampstead, within a few miles of Binfield. At Whiteknights, near Reading, lived another Roman Catholic, Mr. Englefield, "a great lover of poets and poetry." Through him Pope made the acquaintance of Wycherley and Harry Cromwell, and Wycherley introduced him to Walsh, then of great renown as a critic. Thus the aspiring poet, before he was seventeen, was admitted to the society of London "wits" and men of fashion, and he was cordially encouraged as a prodigy. It may be doubted whether the company of these veteran relics of Restoration manners was much for the benefit of the moral tone of the bookish youth, who learnt from them to speak and write of the fair sex with a very knowing air of rakish gayety. But he discussed poetry also with them, as was then the fashion, and soon under their influence his own vague aspirations received shape and direction.

Walsh's contribution to his development was the advice to study "correctness," as the one merit that was still possible for an English poet. But before he was introduced to Walsh, which was in 1705, he had already written the first draft of his "Pastorals," a subject on which Walsh was an authority, having written the preface to Dryden's translation of Virgil's *Eclogues*. Trumbull's influence was earlier and more extensive. For him may fairly be claimed the credit of having been Pope's schoolmaster in poetry. It was he who turned Pope's attention to the French critics, out of the study of whom grew the *Essay on Criticism*; he suggested the subject of *Windsor Forest* and he started the idea of translating Homer. When Trumbull first saw the precocious boy, he was hard at work on his great epic. He had probably chosen his subject on the first impulses of his crude ambition, because it was an established maxim at the time that a great epic is the greatest work of which the human mind is capable. It says something for Pope's docility at this stage that he recognized so soon that a long course of preparation was needed for such a *magnum opus*, and began steadily and patiently to discipline himself. The epic was put aside and afterwards burnt; versification was industriously practiced in shorter "essays"; and an elaborate study was made of accepted critics and models. When we look at the subjects of Pope's juvenile attempts, we cannot fail to be struck by a singular clearness of purpose in his poetic ambition, such as might have come from the judgment of the accomplished man of the world who was his adviser. He not only chose kinds of poetry in which there was an interest at the time, and a consequent likelihood of gaining attention and winning applause, but he had an eye to subjects that had not already been appropriated by great English poets, and in which success was still open to all comers. At the beginning of the 18th century Dryden's success had given great vogue to translations and modernizations. The air was full of theories as to the best way of doing such things. What Dryden had touched Pope did not presume to meddle with,—Dryden was his hero and master; but there was much more of the same kind to be done. Dryden had rewritten three of the Canterbury tales; Pope tried his hand at the *Merchant's Tale*, and the *Prologue to the Wife of Bath's Tale*, and produced also an imitation of the *House of Fame*. Dryden had translated Virgil; Pope experimented on the *Thebais* of Statius, Ovid's *Heroides* and *Metamorphoses*, and the *Odyssey*. He knew little Latin and less Greek, but there were older versions in English whose metre he could improve upon and from which he could get a clue to the sense; and, when the correspondents to whom he submitted his versions pointed out mistranslations, he could answer that he had always agreed with them, but that he had deferred to the older translators against his own judgment. It was one of Pope's little vanities—very venial in a nature requiring such support—to try to give the impression that his metrical skill was more precocious even than it was, and we cannot accept his published versions of Statius and Chaucer (published in "miscellanies" at intervals between 1709 and 1714) as indisputable evidence of his proficiency at the age of fifteen or sixteen, the date, according to his own assertion, of their composition. But it is indisputable that at the age of sixteen his skill in verse was such as to astonish a veteran critic like Walsh, and that his verses were handed about in manuscript and admired by men then in the foremost rank in literature. There is no better proof of his dexterity than his imitations, or rather parodies, of Chaucer, Spenser, Rochester, and Dorset, though dexterity is their only merit. His metrical letter to Cromwell, which Mr. Elwin dates in 1707, when Pope was nineteen, is also a brilliant feat of versification, and has turns of wit in it as easy and spirited as any to be found in his mature satires. Pope was twenty-one when he sent the "Ode to Solitude" to Cromwell, and said it was written before he was twelve years old. He may have retouched this; in all probability he did; perhaps every line of it was written when he was twenty-one; but there is abundance of external evidence of his extraordinary precocity as a metrician. He was vain enough to try to make it appear still more extraordinary than it was; but the attempt was hardly more peurile and comically superfluous than the solemn efforts of criticism to reduce his pretensions. They are too solidly founded to be shaken either by his own vain superstructure or by the outraged critic's vindictive undermining.

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[1] According to his own statement to Spence, his "Conversations" with whom are the chief authority for all the incidents of his youth. The value of the authority is much suspected. "He was more willing to show what his father was not than what he was," and Johnson accepted the statement that he was "a linen-draper in the Strand." Pope's vanity also renders doubtful in some details what he says about his own precocity.

Precocious Pope was, but he was also industrious; and he spent some eight or nine years in arduous and enthusiastic discipline, reading, studying, experimenting, taking the advice of some and laughing in his sleeve at the advice of others, "poetry his only business," he said, "and idleness his only pleasure," before anything of his appeared in print. In these preliminary studies he seems to have guided himself by the maxim formulated (after a French model) in a letter to Walsh (written at the date he gives, or later) that "it seems not so much the perfection of sense to say things that have never been said before, as to express those best that have been said oftenest."' His first publication was his "Pastorals." Tonson the bookseller had heard these pastorals highly spoken of, and he sent a polite note to Pope asking that he might have them for one of his miscellanies. They appeared accordingly in May, 1709, at the end of a volume containing contributions from Philips, Sheffield, Garth, and Rowe, besides Pope's version of Chaucer's *Merchant's Tale*. We have not space to show what can be said on both sides about these artificial compositions, avowedly designed to represent the manners of an imaginary golden age, when men of "wit and refinement" were shepherds. The worst that can be said of them was said by implication in the *Guardian* in 1713, when a case, which was afterwards justified by Allan Ramsay, was made out for the representation of real English country life. Johnson, though he did not approve of pastorals in the abstract, said a word of common sense against exaggerated depreciation of Pope's attempt. Few persons are likely nowadays to put themselves in a position for making a fair historical estimate of Pope's pastorals. There was a passing fashion for the kind of thing at the time, and possibly he wrote them under the impression that they offered a new field for poetic ambition in English, not knowing or forgetting what had been done by Giles Fletcher and Milton. Or he may have thought that a great poet should begin as Virgil began with pastorals. At any rate his pastorals, though Johnson was right in remarking the "closeness of thought" shown in their composition, cannot be ranked high as poetry, however much superior to everything else written in a passing fashion.

Pope's next publication was the *Essay on Criticism*. "In every work regard the writer's end," is one of its sensible precepts, and one that is often neglected by critics of the essay, who comment upon it as if Pope's end had been to produce an original and profound treatise on first principles. His aim was much less lofty—being simply to condense, methodize, and give as perfect and novel expression as he could to floating opinions about the poet's aims and methods, and the critic's duties, to "what oft was thought but ne'er so well expressed." "The town" was interested in *belles lettres*, and given to conversing on the subject: Pope's essay was simply a brilliant contribution to the fashionable conversation. The youthful author said with delicious loftiness that he did not expect the sale to be quick because "not one gentleman in sixty, even of liberal education, could understand it." But he misjudged his audience. The town was fairly dazzled by it—such learning, such comprehensiveness of judgment, such felicity of expression, was indeed a marvel in one so young. Many of its admirers, doubtless, like Lady Mary Montague, would have thought less of it if they had not believed all the maxims to be original; but people of fashion are seldom wide readers, and they gave Pope credit for much that they might have found, where he found it, in Quintilian, Rapin, and Bossu. "The truth is," Mr. Elwin says, "that Addison, by his encomiums and authority, brought into vogue the exaggerated estimate entertained of the essay." Nothing could be more preposterously far from "the truth."

A better illustration could not be found of the critical vice that Pope censures of "forming short ideas" by attending to parts to the neglect of the whole. If the whole of Addison's paper is read, it stands out in its true colors as a kindly gentle attempt to throw cold water on the enthusiasm about a work which had been published for some months and was already, as the paper admits, "highly esteemed by the best judges." It is "a masterpiece in its kind"; but people expect too much from the kind—originality, for instance. And again, it is "a masterpiece in its kind," worthy of a place beside Roscommon's *Essay on Translated Verse* and Mulgrave's *Essay on the Art of Poetry!* Most exaggerated encomiums these! How kindly, too, the paper opens by giving prominence to trivial incidents in the essay, one or two passing strokes of satire at Blackmore and Dennis. Bad poets are given to detraction; they try to raise themselves by pulling down the reputation of their brothers in the art. A third of the whole paper is devoted to warning the young poet against a spirit of envy and detraction, all because he had thrown a stone in passing at two of the common butts of their generation. But this was Addison's kindliness; he wished to give the promising youth a lesson against a bad habit. Read the whole paper (*Spectator*, No. 253) and judge.

The *Rape of the Lock* in its first form appeared in 1712 in *Linton's Miscellany*; the "machinery" of sylphs and gnomes was an afterthought, and the poem was republished as we now have it early in 1714. This was his first poem written on an inspiration from real life, from nature and not from books. A gentleman had in a frolic surreptitiously cut off a lock of a young lady's hair, and the liberty had been resented; Pope heard the story from his friend Caryll, who suggested that it might be a subject for a mock-heroic poem like Boileau's *Lutrin*. Pope caught at the hint; the mock-heroic treatment of the pretty frivolities of fashionable life just suited his freakish sprightliness of wit, and his studies of the grand epic at the time put him in excellent vein. The *Rape of the Lock* is almost universally admitted to be his masterpiece. English critics from his own time to the present have competed in lauding its airiness, its ingenuity, its exquisite finish. But M. Taine's criticism shows how much depends upon the spirit in which such humorous trifles are approached. The poem strikes M. Taine as a piece of harsh, scornful, indelicate buffoonery, a mere succession of oddities and contrasts, of expressive figures unexpected and grinning, an example of English insensibility to French sweetness and refinement. Mr. Leslie Stephen objects on somewhat different grounds to the poet's tone towards women. What especially offends the French critic's delicate sense is the bearishness of Pope's laughter at an elegant and beautiful woman of fashion. Pope describes with a grin of amusement all the particulars of the elaborate toilet with which Belinda prepared her beauty for conquest, and all the artificial airs and graces with which she sought to bewitch the heart of susceptible man. The Frenchman listens without sympathy, without appreciation, with the contemptuous wonder of a well-bred man at clownish buffoonery. What is there to laugh at? Is she not preparing a beautiful picture? She cannot do this without powders and washes and paint-pots. What is there to laugh at in this? It is mere matter of fact. The entire surrender of the female heart to little artifices for little ends does not apparently strike the Frenchman as ludicrous. Mr. Stephen's laughter is checked by the serious thought that this is a misrepresentation of women, that women are spoken of in the poem as if they were all like Belinda. But the Frenchman is not moved to laughter at all; it would seem as if his delight in the finished picture, the elegant graceful captivating woman, hallowed every ingredient used in the making of it. Such are the differences in national humor. With English readers the change of manners since the fashionable party rowed up the river to spend a happy day at Hampton is more likely to be an obstacle to the enjoyment of Pope's airy extravagance.

In the interval between the first and the enlarged edition of the *Rape of the Lock*, Pope gave the finishing touches to his *Windsor Forest*, and published it in March, 1713, with a flattering dedication to the secretary at war and an opportune allusion to the peace at Utrecht. This was a nearer approach to taking a political side than Pope had yet made. His principle had been to keep clear of politics, and not to attach himself to any of the sets into which literary men were divided by party. Although inclined to the Jacobite party by his religion, he was on friendly terms with the Whig coterie, so friendly indeed as to offend some of his co-religionists. He had contributed his poem "The Messiah" to the *Spectator*; he had written an article or two in the *Guardian*; and he wrote a prologue for Addison's *Cato*. But Pope's advances had not been received in a way to satisfy a man of his petulant and exacting temper. Mr. Elwin is much mistaken in supposing that Addison helped to bring Pope into notice in the *Spectator*. We have seen how he treated the *Essay on Criticism*. When the *Rape of the Lock* was published, Addison is said to have praised it to Pope himself as *merum sal*, but he was much more guarded in the *Spectator*. There he dismissed one of the gems of English literature with two sentences of patronizing faint praise to the young poet whom he rejoiced to see getting on, coupled it with Tickell's "Ode on the Prospect of Peace," and devoted the rest of the article to an elaborate puff of "the pastorals of Mr. Philips." We have only to look at the shameless puffery of the members of the little senate, not only in this article but throughout all the periodicals of the coterie, to see how little the young Mr. Pope owed to Addison.

When Pope showed a leaning to the Tories in *Windsor Forest*, the coterie, so far from helping him, made insidious war on him—not open war but underhand war. Within a few weeks of the publication of the poem, and when it was the talk of the town, there began to appear in the *Guardian* a series of articles on "Pastorals." Not a word was said about *Windsor Forest*, but everybody knew to what the general principles referred. Modern pastoral poets were ridiculed for introducing Greek moral deities, Greek flowers and fruits, Greek names of shepherds, Greek sports and customs and religious rites. They ought to make use of English rural mythology—hobthrushes, fairies, goblins, and witches; they should give English names to their shepherds; they should mention flowers indigenous to English climate and soil; and they should introduce English proverbial sayings, dress, and customs. All excellent principles, and all neglected by Pope in *Windsor Forest*. The poem was fairly open to criticism in these points; there are many beautiful passages in it, showing close though somewhat professional observation of nature, but the mixture of heathen deities and conventional archaic fancies with modern realities is incongruous, and the comparison of Queen Anne to Diana was ludicrously infelicitous. But the sting of the articles did not lie in the truth of the oblique criticisms. "The pastorals of Mr. Philips," published four years before, were again trotted out. Here was a true pastoral poet, the eldest born of Spenser, the worthy successor of Theocritus and Virgil! Pope's pastorals have their defects, great defects, but it was an unkind cut to him to prefer such trash, and with such audacious emphasis. It was an affront, but so contrived that the sufferer could not retaliate without putting himself in the wrong, a mean backbiting provocation, the action of a critic "willing to wound and yet afraid to strike."

Pope took an amusing revenge, which turned the laugh against his assailants. He sent Steele an anonymous paper in continuation of the articles in the *Guardian* on pastoral poetry, reviewing the poems of Mr. Pope by the light of the principles laid down. Ostensibly Pope was censured for breaking the rules, and Philips praised for conforming to them, quotations being given from both. The quotations were sufficient to dispose of the pretensions of poor Philips, and Pope did not choose his own worst passages, accusing himself of actually deviating sometimes into poetry. Although the *Guardian's* principles were also brought into ridicule by burlesque exemplifications of them after the manner of Gay's *Shepherd's Week*, Steele, misled by the opening sentences, was at first unwilling to print what appeared to be a direct attack on Pope, and asked Pope's consent to the publication, which was graciously granted.

The relations between Pope and his Whig friends were further strained by one or two little incidents about the same time. The truculent Dennis attacked both Pope's *Rape of the Lock* and Addison's *Cato*. Pope said nothing in his own defence, but—we were very obliging in those days—defended his friend Addison in a *Narrative of the Frenzy of John Dennis.* The attack was so coarse that Addison sent Steele to Dennis to disclaim all connection with it. Then Pope asked his friend Addison's advice about the enlargement of the *Rape of the Lock*, and Addison advised him to leave it as it was, which advice the man who had asked it attributed to jealousy.

The estrangement was completed in connection with Pope's translation of Homer. This enterprise was definitively undertaken in 1713. The work was to be published by subscription as Dryden's Virgil had been. Men of all parties subscribed, their unanimity being a striking proof of the position Pope had attained at the age of twenty-five. It was as if he had received a national commission as by general consent the first poet of his time. But the unanimity was broken by a discordant note. A member of the Addison clique, Tickell, attempted to run a rival version. There was nothing criminal in this, but it was an irritating continuation of the cold grudging treatment that Pope had all along received from the same quarter. Pope suspected Addison's instigation; Tickell had at least Addison's encouragement. Pope's famous character of Addison, if not true in the main, is at least a strictly fair description, inspired not by malignity but by legitimate resentment, if resentment is ever legitimate, of Addison's treatment of himself as he was rising into fame.[1] Pope afterwards claimed to have been magnanimous, and he is suspected of having supported this claim by petty inventions in his account of the quarrel. Magnanimity he could not fairly claim; but he did not attack without provocation.

The translation of Homer was Pope's chief employment for twelve years. The new pieces in the miscellanies published in 1717, his "Elegy on an Unfortunate Lady" and his "Eloisa to Abelard," were probably written some years before their publication. The *Iliad* was delivered to the subscribers in instalments in 1715, 1717, 1718, and 1720. For the translation of the *Odyssey* he took Fenton and Broome as coadjutors, who between them translated twelve out of the twenty-four books.[2] It was completed in 1725. The profitableness of the work was Pope's chief temptation to undertake it. He cleared more than £8000 by the two translations, after deducting all payments to coadjutors—a much larger sum than had ever been received by an English author before. Pope, with his economical habits, was rendered independent by it, and enabled to live nearer London. The estate at Binfield was sold, and he removed with his parents to Chiswick in 1716, and in 1718 to Twickenham, to the residence with which his name is associated. Here he held his little court, and was visited by his intimates Arbuthnot, Gay, Bolingbroke (after his return in 1723), and Swift (during his brief visits to England in 1726 and 1727), and by many other friends of political eminence. Martha Blount, after his mother's death in 1733, was occasionally domiciled in his house.

The translation of Homer established Pope's reputation with his contemporaries, and has endangered it ever since it was challenged. It was the Homer chiefly that Wordsworth and Coleridge had in their eye when they began the polemic against the "poetic diction" of the 18th century, and struck at Pope as the arch-corruptor. They were historically unjust to Pope, who did not originate this diction, but only furnished the most finished examples of it. Mr. Leslie Stephen has asked in what the much abused pseudo-poetic diction consists. A long analysis would be required to answer the question in detail, but in substance it consisted in an ambition to "rise above the vulgar style," to dress nature to advantage—a natural ambition—when the arbiters of literature were people of fashion. If one compares Pope's "Messiah," or "Eloisa to Abelard," or an impassioned passage from the *Iliad*, with the originals that he paraphrased, one gets a more vivid idea of the consistence of pseudo-poetic diction than could be furnished by pages of analysis. But Pope merely used the established diction of his time. A passage from the *Guardian*, in which Philips was commended as against him, shows in a single example the great aim of fashionable poets in those days. "It is a nice piece of art to raise a proverb above the vulgar style and still keep it easy and unaffected. Thus the old wish, 'God rest his soul,' is very finely turned:

> 'Then gentle Sidney liv'd, the shepherd's friend,
> *Eternal blessings on his shade attend.*'"

Pope would have despised so easy a metamorphosis as this, for, just as dress is often valued for what it cost the wearer, so the poetic dress of nature was esteemed in proportion to the poet's labor and ingenuity in devising it. The work of his coadjutors and imitators in the *Odyssey* may be distinguished by this comparative cheapness of material. Broome's description of the clothes-washing by Nausicaa and her maidens in the sixth book may be compared with the original as a luminous specimen.

The year 1725 may be taken as the beginning of the third period of Pope's career, when he made his fame as a moralist and a satirist. In point of sheer literary power the works then composed are his greatest, but the subjects chosen belong essentially to the lower levels of poetry. Why did Pope, when his independence was secured and he was free to choose, "take to the plains," to use Wordsworth's phrase, "when the heights were within his reach"? His choice was determined partly by character and partly by circumstances. It may be doubted whether Pope had the staying power necessary for the composition of a great imaginative work, whether his crazy constitution would have held together through the strain. He toyed with the idea of writing a grand epic. He told Spence that he had it all in his head, and gave him a vague (and it must be admitted not very promising) sketch of the subject and plan of it. But he never put any of it on paper. He shrank as with an instinctive repulsion from the stress and strain of complicated designs. Even his prolonged task of translating weighed heavily on his spirits, and this was a much less formidable effort than creating an epic. He turned rather to designs that could be accomplished in detail, works of which the parts could be separately labored at and put together with patient care, into which happy thoughts could be fitted that had been struck out at odd moments and in ordinary levels of feeling.

The *Dunciad* (1728) was the first work of the new period. Circumstances turned him to satire when he was free from the *Odyssey*, and from his edition of Shakespeare, a bookseller's commission completed in the same year. Young's satire, *The Universal Passion*, had just appeared and been received with more enthusiasm than anything published since Pope's own early successes. This alone would have been powerful inducement to Pope's emulous temper. Swift was finishing *Gulliver's Travels*, and came over to England in 1726. The survivors of the Scriblerus Club—Swift, Pope, Arbuthnot, and Gay—resumed their old amusement of parodying and otherwise ridiculing bad writers, especially bad writers in the Whig interest. A volume of their *jeux d'esprit* was published in 1727. According to Pope's own history of the *Dunciad*, the idea of it grew out of this. Among the miscellanies was a "Treatise on the Art of Sinking," in which poets were classified; with illustrations, according to their eminence in the various arts of debasing instead of elevating their subject. No names were mentioned, but the specimens of bathos were assigned to various letters of the alphabet, most of them taken at random. But no sooner was the treatise published than the infatuated scribblers proceeded to take the letters to themselves, and in revenge to fill the newspapers with the most abusive falsehoods and scurrilities they could possibly devise. "This gave Mr. Pope the thought that he had now some opportunity of doing good, by detecting and dragging into light these common enemies of mankind," who for years had been anonymously aspersing almost all the great characters of the age.

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[1] A very different view is argued by Mr. Elwin (with strange blindness, as the present writer thinks, to the cardinal circumstances here set forth), in his introductions to *Windsor Forest*, the *Essay on Criticism*, and the *Rape of the Lock*. See also Mr. Leslie Stephen's *Pope*, and Mr. Courthope's *Addison*.

[2] 1, 4, 19, and 20 are by Fenton; 2, 6, 8, 11, 12, 16, 18, 23 by Broome.

The truth probably lies between this account and that adopted by those who take the worst view of Pope's character. This is that he was essentially vindictive and malignant, and that, as soon as his hands were free from Homer, he proceeded to settle old scores with all who had not spoken as favorably as he liked about himself and his works. The most prominent objects of his satire can be shown to have given him personal offence—Theobald, Cibber, Dennis, Lintot, and others. This indeed was avowed by Pope, who claimed that it was their attacks on himself that had given him a right to their names. We may admit that personal spite influenced Pope at least as much as disinterested zeal for the honor of literature, but in the dispute as to the comparative strength of these motives, a third is apt to be overlooked that was probably stronger than either. This was an unscrupulous elfish love of fun, and delight in the creations of a humorous imagination. Certainly to represent the *Dunciad* as the outcome of mere personal spite is to give an exaggerated idea of the malignity of Pope's disposition, and an utterly wrong impression of the character of his satire. He was not a morose, savage, indignant satirist, but airy and graceful in his malice, writing more in fun than in anger, revengeful perhaps and excessively sensitive, but restored to good-humor as he thought over his wrongs by the ludicrous conceptions with which he invested his adversaries. We do not feel the bitterness of wounded pride in his writings, but the laughter with which that pride was consoled. He loved his own comic fancies more than he hated his enemies. His fun at the expense of his victims was so far cruel that he was quite regardless of their sufferings, probably enjoyed them; but it was an impish and sprite-like cruelty, against which we cannot feel any real indignation because it is substantially harmless, while its ingenious antics never fail to amuse. Even when he exults in the poverty and material distresses of his victims, the coarseness of the matter is redeemed by the irresponsible gayety of the manner. Such things should not be taken too seriously, if a Scotsman may say so. Further, even if Pope is regarded as a bitter malignant, it must be with two important qualifications. His plea that he was never the aggressor in a quarrel, in spite of all Mr. Elwin's special pleadings to the contrary, was a truthful plea, though his sensitiveness to criticism was such as to make him fancy slights, and the withholding of praise where praise was due would have been construed by him as a positive offence. And his literary conscience was so strong that not one of his attacks on literary grounds was unjust. Pope was a most generous critic of real merit. The only doubtful exception is the case of Bentley, whom he satirized in the reconstruction and enlargement of the *Dunciad* made in the last years of his life at the instigation, it is said, of Warburton. Looked at apart from personal questions, the *Dunciad* is the greatest feat of the humorous imagination in English poetry.

There was much more of unjust judgment in Pope's *Satires and Epistles of Horace Imitated*, published at intervals between 1733 and 1738, because in them he oftener wrote of what he did not personally know, and was the mouthpiece of the animus of his political friends. These friends were all in opposition to Walpole, who was then at the height of his power, and the shafts of Pope's satire were directed at the adherents of the great minister. Pope's satires give the concentrated essence of the bitterness of the opposition. We see gathered up in them the worst that was thought and said about the court party when men's minds were heated almost to the point of civil war. To appreciate fully the point of his allusions requires of course an intimate acquaintance with the political and social gossip of the time. But apart from their value as a brilliant strongly-colored picture of the time Pope's satires have a permanent value as literature. It is justly remarked by Pattison[1] that "these *Imitations* are among the most original of his writings." The felicity of the versification and the diction is universally admired.

The *Essay on Man* (1732–34) was also intimately connected with passing controversies.[2] It belongs to the same intellectual movement with Butler's *Analogy*—the effort of the 18th century to put religion on a rational basis. But Pope was not a thinker like Butler. The subject was suggested to him by Bolingbroke, who is said also—and the statement is supported by the contents of his posthumous works—to have furnished most of the arguments. Pope's contribution to the controversy consisted in brilliant epigram and illustration. In this didactic work, as in his *Essay on Criticism*, he put together on a sufficiently simple plan a series of happy sayings, separately elaborated, picking up the thoughts as he found them in miscellaneous reading and conversation, and trying only to fit them with perfect expression. The want of logical coherence in his system was shown by the very different interpretations put upon it. Dealing as it did in incomparably brilliant fashion with a subject of living interest, the *Essay* at once attracted attention both at home and abroad, and Pope was attacked by a Swiss professor as an ally of the freethinkers. But a champion of his orthodoxy was found in Warburton. Pope was so delighted with the pugnacious paradoxist's reply to De Crousaz that he made Warburton's acquaintance. The readiness with which Pope allowed Warburton to take possession of himself and his works in his old age was not a symptom of senile weakness. It was an act of that charactertistic business-like acuteness which he showed throughout in the management of his reputation. He saw that as long as Warburton was the authorized commentator on his works there was not likely to be any lack of critical debate about him and about them.

The *Essay on Man*, which may be said to contain the essence of the thought of men of the world in his generation on its subject—such was the poet's skill and judgment in collecting the substance of floating opinion—was announced by Pope as part of a system of "pieces on human life and manners." Whether Warburton was authorized or not in his sketch of Pope's intentions, the so-called *Moral Essays* (published at intervals between 1731 and 1735) which Warburton connected with the general plan have each an independent interest. They contain some of the most brilliant of Pope's satirical portraits, and his famous theory of "the ruling passion." If space permitted it might easily be shown that in this theory Pope proved himself a better psychologist than Macaulay, who subjects it to much misunderstanding ridicule.

Pope died on the 30th May, 1744, and was buried in the church of Twickenham. His own ruling passion was what a poet of his generation described as the universal passion, the love of fame. Under the influence of this passion he tried to support his reputation by intrigues such as the statesmen of his time used in climbing the ladder and keeping themselves in place. He had no moral scruple where this was concerned—everything gave way before the ruling passion. For some of these intrigues, so incongruous with our idea of a poet's character, he has suffered severe retribution. Especially of late years he has been violently denounced as little better than a common swindler for his petty manœuvres in connection with the publication of his letters—letters designed to exhibit him as a pattern of friendship, magnanimity, and all the virtues. These manœuvres, which were first tracked with great patience and ingenuity by Mr. Dilke,[1] are too intricate to be recorded in short space. This, in effect, is what he seems to have done. He collected his letters from his friends, retouched them, changed dates and passages to suit the picture of himself which he wished to present, deposited the collection thus manipulated in the safe-keeping of the earl of Oxford, then sent a printed book of them to Curll, and intrigued to make it appear that they had been fraudulently published without his consent. It was a ridiculously petty action, but to characterize it as Mr. Elwin has done will be fair when it is customary to use similar language about the intrigues of statesmen and diplomatists. To apply it to Pope at present is not to call a spade a spade, but a molehill a mountain. Recent revelations have not affected by one iota Johnson's judgment of his character. The man who "played the politician about cabbages and turnips," and "hardly drank tea without a stratagem," was not likely to be straightforward in a matter in which his ruling passion was concerned. Against Pope's petulance and "general love of secrecy and cunning" have to be set, in any fair judgment of his character, his exemplary conduct as a son, the affection with which he was regarded in his own circle of intimates, and many well-authenticated instances of genuine kindliness to persons in distress.

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[1] In his incomparable edition of the *Satires and Epistles*.

[2] See Pattison's edition of the *Essay on Man*.

(W. M.)

POPEDOM.[2] Both the ecclesiastical and the temporal authority formerly exercised and still claimed by the popes of Rome profess to be of divine appointment, appealing in the first place to the language of the New Testament, and in the next to the tradition of the church, handed down, as it is asserted, in unbroken continuity from apostolic times to the present age. According to the theory thus put forth, Peter the apostle was indicated by Christ Himself as superior to the rest of the twelve in faith and spiritual discernment, and as the one of the number whom it was His design to invest with special pre-eminence. In like manner, the church itself which Peter was afterwards to found and to preside over was predestined to a like superiority among other churches, while his personal superiority was to be vested in perpetuity in his successors. In conformity with this divine design Peter, accompanied by Paul, went to Rome after Christ's death, and founded there a church over which he presided as its bishop for twenty-five years,—from the first year of the reign of Claudius, 41 A.D., to 67 A.D.,—eventually suffering martyrdom in the same year and on the same day as St. Paul, in the persecution under Nero. And, if we accept the records preserved in the Roman Church, we shall believe that St. Peter's successors, so long as Christianity was the object of state persecution, continued heroically to encounter the same glorious fate, the distinction of martyrdom being assigned in the Roman calendar to all but two of the bishops of Rome from Linus to Eusebius (see list at conclusion of article).

St. Peter at Rome.

In dealing with a subject in which the evidence is frequently ambiguous and conflicting, and sometimes of more than doubtful genuineness, and with a period of much obscurity, no amount of research will often serve to point to more than a conjectural conclusion. But, inasmuch as it is on the basis of the assumptions involved in the above theory that the claims of the Church of Rome mainly rest, it will be desirable to state, as concisely as possible, the main facts and arguments on which those who deny these assumptions ground their contrary opinion.

Theory of his pre-eminence among the apostles.

The question whether or no St. Peter was designed for pre-eminence among the apostles resolves itself, it is evident, into one of New Testament criticism; but from the time of Origen, who visited Rome early in the 3d century, when the theory first began to be put forward, there has always been a certain section in the church who have distinctly repudiated the affirmative assumption. "For if," says Origen, "you hold that the whole church was built by God on Peter alone, what will you say concerning John, the son of thunder, and each of the other apostles"? (Migne, *Patrologia Græca*, xiii. 397). Next, as regards the evidence for St. Peter's presence in Rome and lengthened labors there, as the head of a Christian congregation, it is maintained by the great majority of Protestant scholars that there is no proof that he was ever in Rome at all; that the "Babylon" referred to in his first epistle (ch. v. 13) is really the distant city of the East; and that, even if his presence in Rome be admitted, his arrival there must have been long subsequent to that of his brother apostle, and his labors altogether subordinate in importance,—conclusions supported by the complete silence observed in the Acts of the Apostles respecting both him and his work in the capital of the empire. On the other hand, it is urged that, as no known tradition assigns the martyrdom of Peter to any other place than Rome, every allusion to that event is implicitly an argument for his visit to the capital; and, generally speaking, it may be said that the most recent and authoritative research seems to point to the conclusion that he both visited Rome and taught there, but that his labors were carried on in a spirit of rivalry, not to say antagonism, to those of Paul, being bestowed exclusively on a Judaizing church, while those of his fellow-apostle were devoted to the Gentile community. Of the important feature which harmonizes perfectly with these conclusions—namely, that the Church of Rome, attaching itself directly to the church of Jerusalem, became the depositary of a Jewish-Christian rather than of a Pauline tradition—there can be no doubt whatever.

The Jews at Rome.

The existence of a considerable poor Jewish element in Rome as early as the latter half of the first century is attested by numerous facts and allusions in the classical writers. The Jews were everywhere actively engaged in commercial pursuits, and formed an influential section in all great centres. Josephus tells us that, when on one occasion the Jews of Palestine presented a petition to the emperor Augustus, it was supported by no less than eight thousand of their countrymen resident in the capital. The chief quarters of this Jewish colony were in the Trastevere, about the base of the Janiculum; and its members were distinguished by the fidelity with which they cherished their national customs and beliefs. Both Rome and the Jewish community in its midst must accordingly have appeared a field of primary importance in the work of evangelization; and it is evident that the questions raised by the claims of Christianity would there be discussed with the greatest ardor, and the most strenuous endeavors be made to bring them to an ultimate issue. That such was really the case is sufficiently proved by a well-known passage in Suetonius, who relates that about the middle of the 1st century there were constant riots among the Jewish population, their ringleader being one "Chrestus," and that Claudius in consequence expelled them from the city. There is no reason for supposing that this section of the community would be estranged to any great degree, by the pursuits and associations of their daily life, from those by whom they were surrounded. The influences that then pervaded alike the Roman literature, culture, and civilization were mainly Greek, and the Jewish element was no less affected by these

Passage in Suetonius.

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[1] See *Papers of a Critic.*

[2] The design of the present article is simply to give the main outlines of the history of the Papacy as an institution: the details connected with the personal history of each pontiff will be found under the respective names of the different popes. The dates immediately after the name of each pope denote the period of his pontificate.

influences than the Latin. Greek, again, was the ordinary medium of commercial intercourse throughout the Roman world, and the Jew was largely engaged in commerce. Greek therefore had, except in the Syrian provinces, become the language of his daily life, as it had long been that of his sacred books read aloud in the synagogues, and of the annals of his race as recorded by the national writers.

The importance of the passage above referred to in Suetonius, of which the very inaccuracy which it embodies is in itself highly significant, has perhaps hardly been sufficiently recognized, for it not only records an important fact but it sheds light on subsequent history. It enables us to understand that, when the Jewish population was permitted to return to Rome, its members, whether adherents of the national faith or converts to the new, would, in common with the whole Christian community, feel the necessity of extreme caution lest their religious observances or their religious differences should again attract the notice of the Roman magistrate and expose them to fresh persecution. Of this character would appear to be the sentiments indicated in the epistle of Clemens Romanus (supposed by some to have been the same with the Clemens whose name is inserted as that of the third bishop of Rome) when he refers to the sudden and repeated "calamities and adversities which are befalling us"—a passage generally interpreted as having reference to the persecution under Nero and the impending persecution under Domitian (Lightfoot, *Append.*, p. 267). In such considerations as these we may fairly consider that we have a reasonable explanation of the fact that during the first two centuries of its existence we hear so little of the Christian church in Rome.

Earliest lists of the Roman bishops.

With such considerations before us, it is scarcely necessary to point out that Greek was also the language of the early Christian church in Rome. In whatever proportions, therefore, that church was composed of Christianized Jews or of Christianized pagans, its records would naturally be, as we find them to have been, in the Greek language. Hegesippus, "the father of church history," makes a statement which is generally understood to imply that, being in Rome in the time of Anicetus (bishop, 155[1]–168 A.D.), he made a list of the bishops of the see. This list is not extant; but in Irenæus, who wrote his *Adversus Hæreses* a few years later, we have another Greek list of twelve bishops, which shows the succession accepted at Rome in the time of Eleutherius, the contemporary of Irenæus, and at the head of which stand the names of both Peter and Paul. To these lists are to be added two other Greek lists, the one in the *Chronicon* of Eusebius, the other in the *Ecclesiastical History* of the same writer. Of these, the former extends from Peter to Gaius (the last bishop before the Diocletian persecution), and gives the periods of office. It is derived from the Armenian translation, but is not contained in the version by Jerome. The first Latin list, the *Catalogus Liberianus*—supposed by Mommsen to have been derived from the *Chronicon* of Hippolytus, bishop of Portus, and to have been in turn the original from which the *Catalogus Felicianus* (the oldest existing version of the *Liber Pontificalis*—see *infra*) was taken—is so called because it was compiled in the episcopate of Liberius, who succeeded 352 A.D. We have also two other Latin lists of some authority, in Augustine (*Epist.* 53; Migne, *Patrol.*, xxxiii. 195) and in Optatus (*De Schism. Don.*, ii. 3).

It is undeniable that in all the foregoing lists there are considerable discrepancies. The Liberian catalogues gives us a certain "Cletus," as the immediate predecessor of Anacletus; scholars like Mommsen and Lipsius are divided in opinion as to whether Anicetus was the predecessor or the successor of Pius; while, as regards the duration of each episcopate, there are equally important discrepancies. But difficulties like these cannot justly prejudice our acceptance of the general tradition with which they are associated; they are rather to be looked upon as supplying valuable incidental evidence with respect to the status of the Roman episcopate; and, while the lists themselves prove, on the one hand, that before the termination of the 3d century the office was held to be of such importance that its succession was a matter of interest to ecclesiastics living in distant sees, the *variations* that the lists present indicate not less clearly that the Roman bishopric at this period could not have held that position in relation to the church—the parallel to that of the imperial office in the empire—claimed for it by writers like Bellarmine.

Epistle of Clemens Romanus.

The comparative history of institutions would, in itself, incline us to look for a less precise and exalted conception of the office, as discharged by these early bishops, than when, after a lapse of centuries and a succession of varied experiences, its duties and responsibilities had become defined and developed; but it is also a fact of considerable significance that those who were elected to the office from the time of Clement were for the most part men whose very names would probably not have survived but for their appearance in these lists, and that, even when, in one or two instances, their individual careers emerge from the general obscurity, they themselves appear as speaking and acting in a manner which seems hardly compatible with those exalted prerogatives which, as some maintain, were inherent in the office from its first commencement. In the recently recovered portion of the epistle of Clemens Romanus, above cited, it is, for example, highly significant to find that the letter purports to emanate, not from the "bishop of Rome," but from "the church at Rome," and to find again that, even so late as the 2d century, this letter is in like manner referred to as emanating from the community, and not from the individual. This feature, indeed, is not a little suggestive with respect to the development of the Roman supremacy. While the letter is wanting in anything that implies any special pre-eminence on the part of the Roman bishop, it is at the same time characterized by a certain admonitory tone, such as could hardly have been assumed if the community by whom it was sent had not been held to possess a recognized superiority over the community to whom it was written, but this superiority is not greater than would naturally belong (notwithstanding their common founder) to the church in imperial Rome as contrasted with the church at subject Corinth,—to the church of the august capital from whence emanated the laws which govern the empire and the church of the fallen city which, two centuries and a half before, the Roman arms had well nigh effaced from existence.

Letters of Ignatius.

If again we accept as genuine the evidence afforded in those seven letters of Ignatius which most critics are disposed to accept as genuine, the relations of the Roman Church to the other churches of the empire appear to be of the same character. Ignatius, when on his way to Rome (probably early in the 2d century) to suffer martyrdom, addressed a letter to the Christian community in that city. In this letter there is again an equally direct reference to a certain primacy of the church in Rome, which is addressed as "she who hath the presidency in the place of the region of the Romans." But this expression is immediately followed by a definition of this primacy which is altogether incompatible with the theory that it is derived from the episcopal succession in the church; it is spoken of as founded upon sentiments of Christian fellowship, with the additional considerations attaching to the dignity and superior advantages belonging to the church of the capital.

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[1] For this date see article "Pope" in Smith's *Dict. of Christian Antiquities*, p. 1657.

Passage in Irenæus.

Denial of the Roman Supremacy.

The conclusion to which the foregoing evidence points is again strongly confirmed by the general fact that, as each new pretension on the part of the Roman see was put forward, it was called in question and repudiated by some one or other section of the Christian community. An obscure and doubtful passage in Irenæus (*Adv. Hæres.*, bk. iii. c. 3) testifies, at most, to nothing more than a fuller recognition of the primacy of the Roman Church, while in the same writer, who, it will be remembered, was bishop of the church at Lyons, we have a notable instance of a distinct repudiation of the claims of the Roman bishop to dictate to the bishops of other dioceses. This was on the occasion of a sentence of excommunication which VICTOR I. (*c.* 190–202 A. D.) had pronounced upon certain bishops in the province of Asia Minor,[1] on account of their refusal to celebrate Easter at the particular time enjoined by the church in Rome. Victor appears not to have had recourse to this extreme measure until after he had consulted with his episcopal brethren in Palestine, Pontus, Gaul, and Corinth; but Irenæus, notwithstanding, remonstrates boldly with him on the rigor of his proceeding, and on the impolicy of thus cutting himself off from an important section of the church on a mere matter of ceremonial observance. We find again Tertullian, who during his residence in Rome had acquired a certain practical knowledge of the administrative characteristics of its church, implicitly intimating his disapproval in his treatise *De Pudicitia* (sec. i.) of the assumption by the Roman bishop of the titles of "pontifex maximus" and "episcopus episcoporum"; in another of his treatises (*De Virgin. veland.*;[2] Migne, *Patrol.*, pp. 767–8), he distinctly impugns the claim made by ZEPHYRINUS (202–218) of a certain superiority in the Roman see derived as a tradition from St. Peter.

Evidence afforded in the case of Callistus.

The evidence with which we are presented for the rest of the 3d century is of a similar character. CALLISTUS (218–223), the successor to Zephyrinus, was originally a Christian slave in Rome during the bishopric of Victor, who (if we accept the narrative of Hippolytus) had been sent on account of his turbulence and dishonest practices to the mines in Sardinia. Victor, who was acquainted with the circumstances of his career, deemed him, notwithstanding, so little deserving of commiseration that, when, through the influence of Marcia, the mistress of the Emperor Commodus, he had succeeded in bringing about the liberation of a certain number of Callistus's Christian fellow-sufferers in Sardinia, he did not include in the list the name of Callistus himself. The latter, however, managed to regain his freedom, and ultimately himself became bishop of Rome. During his brief episcopate his administration, as well as that of his predecessor Zephyrinus, was unsparingly criticized by Hippolytus, the well-known bishop of Portus. Against Callistus Hippolytus alleges the greatest laxity in the admission of candidates to ecclesiastical orders, and also undue connivance at marriages dishonorable to those professing the Christian faith; while Zephyrinus is depicted as a man of but little intelligence and of ignoble aims. It is evident that when a suffragan bishop could venture thus to criticize his metropolitan the authority wielded by the latter, even in his own diocese, was very far from meeting with unquestioning obedience.

The foregoing evidence, together with many other similar facts which cannot here be enumerated, points clearly to two important conclusions: first, that in the course of the 2d and 3d centuries the Church of Rome began to put forth unprecedented claims to a certain superiority among other churches; and, secondly, that these claims not unfrequently encountered considerable opposition as novel and unjustifiable.

Circumstances favoring the Roman claims.

Creation of the dignity of metropolitan.

The circumstances which contributed to bring about their ultimate establishment were various. The Roman Church itself had, from the first, been associated with that severer type of Christian belief which had its chief seat at Jerusalem; and, after the Holy City and its temple were alike razed to the ground by Titus (70 A. D.), much of the reverence which had belonged to Jerusalem was transferred to Rome. In relation to the episcopal office itself, again, it is to be noted that the general conception of its functions underwent, at this period, considerable change. On this point a passage in Jerome (*Ad. Tit.*, i. 7) is of special significance. He here expressly attributes the institution of the episcopal order to the necessity which had arisen of repressing the numerous schisms in the church; and he goes on to observe that bishops would consequently do well to bear in mind that their office, with its involved authority over presbyters, was to be regarded rather as the result of custom and tradition than of divine appointment. As regards any special supremacy attaching to the Roman episcopate, the evidence afforded by another passage in Jerome is not less notable. In one of his most important letters (*Ad Rusticum*; Migne, *Patrol.*, xxii. 932) he fully recognizes the expediency and value of a central supreme authority, vested in a single individual. In support of his position he adduces examples from the animal kingdom, from the imperial power, from the judicial power, from the military power, and then goes on to say, "so again each church has its one bishop, its one arch-presbyter, its one archdeacon, every ecclesiastical grade relying on its leader," but to the clenching example, derivable from the supreme pontiff himself, no reference is made. It seems, accordingly, an inevitable inference that by one of the greatest of the Latin fathers, writing at the close of the 4th century, the Roman theory of the popedom was unrecognized. But the circumstances which perhaps most conduced to the acceptance of the papal pretensions was the creation of a new office in the ecclesiastical organization, that of the metropolitan. So long as Christianity was the religion only of an obscure sect, or of a persecuted minority in the Roman state, lying also under the suspicion of political disaffection, it probably sought to avoid attracting further attention to itself by any elaborate attempt at organization. At the same time the political organization of the empire, from its long established and universally recognized territorial divisions, its system of intercommunication, and its arrangement of the executive power, must have obviously seemed to furnish the most practicable outlines for the administration of a great and growing ecclesiastical community. The chief cities or *metropoleis* of the several Roman provinces were accordingly from the first selected as the seats of the principal Christian churches—Antioch, Corinth, Ephesus, and Thessalonica respectively representing the chief ecclesiastical centres of Syria, Achaia, Asia, and Macedonia. And when, again, under Constantine and his successors, the distribution of civil authority was further modified by the creation of four patriarchates, subdivided into twelve "dioceses" or major provinces, these changes were soon followed by corresponding modifications on the part of the church organization. In this manner we are able to understand how it is that we find the bishop of Rome successively assuming, as in the pontificates of Fabianus and Cornelius, the more extended authority of a metropolitan,[3] and, as in the days of Julius I. and Siricius, the authority of a patriarch.

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[1] An expression which, it must be noted, is to be understood with considerable qualification as applied to the Roman province.

[2] The evidence afforded in the above two treatises carries the greater weight in that they were not written until after Tertullian had become a convert to the austere tenets of Montanism, when he must have been all the more inclined to favor the type of Christianity which then prevailed at Rome.

[3] In the canons of the council of Nicæa (325) the authority of a metropolitan is distinctly recognized, and in those of the council of Antioch (341) it is defined with greater precision,

Removal of the imperial court to Constantinople.

Rome becomes the centre of orthodoxy.

But no external event exercised a more potent influence on the early history of the Roman Church than the removal of the seat of imperial power to Constantinople (330). For more than a century from that event it was not a little doubtful whether the patriarch of "Nova Roma" might not succeed in asserting an authority to which even the Western pontiff might be compelled to defer. It became accordingly an object of primary importance with the latter to dissociate as far as possible in the mind of Christendom the notion of an ecclesiastical supremacy derived, like that at Constantinople, mainly from the political importance of the capital from the conception of that supremacy which he himself claimed as the representative of the inalienable authority and privleges conferred on St. Peter and his successors. For such a policy an additional motive was created by the predilection shown by Constantine for his new capital, and the conviction which he is said to have entertained that the days of ancient Rome were numbered.[1] From henceforth it was the key-note to the utterances of the Roman primate that his supremacy, as a tradition from apostolic times, could never depart from him and his successors, and that, as representing the authority of the two chief apostles, it had claims upon the obedience and reverence of the whole Christian church such as no other *apostolica sedes* could produce. To the ultimate assertion of these pretensions the long and fierce struggle carried on between the followers of Arius and the supporters of orthodoxy materially contributed. The appeal to the arbitration of Rome, preferred both by Athanasius and by the Arian party, placed JULIUS I. (337–352) in the proud position of the recognized protector of the orthodox faith. In the year 339 Athanasius himself visited the Western capital and resided there for three years. His presence and exhortation confirmed the Roman pontiff still further in his policy; and from this time we perceive the see of Rome assuming, more distinctly than before, the right to define doctrine and the function of maintaining the true standard of faith amid the numerous heresies that were then troubling the whole church. While Constantinople was conspicuous by its attachment to Arianism, Rome appeared as the champion of the orthodox belief. In another direction the Western see would appear to have been also advancing important and exclusive claims. If we accept as genuine the letter of Julius to the Eusebians, written after the acquittal of Athanasius, the pontiff already maintained that, in all proceedings whereby the conduct or orthodoxy of any of the higher ecclesiastical authorities was called in question, the canonical method of procedure required that the Roman see should be consulted before any initiative was taken. In other words, the council which had been convened at Tyre to try Athanasius had usurped the functions which belonged to the pontiff of Rome alone.

First schism.

During the bishopric of LIBERIUS (352–366) we meet with the first instance of a schism in the Roman Church, and, in the person of Felix, with the first representative of that maintenance of a rival claim to the see which in later history assumed such importance in connexion with the antipopes. The contested succession of DAMASUS (366–384), although attended by scenes of brutal violence and outrage, affords further illustration of the main question then at issue. Damasus, who had been the personal friend of Liberius, represented the cause of orthodoxy, and his triumph over his rival, Ursinus, was hailed with exultation by the chief contemporary teachers of the church. During his tenure of the see Arianism in the West almost ceased to exist.

Counter pretensions of Constantinople.

At the council of Nicæa (325), one of the canons enacted (the sixth) had already assigned to the three sees, or patriarchates, of Rome, Alexandria, and Antioch, their honorary rank in the order of their enumeration. In the year 381 the council of Constantinople was convened; it was an assembly in which the Western Church took no share, and its notable third canon was accordingly enacted without opposition. By this it was declared that the bishop of Constantinople, or Nova Roma, was entitled, although the representative of a non-apostolic see, to the next place after Rome, and consequently to precedence of the older and apostolic sees of Alexandria and Antioch. This distinguished position was assigned to him as the supreme ecclesiastical authority in the new centre of political power, and a theory of the basis of ecclesiastical dignity was thus put forward by the church which was in direct conflict with that maintained by Rome.

The Decretals.

The pontificate of SIRICIUS (384–398) is chiefly remarkable as that with which commences the series known as the Decretals—a collection of pastoral letters and of replies to questions submitted for their consideration sent by the popes to the churches of the West. These subsequently formed the basis of a vast and elaborate series of forgeries known as the decretals of the pseudo-Isidorus, of which we shall have occasion again to speak; but the genuineness of the letter of Siricius to Himerius, bishop of Tarragona, does not appear to have ever been called in question, and it takes its stand therefore as the earliest existing decretal. In the influence which they exercised upon Western Christianity neither Siricius nor his successor ANASTASIUS I. (398–401) could compare with their illustrious contemporary, Ambrose, bishop of Milan, whom the emperor Theodosius pronounced to be the only true bishop whom he had known. But Ambrose, although acting in perfect independence of the Roman see, always professed to take it as his model in matters of discipline, and by the respect which his example inspired in others for the episcopal office in general he indirectly augmented the conception of the papal prerogatives.

Division of the empire.

With the division of the empire in the year 395 the question of the Roman precedence of Constantinople was left for a time in abeyance; but in the West the authority of the bishop of Rome became more and more firmly established. In the following century the general conditions under which he was called upon to act became so materially modified as to constitute a new period in the history of our subject.

Popes of the 5th century.

Innocent I.

The characters of the men who filled the papal chair during this century, most of them of exemplary life, some of commanding genius, would alone suffice to constitute it a memorable era. "Upon the mind of Innocent I." say Milman, "seems first distinctly to have dawned the vast conception of Rome's universal ecclesiastical supremacy." INNOCENT I. (402–417) seems indeed to have been the first of the popes who ventured to repudiate those political conceptions which threatened to circumscribe the extending influence of his office. Writing in the year 415 to Alexander, bishop of Antioch, he implies that the church in that city, as an "apostolica sedes," is entitled to rank second only to Rome; "but not," he adds, "so much on account of the grandeur of the city itself as because it is shown to be the first apostolic see" (Mansi, *Concilia*, vol. iii. p. 1055). In the same letter he distinctly repudiates the notion that the church is bound by political divisions; the emperor may create two capitals (*metropoleis*), but it by no means follows that a second metropolitan is to be appointed by the church. In the year 412 he gave practical proof of his determination to assert his own theory of his prerogatives, by appointing the archbishop of Thessalonica his vicar over the extensive province of Illyricum, of which but a small portion lay in the Western empire; and, when the bishops of the province showed themselves less amenable than he had anticipated to his directions in matters of discipline, he insisted with unprecedented explicitness on the jurisdiction of his see as "head of all the churches." Innocent was succeeded by **Zosimus** (417–418) and **Boniface** (418–422). The former, whose pontificate lasted only twenty-one months, exhibits a noteworthy exception to the traditions of his see, in the disposition he at one time showed to temporize with Pelagianism, and even to set aside in its favor the decrees of his predecessor. The pontificate of Boniface is notable as having been preceded by a contested election which afforded the emperor Honorius an opportunity for the exercise of his intervention, thereby establishing a precedent for imperial interference on like occasions. At the instance of Boniface himself, Honorius enacted an ordinance designed to avert the scandals incident to such contests. By the new provisions, all canvassing for the vacant chair was strictly prohibited; in the event of a disputed election both candidates were to be deemed ineligible; finally, it was essential to any election that the candidate should have been chosen by the unsolicited suffrages of the qualified clergy, and that their choice should have been ratified by the approval of the entire church community. The successor of Boniface was **Cœlestinus** I. (422–432). The evidence afforded by the events of his pontificate is somewhat conflicting in character. On the one hand, we find the churches of Africa putting forward their latest recorded protest against the Roman pretensions, adducing the sixth canon of the council of Nicæa in support of their protest; on the other hand, the success with which Cœlestinus intervened in Illyricum, and again in connection with the sees of Narbonne and Vienne, proves that the papal jurisdiction was being accepted with increasing deference in other parts of the empire. The effect with which his solicited decision was given in the controversy raised by Nestorius, the patriarch of Constantinople, and the synod held under his auspices in Rome (430) for the further consideration of the same question, likewise added to the reputation of his office.

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[1] The story of the "Donation of Constantine" and the long enumeration of the possessions which he bestowed on the church, preserved in the *Liber Pontificalis*, must be looked upon as accretions of a later period. It is supposed, however, that Constantine built the original Vatican basilica, the church of St. Agnes, and the Lateran.

Effects of barbaric invasion.

Barbaric invasion, although resulting in the overthrow of many of the institutions of civilization, and in widespread suffering and social deterioration, served but to enhance the influence and importance of the Roman see. The apparent fulfilment of prophecy, pagan as well as Christian, when the city was taken and sacked by Alaric (410), seemed to complete the effacement of the temporal power in Rome. Neither the Western emperors nor the Gothic conquerors held their court in the ancient capital, where the pope was now at once the most important and conspicuous authority. In the African provinces, the demoralization occasioned by the fierce controversies and dissensions concerning Pelagianism and Donatism compelled the Catholic communities to exchange their former attitude of haughty independence for one of suppliant appeal, and to solicit the intervention and counsel which they had before rejected. Such was the aspect of affairs in the West when **Leo the Great** (440–461)—by some regarded as the true founder of the mediæval popedom—succeeded to the primacy.

Leo the Great.

A citizen of Rome by birth, he exemplified in his own character many of the antique Roman virtues—a tenacious adherence to tradition in matters of religious belief, an indomitable resolution in the assertion of the prerogatives of his office, and the austere practice of the recognized duties of social life. This rigid maintenance of orthodoxy had been instilled into him (or at least confirmed) by the exhortations of Augustine, with whom he had become personally acquainted when on a mission to the African province; and before his election to the papal office the celebrated Cassian had conceived so high an opinion of his virtues and abilities as to dedicate to him his treatise on the Incarnation. Regarded, indeed, simply as the able antagonist of the Manichæan and Eutychian heresies, and as the first author of the Collect, Leo would fill no unimportant place in the annals of Latin Christendom; but his influence on church history in other respects is of a far deeper and more potent kind. In none was it followed by more important results than by the success with which he established the theory that all bishops who, in questions of importance, demurred to the decision of their metropolitan should be entitled to appeal to Rome. He obtained the recognition of this principle not only in Illyricum, as his predecessor Innocent had done, but also in Gaul; and the circumstances under which he did so in the latter province constitute the whole proceedings a memorable episode in church history. Celidonius, bishop of Besançon, had been removed from his bishopric by his metropolitan, the eminent Hilary of Arles, and determined to proceed to Rome to appeal against his sentence in person. He was followed thither by Hilary, who courageously protested against any exercise of the pontifical authority which should trench upon his own as metropolitan, and for which, in the present instance, it seems to be generally admitted that the canons of the church down to the time of Dionysius Exiguus (fl. 525) afforded no sanction.[1] Leo, however, not only annulled the sentence of deprivation, but condemned Hilary's entire conduct. The latter could only remonstrate in terms of energetic but ineffectual protest, and then took his departure from the city to die soon after at Arles. His name, along with that of Irenæus, stands at the head of that long succession of able churchmen who, sometimes in conjunction with the temporal power and sometimes independently of it, have gained for the Gallican Church a character for systematic opposition to the encroachments of the Roman see which (if we except the Church of Utrecht) is unique among the communities of Western Catholicism. In a circular letter to the churches of Gaul, Leo subsequently passed a formal and deliberate censure upon Hilary's conduct; and this measure was followed up by an imperial edict, in which, again, we have a remarkable illustration of that compact between the state and the church which assumed such importance at a later period. In this decree of Valentinian III. (445) the primacy of Rome is placed upon a triple basis—the merits of St. Peter, the majesty of the city of Rome, and the authority of a council (*sacræ synodi auctoritas*). To which of the councils reference is intended is by no means clear; but all bishops are required by this imperial edict to present themselves when summoned at the tribunal of the Roman pontiff (*Novellæ*, ed. Hänel, pp. 172–5). As, prior to this time, the emperors themselves had always claimed, though they had not invariably exercised, the right of representing a supreme court of appeal, this transfer of such a prerogative to Rome may fairly be regarded as marking the commencement of a new era in the conception of the papal office.

Rome constituted a court of appeal.

Influence of Arianism.

The chief obstacle to the recognition of the supremacy of the Roman pontiff was now to be found in the revival of Arianism, which, professed alike by the Goth and the Vandal, represented the dominant faith in the chief cities of northern Italy, as well as in Africa, Spain, and southern Gaul. But the rivalry thus generated only increased the disposition of the Catholic party to exalt the prerogatives of their head, and the attitude of Rome towards other churches continued to be more and more one of unquestionable superiority. In the year 483 Pope Felix II. (or III.) ventured upon an unprecedented measure in citing Acacius, the patriarch of Constantinople, to Rome, to answer certain allegations preferred against him by John, patriarch of Alexandria, whom he designates as "frater et coepiscopus noster" (Thiel, *Epistolæ*, p. 239). On Acacius refusing to recognize the legality of the letter of citation, he was excommunicated by Felix. The successor of Felix, Gelasius I. (492–496), refused to notify, as was customary, his election to the patriarch of Constantinople, and by his refusal implicitly put forward a fresh assumption, viz., that communion with Rome implied subjection to Rome. Throughout the pontificate of Gelasius the primacy of the Roman see was the burden of his numerous letters to other churches, and he appears also to have been the first of the pontiffs to enunciate the view that the authority which he represented was not controllable by the canons of synods, whether past or present. In Italy these assumptions were unhesitatingly accepted. The Palmary Synod, as it was termed, convened in Rome during the pontificate of Symmachus (498–514) formally disavowed its own right to sit in judgment on his administrative acts. Ennodius, bishop of Pavia (*circ.* 510), declared that the Roman pontiff was to be judged by God alone, and was not amenable to any earthly potentate or tribunal. It is thus evident that the doctrine of papal infallibility, though not yet formulated, was already virtually recognized.

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[1] That is, unless we admit the genuineness of the canons of the council of Sardica (343), which probably few who have studied the evidence will be prepared to do.

The Gothic monarchs.

During the Gothic rule in Italy (493–553), its representatives manifested the utmost tolerance in relation to religious questions, and showed little disposition to impose any restraints on the policy of the popes, although each monarch, by virtue of his title of "king of the Romans," claimed the right to veto any election to the papal chair. In the year 483, when Odoacer sent his first lieutenant Basilius, from Ravenna to Rome, the latter was invested with the titles "eminentissimus" and "sublimis." The pope accordingly appeared as politically the subject of his Arian overlord. The advantage thus gained by the temporal power appears to have been the result of its intervention, which Simplicius (468–483) had himself solicited, in the elections to the papal office, and one of the principal acts of the Palmary Synod (above referred to) was to repudiate the chief measures of Basilius, which had been especially directed against the abuses that prevailed on such occasions, and more particularly against bribery by alienation of the church lands. The assertion of this authority on the part of the civil power was declared by the synod to be irregular and uncanonical, and was accordingly set aside as not binding on the church. The fierce contests and shameless bribery which now accompanied almost every election were felt, however, to be so grave a scandal that the synod itself deemed it expedient to adopt the ordinance issued by Basilius, and to issue it as one of its own enactments. In order more effectually to guard against such abuses, Boniface II., in the year 530, obtained from a synod specially convened for the purpose the power of appointing his own successor, and nominated one Vigilius—the same who ten years later actually succeeded to the office. But a second synod, having decided that such a concession was contrary to the traditions of episcopal succession, annulled the grant, and Boniface himself committed the former decree to the flames. At his death, however, the recurrence of the old abuses in a yet more flagrant form induced the senate to obtain from the court of Ravenna a measure of reform of a more comprehensive character, and designed to check, not only the simoniacal practices within the church itself, but also the extortion of the court officials.

Dionysius Exiguus.

In the year 526 Dionysius Exiguus, a monk in Rome, undertook the labor of preparing a new collection of the canons of the councils, and, finding his production favorably received, proceeded also to compile a like collection of the papal letters or decretals, from the earliest extant down to those of Anastasius II. in his own day. The letters of the popes were thus placed on a level with the rescripts of the emperors, and in conjunction with the canons formed the basis of the canon law, which afterwards assumed such importance in connection with the history of the church. The negative value of the collection formed by Dionysius may be said, however, almost to equal that of its actual contents; for, from the simple fact that it does not contain those yet earlier decretals subsequently put forth by the pseudo-Isidorus, it affords the most convincing disproof of their genuineness.

Results of subjection to the Greek emperors.

The substitution of the rule of the Greek emperors for that of the Gothic monarchs was inimical in almost every respect to the independence and reputation of the popedom. For a short interval before Justinian landed in Italy, Agapetus (535–536), appearing as the emissary of Theodotus to the Eastern court, assumed a bearing which inspired the emperor himself with respect, and his influence was sufficiently potent to procure the deposition of one patriarch of the Eastern capital and to decide the election of another. But, after Belisarius entered Rome and the city had been reduced to subjection, the pontiff was seen to be the mere vassal of the emperor, and not only of the emperor but of the courtesan on the imperial throne. The deposition of Silverius (536–540), and his mysterious fate at Pandataria, together with the elevation of Vigilius (540–555), the nominee of the abandoned Theodora and her pliant slave, completed the degradation of the Roman see. Each successive pope was now little more than a puppet which moved at the pleasure of the Eastern court; and the *apocrisiarius* or deputy whom he maintained at that court was generally (as in the case of Pelagius I., Gregory I., Sabinian, Boniface III., Martin) his own successor—an honor purchased, it can hardly be doubted, by systematic compliance with the imperial wishes. In the career and fate of Vigilius the papal office was dishonored as it had never been before, at once by the signal unworthiness of its bearer and by the indignities heaped upon him by the savage malice of his foes. So sinister, indeed, had become the relations between the Roman bishop and the Eastern court that Pelagius I. (555–560) is said to have besought Narses to send him to prison rather than to Constantinople.

Invasion of the Lombards.

In the year 568 the Lombards invaded Italy. Like the Goths they became converts to Arianism; but they were also far less civilized; and looked with little respect on Roman institutions and Roman habits of thought, while their arrogance, faithlessness, and cruelty gained for them the special detestation of the Roman see. Their conquests did not extend over all Italy. Ravenna and the Pentapolis, Venice, Rome and its duchy (as the surrounding district was then termed), Naples, Calabria, and Sicily remained subject to the empire. In the peninsula the pope was, after the exarch of Ravenna, the most powerful potentate, and the presence of a common foe caused the relations between between himself and the empire to assume a more amicable character. The emperor, indeed, continued to control the elections and to enforce the payment of tribute for the territory protected by the imperial arms; but, on the other hand, the pontiff exercised a definite authority within the Roman duchy, and claimed to have a voice in the appointment of the civil officers who administered the local government. From the time of Constantine the Great the church had possessed the right of acquiring landed property by bequests from individuals, and the Roman see had thus become greatly enriched. Some of its possessions lay far beyond the confines of Italy. It was one of the last acts of Celestine I. to address to the emperor Theodosius II. an appeal for the imperial protection of certain estates in Asia, which a lady named Proba had bequeathed to the Roman see for the maintenance of "the clergy, the poor, and certain monasteries" (Coustant, ed. Schoenemann, p. 879). "Ever since the restriction of the Western empire," says Mr. Bryce, "had emancipated the ecclesiastical potentate from secular control, the first and most abiding object of his schemes and prayers had been the acquisition of territorial wealth in the neighborhood of his capital. He had indeed a sort of justification, for Rome, a city with neither trade nor industry, was crowded with poor, for whom it devolved on the bishop to provide." The motives for acquiring such wealth did not, accordingly, cease to actuate the pontiff, even when the paralyzing influences of the imperial despotism were again very sensibly felt; but the territory thus gained, known as the "patrimonium Petri," must not be supposed to have involved that claim to temporal sovereignty put forth at a later period. Originally bestowed mainly for the relief of the sick and destitute, the patrimonial revenues came, in course of time, to be applied to the maintenance of the pope himself and the clergy of his diocese, and to the erection and repair of churches. They were strictly inalienable; and the pontiff himself was regarded simply as the steward, for the time being, of the estate.

Gregory the Great.

Under **Gregory** I. (590–604), commonly known as "the Great," this territorial wealth became largely augmented; and, although, amid the universal demoralization and wide-spread misery of his age, he professed to discern the unmistakable signs of the approaching end of the world, the efficient administration of the estates of the church was an object of his unceasing solicitude. Of noble descent, great wealth, and considerable learning, he possessed also a capacity for administration not inferior to that of his predecessor Leo, and his best energies were devoted to the interests of his diocese and the alleviation of the want and misery of which it was the constant scene. His *Letters*, which constitute a remarkable picture both of the man and his age, and attest the minute and unwearied care which he bestowed on everything relating to the affairs of his see, appear to have been taken as the model for the *Liber Diurnus*, or journal of the Roman curia, which was commenced in the following century. In other respects his genius for administration, his good sense and tact, are equally conspicuous. Through his influence with Theudelinda, the wife of Agilulf, the Lombard monarch, he not only succeeded in averting another siege of Rome, but he also managed to bring about the establishment of amicable relations between the Lombards and the Roman population. With the Byzantine court he did his best to maintain a friendly intercourse, although in his zeal on behalf of monasticism he withdrew his *apocrisiarius* from Constantinople, when the emperor Maurice forbade his soldiers to assume the monastic life. It is perhaps the greatest blot on Gregory's memory that, when the emperor and his family were cruelly murdered by Phocas, who seized upon the imperial dignity, Gregory was not above congratulating the usurper on the circumstances of his accession, an act of adulation but insufficiently extenuated by his panegyrists, as taking its rise in feelings of genuine, though mistaken, religious enthusiasm. His efforts on behalf of primary education, which have caused him to take rank in the Roman calendar as the patron saint of school festivals, are deserving of high praise; but, on the other hand, his illiberal condemnation of the pagan literature (in striking contrast to the Benedictine traditions of a later time) diminishes not a little our impression of his real greatness. He stands, however, among the foremost of the popes, and the impress of his character and teaching must be held to have permanently modified the views and policy of the Roman curia.

The successors of Gregory.

The personal qualities and virtues of Gregory are thrown into stronger relief by the comparative insignificance of his successors in the 7th century, whose tenure of office was, for the most part, singularly brief and inglorious. His immediate successor was **Sabinianus** (604–606), who, after a few months' tenure of office, and an interval of a whole year which remains entirely unaccounted for, was succeeded by Boniface III. (607). Boniface was the last *apocrisiarius* who had represented Gregory at the imperial court, and he appears to have been successful in completely winning the favor of Phocas, who at his suggestion passed a decree declaring "the Apostolic Church of Rome" to be "the head of all the churches." He did this, says Paulus Diaconus, "because the church of Constantinople had styled itself the first of all the churches."[1] In this manner the imperial veto was distinctly pronounced on the claim of the Byzantine Church to be regarded as of universal authority—a claim which it now became the policy of the Church of Rome to assert on her own behalf on every possible occasion. The new and intimate relations which Gregory and his emissaries had created between the church and the great Teutonic races especially favored these assumptions. Frankland and England alike were brought within the range of influences of incalculable after importance, the development of which in the 7th and 8th centuries may fairly be looked upon as constituting a distinct era in the history of the popedom. In Rome itself, on the other hand, the interest of the drama becomes perceptibly lessened. In the long and rapid succession of the pontiffs, most of them pliant Greeks or Syrians, the nominees of the exarch of Ravenna, and intent on winning the favor of both the emperor and his representative, scarcely one appears as actuated by more than the traditional views of his office and its functions. One of them, who ventured to thwart the imperial purpose, paid dearly for his conscientiousness. The Byzantine capital, at this period, was distracted by the interminable controversies carried on between the Monothelites and their opponents. The emperor, the half-insane Constans, arrogated to himself the function of mediating between the contending parties, and sought to wring from **Martin** I. (649–653) an authoritative assent to a compromise of doctrine which, to that pontiff, appeared to involve the sacrifice of orthodoxy. The latter convened a council at the Lateran and formally condemned the proposed solution. He was soon after induced to repair to Constantinople, and, having there been arraigned on a false charge of fomenting political intrigue, was deprived of his see and, although in advanced years and feeble health, banished to a gloomy prison on the Euxine, where he soon after died.

Advances made by the papacy in the West.

But, while thus menaced and dishonored in Italy, the papal power was making important advances in the west. In England the resistance offered by the representatives of the British Church was soon overcome, and from the time of the council of Whitby (664) the teachings and traditions of Gregory, as enforced by Augustine, Theodorus, Wilfrid, and others, found ready acceptance. The humanizing influences which these representatives of the Roman culture diffused around them exercised a potent spell over the minds and wills of the English population. Monasteries were founded; cathedrals rose, each with its school of instruction for the young, and its charity for the needy; and a spirit of filial though far from slavish devotion to Rome was everywhere created.

Relations to Frankland.

In Frankland, however, the Merovingian kings and the population of Neustria and Austrasia exhibited a different spirit, and the civil power showed no disposition to welcome foreign interference even in connection with ecclesiastical institutions. It is observed by Guizot that from the death of Gregory the Great to the time of Gregory II. (604–715) not a single document exists which can be cited as proof of intercommunication between the rulers of Frankland and the papacy. The series of events which led to such different relations, enabling the Roman pontiff eventually to shake off both his fear of the Lombard and his long dependence on the Byzantine emperor, forms one of the most interesting passages in European history.

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[1] *De Gestis Longobard.*, bk. iv., c. 36; this remarkable passage is reproduced by Bede, *De Temporum Ratione*, Migne, *Patrol.*, xc. 565; and also by Anastasius, *De Vitis Rom. Pont.*, in life of Boniface III., Migne, *Patrol.*, cxxviii. 671.

Gregory II.

In the year 715 the long succession of pliant Greeks and Syrians in the papal chair was broken by the election of a man of Roman birth and endowed with much of the strength of purpose that belonged to the ancient Roman. In Gregory II. (715–731) men recognized no unworthy successor of his great namesake, and by Gibbon he is regarded as the true "founder of the papal monarchy." In no respect were his care and religious sentiments more conspicuously manifested than in connection with the evangelization of distant lands, and it was under his auspices that the celebrated Winfrid or Boniface first commenced his famous missionary work in Frankland. His rapid success in the work of converting the still heathen populations is a familiar story. From Gregory III. (731–741) Boniface received the appointment of papal legate; he took the oath of perpetual fidelity to the supreme pontiff, and wherever he went he preached the duty of a like submission. He enforced the theory of the Catholic unity and of the obligation of the whole body of the clergy to render implicit obedience to the representative of that unity,—the successor of St. Peter, the spiritual superior of all earthly tribunals.

Rupture with the empire.

While bonds of union were thus being created in the West, theological differences were exercising a very different though not less important influence in the East. It was in the year 731 that Gregory III., the last of the pontiffs who received the confirmation of his privileges from Constantinople, issued a sentence of excommunication against the Iconoclasts. It was the papal rejoinder to the decree of Leo the Isaurian, passed in the preceding year, commanding that all images in the churches of the empire should be forthwith removed. Although he was a Syrian by birth, orthodoxy was dearer to Gregory than political allegiance, and the sequel justified his policy. The emperor, indeed, retaliated by what could not but be deemed a disastrous blow. All the dioceses within the empire where the Roman pontiff had hitherto claimed obedience—Calabria, Sicily, and Illyricum—were forthwith absolved from their ecclesiastical allegiance, and the revenues from their rich "patrimonies," which had before flowed into the papal treasury, were confiscated. But the tie which had hitherto bound the popedom to the empire was thus effectually broken.

Under these circumstances a compact with the Lombards, who had by this time become converts from Arianism to the Catholic faith, would have seemed the obvious policy on the part of Rome, had not the political aims of the former stood in the way. The Lombard coveted the possession of the capital, and this design, the cherished design of centuries, marked him out as perforce the foe of the popedom. In his extremity, therefore, the Roman pontiff turned to the Frank, untainted by the heresy of Arianism, and already, as the result of the teachings of Boniface, disposed to assent to any claims of the papacy which did not involve the diminution of his own prerogatives or the restoration of alienated revenues. In the year 752 Pepin le Bref assumed the dignity and title of "king of the Franks." He did so, the annalists are unanimous in assuring us, with the consent and sanction of Pope Zacharias, and he was anointed and crowned by Boniface—a momentous precedent in relation to European history. In the following year, during the pontificate of Stephen III. (753–757) Aistulf, the king of the Lombards, invaded the duchy of Rome with the avowed purpose of adding the capital itself to his dominions. He seized Ravenna and the exarchate; and Stephen, finding remonstrance and entreaty alike unavailing, fled for protection to the Frankish territory and was received by King Pepin with every mark of sympathy and profound respect. Within a short time after, Pepin invaded the Lombard domain and wrested from its monarch an extensive territory embracing Ravenna and the Pentapolis; and at a council held at Quiercy, in the same year (754), he handed over this territory to Stephen, "to be held and enjoyed by the pontiffs of the apostolic see for ever." Such appears to be the real origin of that "donatio," or gift of territory (referred back, by the invention of after times, to the age of Constantine the Great), which constituted the pope a temporal ruler over what were subsequently known as the "States of the Church." The munificence of Pepin was rivalled by that of his son. In the year 774, on the occasion of the visit of Charles (known as the Great) to Rome, the donation of his father was made the ground for soliciting and obtaining a yet larger grant, comprising much of the territory already bestowed, but extending to at least double the area stipulated for in the earlier donation.

Alliance with the Carolingian dynasty.

State of the papal claims at the close of the 8th century.

It will thus be seen that, towards the close of the 8th century, the germs of the chief papal claims were already in existence, and only needed for their full development those favoring conditions which, with the lapse of time, were certain to occur, and for which, from its peculiar character as an institution, the popedom itself was so well able to watch and wait. Already the pontiff claimed the dispensing power, *i.e.*, the right to dispense with the observance of the existing canonical law under conditions determinable at his pleasure. Already he claimed the right to confer privileges—a power subsequently wielded with enormous effect in enabling monastic and episcopal foundations to urge their encroachments on the rights and jurisdiction of the secular power. He assumed again, in Western Christendom at least, the rights of an universal metropolitan—demanding that in all elections to bishoprics his sanction should be deemed essential; and the arrival of the *pallium* from Rome was already awaited with anxiety by all newly-elected metropolitans. By the encouragement which was systematically given to appeal to Rome, what had before been the exception became the practice, and that "extraordinary" authority, as it was termed, which had been introduced, in the first instance, only under the pretext of providing a fixed court of appeal in cases of dispute which threatened otherwise to prove incapable of adjustment, developed into an immediate and ordinary jurisdiction—into an authority, that is to say, which in all questions of graver import set aside that of the bishop, and even that of the metropolitan, and made reference to Rome the rule rather than the exception. In theory, although the claim was admitted neither by the rulers of Frankland nor by those of England, the Roman pontiff already claimed also to present to all benefices. Although he had not, as yet, assumed the distinctive insignia of his office—the triple crown and the upright pastoral staff surmounted by the cross—he more and more discouraged the application of the name of "papa" (pope) to any but himself. The title of "universal bishop," which both Pelagius II. and Gregory the Great had disclaimed, seemed his by right after the decree of Phocas, and with the lapse of two centuries from that time was assumed by no other rival. The titles of "apostolicus," "claviger" (the bearer of the keys), and "servus servorum Dei" were claimed in like manner as exclusively his. One temporal potentate had already received his crown as a grant from the pontifical chair; the occupant of that chair was already himself a temporal sovereign.

Development of the Roman theory.

That the mediæval conception of the papal office was one of gradual and slow development appears accordingly to be beyond all reasonable doubt, and this feature belongs in common to the whole hierarchical system. We find, for example, that the conception of the episcopal order and its functions grew with the increasing power and wealth of the church. In like manner if we compare the theory of the equality of bishops one with another, enunciated by Cyprian, with the prerogatives of a metropolitan, as laid down at the council of Antioch (341), and subsequently further magnified, we are conscious of the introduction of what is tantamount to a new theory. And, finally, we become aware of yet another hierarchical order, as we see rising up the patriarchates of Rome, Alexandria, Antioch, Jerusalem, and Constantinople, each invested by the church with an assigned order of precedence. Something, however, was yet wanting which should crown the gradations thus successively created, and complete the analogy to the Roman political organizations—the institution of the monarchical dignity. It was for this supreme honor that Rome and Constantinople contended, at a time when, from various causes and circumstances, the other patriarchates had sunk into an inferiority too marked to admit of rivalry. In this contest the patriarch of Constantinople rested his claim on what may be termed the traditional political foundation—the honor due to the patriarch of the chief seat of empire; this plea, although already sanctioned by the church, was met on the part of Rome by a counter appeal to the supreme reverence due to what was not merely an "apostolica sedes," but a see founded by two apostles, of whom one was the chief of the apostolic order. In this remarkable abandonment of the ancient plea for pre-eminence and the limitation of the argument to that derivable from the claim to be an apostolic see, much of the difficulty and obscurity that belong to the earlier history of the papacy had probably its origin. And it seems but too probable that the endeavor to disguise this change, and to represent the claims advanced by Innocent I., by Leo I., by Gregory the Great, and by Hadrian II., *as already virtually asserted and admitted in the 4th century and in yet earlier times*, has given rise to endless wrestings of isolated passages in writers of good authority, to deliberate falsification of genuine documents, and to what are allowed on all hands to be direct and palpable forgeries. Another feature, which has been made subservient to no small amount of misrepresentation, must not be overlooked. From their earliest appearance, the distinctive claims advanced by the Roman see can only be regarded as a series of encroachments on that original conception of the episcopal office maintained by Cyprian. And so long as the other patriarchates—Alexandria, Antioch, and Jerusalem—maintained their ground, these encroachments wore a comparatively inoffensive guise, being little more than the assertion of the rights of a patriarch or supreme metropolitan within the Roman diocese. But, in addition to and distinct from the patriarchal supremacy, there was the theory of the primacy of the bishop of Rome over all the bishops, patriarchs, and metropolitans—at first little more than an honorary distinction and carrying with it no definite authority or jurisdiction. When the patriarchates of Alexandria, Antioch, and Jerusalem could no longer appear as rivals and Rome was confronted by Constantinople alone, this theory was brought much more prominently forward; while at the same time, in order the better to enforce the papal claims, a confusion was designedly and skilfully introduced of the honorary primacy derived from St. Peter with the actual rights of the head of the Roman diocese. The precedents afforded by the former were adduced in support of the universal jurisdiction claimed by the latter, and in an ignorant and uncritical age were with little difficulty represented as affording sufficient warrant for a large proportion of the claims asserted in the 9th century. It is by the light which we derive from these considerations that we are enabled to discern what appears to be the only theory which offers a solution of the tradition respecting St. Peter and his successors that is in harmony with the historical evidence. When we consider that in the course of the 5th century papal Rome, partly from the ambition of her pontiffs, partly from the concurring influence of external circumstances, had acquired a position of authority in relation to Christendom at large which afforded the prospect of yet more complete and general pre-eminence, and that towards the assertion of such pre-eminence her claim to rank as the greatest and most honored of the "apostolicæ sedes" seemed to offer effective aid, the appearance of legends and spurious documents tending to support such a claim can excite no surprise in the minds of those familiar with the literature of the period. As in the 2d century the attempt to reconcile two earlier and corrupt traditions respecting St. Peter's presence and work in Rome gave rise to the tradition of his five-and-twenty years' episcopate, so, we can understand, it was probably sought to substitute for the simple tradition preserved in "Hegesippus" and Irenæus, with respect to St. Peter's successors, official records (purporting to supply details such as no other church had preserved, and such as it is in the highest degree improbable that the church at Rome should have succeeded in preserving) of an early episcopal succession; while the discrepancies of the different lists that profess to record this succession admit, again, of an adequate if not a satisfactory explanation, if we regard them as, for the most part, independent and purely conjectural efforts to invest the earlier episcopal office with an historical importance to which in the first two centuries it certainly had not attained.

Creation of the Holy Roman Empire.

While the Western primate was thus growing in dignity, wealth, and influence, those ecclesiastical potentates who had once claimed an equal or coördinate rank, with the sole exception of the patriarch of Constantinople, altogether ceased to exist. The Saracen conquests in Syria and Egypt had involved the loss of Jerusalem to Christendom (637), and this had been speedily followed by the extinction of the churches of Antioch and Jerusalem. The patriarch of Constantinople represented, accordingly, the only spiritual power which could compare with that of Rome; but, while *he* continued to be the submissive vassal of the Byzantine court, that court was compelled to see the once no less submissive pontiff of Rome changed into a successful invader of its Italian possessions and into a determined repudiator of its articles of faith. In the year 800 Charles the Great received at the hands of Leo III., in Rome, the imperial crown, and the titles of "emperor" and "Augustus." The authority by virtue of which Leo assumed the right to confer such dignities was probably by no means quite clear even to those who were witnesses of the imposing ceremony. It may perhaps be best described as derived partly from his sacerdotal function, as displayed in the consecrating rites, and partly from the fact that he also acted as the representative of the people in their capacity of electors. To the Byzantine emperor, the whole ceremony and the titles conferred seemed a direct menace to his own prerogative, and completed the estrangement between the West and the East. From that time down to the 15th century Greek institutions and Greek culture were the special objects of dislike and distrust to the papacy. The use of the Greek language had already been discontinued in the records of the Roman Church; and the study of its literature was now systematically discouraged. The assumption by Charles of the imperial dignity and the consequent rise of the "Holy Roman Empire" were events on the importance of which it is unnecessary

The empire and the popedom.

Nicholas I.

The false decretals.

here to dwell. By the theory thus established, a temporal supremacy or "condominium" was created corresponding to the spiritual supremacy of the popedom, and the Roman emperor claimed from all other rulers in Christendom an allegiance corresponding to that which the Roman pontiff claimed from all other ecclesiastical potentates. The imperial authority and papal authority were thus complementary the one to the other. The emperor claimed to 'confirm the papal elections; the pope claimed to confer the imperial crown upon the emperor. But the precise adjustment of these respective claims, and the further assumptions which they suggested or favored, according as the empire or the papacy proved for the time the stronger, gave rise to a series of memorable struggles which sometimes assume proportions that constitute them the pivot on which contemporary history throughout Europe may be said to revolve. The compact originally made between the empire and the popedom, however plausible in theory, was indeed attended with no little danger to both. At one time it appeared probable that the state would overwhelm the ecclesiastical organization and convert it into a machine for political purposes; at another time it seemed no less likely that the latter would subjugate the former and reduce all Western Christendom to a vast spiritual tyranny. During the three centuries that followed upon the creation of the Holy Roman Empire—from the year 800, that is to say, down to the Concordat of Worms (1122)—it was chiefly the former contingency that seemed the more probable. During the pontificate of NICHOLAS I. (858–867), however, the papacy again made a perceptible advance. Nicholas intervened with signal effect in the disputed succession to the Eastern patriarchate, and asserted more distinctly than it had ever been asserted before the theory of the Roman supremacy. He dared, also, to forbid the divorce of Lothair (the powerful monarch of the vast territory which stretched from the German Ocean to the Mediterranean) from his wife Theutberga, thereby establishing an important precedent for papal interference in questions of private morality. And, finally, in his arduous struggle with Hincmar, metropolitan of Rheims, he gained an important victory over the powerful prelates on the Rhine in the question of appeal. It must, however, be admitted that this last advantage was gained only by the use of forged documents—the pseudo-Isidorian decretals, which seem to have first seen the light about the year 850; it was pretended that they had been compiled by Isidore of Seville, an eminent writer and ecclesiastic of the 7th century, and had been brought from Spain to Mainz by Riculfus, the archbishop of that city. This collection embodied a complete series of letters purporting to have been written by the popes of Rome from the time of Clemens Romanus down to that with which the collection by Dionysius Exiguus commences, thus filling up the entire blank, and affording among other data ample precedent for appeals to Rome of the kind against which Hincmar had protested. When some doubt was raised as to the genuineness of the collection, Nicholas did not scruple to assure Hincmar that the originals had been lying from time immemorial in the Roman archives. Among many other fundamental positions laid down in these decretals was one to the effect that no council of the church had canonical validity unless it had been summoned with the sanction of the holy see. The assertion of this theory rendered it necessary considerably to extend the practice of appointing papal legates (*legati a latere*), who now became the ordinary channels of communication between Rome and the Western churches, and through whom all affairs of importance were transacted. The legate convened the provincial councils and presided over them, taking precedence even of the metropolitan. Such encroachments enable us at once to understand how it was that Henry I. of England deemed it necessary to demand from Paschal II. a promise that no legate should be sent into the kingdom until the royal assent had been previously obtained. From the pontificate of Nicholas we date a notable diminution in the power of the metropolitans.

Hadrian II.

Degradation of the curia.

The false decretals have been described as the source to which we may trace that great revolution in the relations of church and state which now gradually supervened. The pontificate of HADRIAN II. (867–872) is especially notable for the application which he sought to make of some of the principles which they laid down. When Lothair, king of Lotharingia, died without heirs, Hadrian claimed the right to bestow the crown on the emperor Louis. Christian Europe, however, was not as yet prepared to accept this bold extension of the papal prerogatives. The kingdom was seized by Charles the Bald, and Hadrian was reminded in a manifesto drawn up by the bishops of Germany that he could not at once be "universal pope and universal king." But the weakness of Charles's claim was undeniable, and we accordingly find him, five years later, consenting to receive the imperial crown at the hands of JOHN VIII. (872–882), not as his heritage but as a gift from the pope. During the dark and stormy period that intervened between the death of Charles the Bald and the coronation of Otto the Great at Rome (962), the Carlovingian empire broke up, and the results that followed were disastrous both for the popedom and the empire. The Saracens occupied southern Italy, and menaced on more than one occasion the capital itself; the Normans poured in successive waves over Frankland; the ravages of the Magyars were yet wider spread and not less terrible. Alike in the civil and the ecclesiastical world the elements of strife and insubordination were let loose; and, while the feudal lords defied the authority of their king, and the power of the French monarch sank to the lowest ebb, the bishops in like manner forsook their allegiance to the Roman pontiff. The archbishops of Ravenna and Milan appeared indeed as his rivals, and the political influence which they commanded more than equalled his; the 10th century has been designated "the noon-day of episcopal independence." The history of the curia at this period is marked by the deepest moral degradation and the most revolting scenes. The papal jurisdiction was limited almost entirely to the capital itself, and even the succession of the pontiffs themselves is with difficulty to be traced. The office, indeed, was sometimes disposed of by the influence of immoral women. The pontificate of STEPHEN VI. (or VII., 896–897) is remembered only for the inhuman manner in which he treated the lifeless corpse of his predecessor Formosus; that of SERGIUS III. (904–911) for the virtual reign of Theodora and her daughter, the two most notorious courtesans of the age; STEPHEN IX. (939–942) was disfigured for life by the brutal treatment which he received at the hands of the Roman mob.

Otto and John XII.

In the dismembered empire, the kingdom of Germany first exhibited signs of returning order and cohesion; and at the solicitation of Pope JOHN XII. (955–963) King Otto led an army into Italy, rescued the land from its cruel oppressor, Berengar, the feudal lord of the realm, and was anointed emperor at Rome. John, however, who was one of the worst of the pontiffs, ill repaid the service rendered to the see; and, foreseeing that the restoration of justice and law was likely to prove fatal to his own misrule, he proceeded to plot the emperor's overthrow. He was summoned to appear before a council presided over by the latter, to meet the accusations brought against him, and, having failed to appear, was formally deposed. On the same occasion the imperial right to confirm the election to the papal office (which had been for some time in abeyance) was formally restored. Of the pontiffs whose names stand in the subsequent succession two were anti-popes, **Benedict** V. (964) and **Boniface** VII. (984–985), set up by the party in rebellion against the imperial power.

Gerbert and Otto III.

With the restoration of law and order the ancient regard for the popedom regained its hold on the minds of men. Under the guidance of the celebrated Gerbert, the youthful enthusiasm of Otto III. aimed at making Rome once more the centre of political dominion and the seat of the imperial power. Hugh Capet, too, professed himself the "defender of the church." A strong sense began also to find expression of the infamy attaching to the associations of the curia. At the first of the two councils convened at Rheims in 991 it was formally demanded, by what decree it was that "numberless priests of God, famed alike for learning and virtue, were subjected to the rule of monsters of iniquity wanting in all culture, whether sacred or profane." The French monarchs were glad, however, to purchase the support of the papacy to aid them in their struggle with the rebellious chieftains by whom the very existence of their authority was menaced, and, until the action of the papal legates again roused the spirit of national resistance, the Capetian dynasty was loyal to the Roman see. That it was so was in no small measure due to the virtues and abilities of **Gregory** V. (996–999), the kinsman of Otto III., a young man of considerable attainments, austere morality, and great energy of purpose, who succeeded to the papal chair at the age of twenty-four. He was succeeded by Gerbert, Pope **Silvester** II. (999–1003), from whom Otto III. derived, as already stated, his ideas of Italian and papal regeneration. But in Germany neither the nobility nor the episcopal order could contemplate with equanimity the projects of either pontiff or emperor, and Otto's schemes were met with a stubborn and paralyzing resistance. Then the feudal princes of the Roman states rose in insurrection; and the ardent young reformer was taken off—it was believed, by poison—at the age of two and twenty, to be followed in the next year by his faithful preceptor on the pontifical throne.

Ascendency of the feudal nobility.

With the disappearance of these two eminent men the popedom relapsed into its former degradation. The feudal nobility—that very "refuse" which, to use the expression of a contemporary writer, it had been Otto's mission "to sweep from the capital"—regained their ascendency, and the popes became as completely the instruments of their will as they had once been of that of the Eastern emperor. A leading faction among this nobility was that of the counts of Tusculum, and for nearly half a century the popedom was a mere apanage in their family. As if to mark their contempt for the office, they carried the election of Theophylact, the son of Count Alberic, a lad scarcely twelve years of age, to the office. **Benedict** IX. (1033–1045), such was the title given him, soon threw off even the external decencies of his office, and his pontificate was disgraced by every conceivable excess. As he grew to manhood his rule, in conjunction with that of his brother, who was appointed the patrician, or prefect of the city, resembled that of two captains of banditti. The scandal attaching to his administration culminated when it was known that, in order to win the hand of a lady for whom he had conceived a passion, he had sold the pontifical office itself to another member of the Tusculan house, John, the arch-presbyter, who took the name of **Gregory** VI. (1045–46). His brief pontificate was chiefly occupied with endeavors to protect the pilgrims to Rome on their way to the capital from the lawless freebooters (who plundered them of their costly votive offerings as well as of their personal property), and with attempts to recover by main force the alienated possessions of the Roman Church. Prior, however, to his purchase of the pontifical office, the citizens of Rome, weary of the tyranny and extortions of Benedict, had assembled of their own accord and elected another pope, John, bishop of Sabina, who took the name of **Silvester** III. (rival pope, 1044–46). In the meantime Benedict had been brought back to Rome by his powerful kinsmen, and now reclaimed the sacred office. For a brief period, therefore, there were to be seen three rival popes, each denouncing the others' pretensions and combating them by armed force. But even in Rome the sense of decency and shame had not become altogether extinguished; and at length a party in the Roman Church deputed Peter, their archdeacon, to carry a petition to the emperor, Henry III., soliciting his intervention. The emperor, a man of deep religious feeling and lofty character, responded to the appeal. He had long noted, in common with other thoughtful observers, the widespread degeneracy which, taking example by the curia, was spreading throughout the church at large, and especially visible in concubinage and simony—alike regarded as mortal sins in the clergy. He forthwith crossed the Alps and assembled a council at Sutri. The claims of the three rival popes were each in turn examined and pronounced invalid, and a German, Suidger (or Suger), bishop of Bamberg, was elected to the office as **Clement** II. (1046–47).

The German popes.

Leo IX.

The College of Cardinals.

The degeneracy of the church at this period would seem to have been in some degree compensated by the reform of the monasteries, and from the great abbey of Cluny in Burgundy there now proceeded a line of German popes, who in a great measure restored the dignity and reputation of their office. But, whether from the climate, always ill-adapted to the German constitution, or from poison, as the contemporary chronicles not unfrequently suggest, it is certain that their tenure of office was singularly brief. Clement II. died before the close of the year of his election. **Damasus** II., his successor, held the office only twenty-three days. **Leo** IX., who succeeded, held it for the exceptionally lengthened period of more than five years (1049–54). This pontiff, although a kinsman and nominee of the emperor, refused to ascend the throne until his election had been ratified by the voice of the clergy and the people, and his administration of the office presented the greatest possible contrast to that of a Benedict IX. or a Sergius III. In more than one respect it constitutes a crisis in the history of the popedom. In conjunction with his faithful friend and adviser, the great Hildebrand, he projected schemes of fundamental church reform, in which the suppression of simony and of married life (or concubinage, as it was styled by its denouncers) on the part of the clergy formed the leading features. In the year 1049, at three great synods successively convened at Rome, Rheims, and Mainz, new canons condemnatory of the prevailing abuses were enacted, and the principles of monasticism more distinctly asserted in contravention of those traditional among the secular clergy. Leo's pontificate closed, however, ingloriously. In an evil hour he ventured to oppose the occupation by the Normans, whose encroachments on Italy were just commencing. His ill-disciplined forces were no match for the Norman bands, composed of the best warriors of the age. He was himself made prisoner, detained for nearly a twelvemonth in captivity, and eventually released only to die, a few days after, of grief and humiliation. But, although his own career terminated thus ignominiously, the services rendered by Leo to the cause of Roman Catholicism were great and permanent; and of his different measures none contributed more effectually to the stability of his see than the formation of the College of Cardinals. The title of "cardinal" was not originally restricted to dignitaries connected with the Church of Rome, but it had hitherto been a canonical requirement that all who attained to this dignity should have passed through the successive ower ecclesiastical grades in connection with one and he same foundation; the cardinals attached to the Roman Church had consequently been all Italians, ducated for the most part in the capital, having but ttle experience of the world beyond its walls, and incapable of estimating church questions in the light of he necessities and feelings of Christendom at large. By the change which he introduced Leo summoned he leaders of the party of reform within the newly-onstituted college of cardinals, and thus attached to is office a body of able advisers with wider views and ess narrow sympathies. By their aid the administration of the pontifical duties was rendered at once more asy and more effective. The pontiff himself was berated from his bondage to the capital, and, even hen driven from Rome, could still watch over the interests of both his see and the entire church in all heir extended relations; and the popedom must now e looked upon as entering upon another stage in its istory—that of almost uninterrupted progress to the innacle of power. According to Anselm of Lucca, it as during the pontificate of Leo, at the synod of Rheims above referred to, that the title of "apostolic ishop" (*Apostolicus*) was first declared to belong to he pope of Rome exclusively. The short pontificate of NICHOLAS II. (1059–61) is memorable chiefly for the fundamental change then introduced in the method of electing to the papal office. By a decree of the second Lateran council (1059[1]), the nomination to the office was vested solely in the cardinal bishops—the lower clergy, the citizens, and the emperor retaining simply he right of intimating or withholding their assent. It was likewise enacted that the nominee should always be one of the Roman clergy, unless indeed no eligible person could be found among their number. At the same time the direst anathemas were decreed against all who should venture to infringe this enactment either in the letter or the spirit. The preponderance thus secured to the ultramontane party and to Italian interests must be regarded as materially affecting the whole subsequent history of the popedom. The manner in which it struck at the imperial influence was soon made apparent in the choice of Nicholas's successor, the line of German popes being broken through by the election of Anselm, bishop of Lucca (the uncle of the historian), who ascended the pontifical throne as ALEXANDER II. (1061–73) without having received the sanction of the emperor. His election was forthwith challenged by the latter, and for the space of two years the Roman state was distracted by a civil war, Honorius II. being supported as a rival candidate by the imperial arms, while Alexander maintained his position only with the support of the Norman levies. The respective merits of their claims were considered at a council convened at Mantua, and the decision was given in favor of Alexander. Cadalous, such was the name of his rival, did not acknowledge the justice of the sentence, but he retired into obscurity; and the remainder of Alexander's pontificate, though troubled by the disputes respecting a married clergy, was free from actual warfare. In these much vexed questions of church discipline Alexander, who had been mainly indebted for his election to Hildebrand, the archdeacon of the Roman Church, was guided entirely by that able churchman's advice, and in 1073 Hildebrand himself succeeded to the office as GREGORY VII.[2] (1073–85). From the memorable struggle between this pontiff and the emperor, Henry IV., we date the commencement of that long series of contests between the papal and the imperial power which distracted alike the holy see and the empire. In the two main objects to which his policy was directed—the enforcement of a celibate life among the clergy and the prohibition of investiture (see INVESTITURE) by the laity—Gregory had on his side the sympathy of the best and most discerning minds of his age. Lay investiture was little more than a cloak for the inveterate and growing abuse of simony, for which the distribution of church patronage by secular potentates afforded special facilities, and the burden of which was now increased by those other forms of tribute, the "regale," "jus spolii," and "servitium," which the growth of the feudal system had developed. But in the hands of Gregory this scheme of ostensible reforms expanded first of all into independence of the temporal power, and finally into a claim to dominate over it. Other schemes (not destined to be realized) engaged his lofty ambition—the conquest of Constantinople, the union of the Eastern and Western Churches, and the expulsion of the Saracens from Christendom. He died in exile; but the theory of his office and its prerogatives which he asserted was brought by his successors to a marvellous realization.

hange in he method f election.

The crusades in relation to the papacy.

The first crusade, which may be looked upon as generated by Gregory's example and a reflex of the policy which led him to sanction the expedition of William of Normandy against England, materially favored papal pretensions. It was proclaimed as a religious war, and it was as a mode of penance that the Norman and Latin warriors were enjoined to gratify their ruling passions of plunder and adventure. More especially it brought to the front of the drama of European action the Latin as opposed to the Teutonic elements—the part taken by Germany in these gigantic expeditions in no way corresponding to her position among European powers. It was impossible that the excommunicated emperor Henry IV. should place himself at the head of such an enterprise, and it was accordingly by URBAN II. (1088–99) that the direction was assumed, and it was under his auspices that the first crusade was proclaimed at Clermont. As the movement gathered force the prestige of the popedom was still further enhanced by the fact that the warriors who had before appeared in the field under the banners of the empire now did so as loyal sons of the church. The new orders of chivalry—the Knights of St. John, the Templars, the Teutonic Order—each bound by religious vows, received their commissions from the pontiff, were invested by him with the sword and the cross, and acknowledged no allegiance to the emperor.

The *Decretum* of Gratian.

Growth of the canon law.

But of all the schemes which Gregory's genius conceived and promoted none was more important in its after-effects than the expansion given to the pseudo-Isidorian decretals—in the first instance by Anselm of Lucca, again by Cardinal Deusdedit, and finally by the celebrated Gratian, a monk of Bologna, who lived about the middle of the 11th century. By Gratian these accumulated forgeries were reduced to order and codified, and his *Decretum*, as it was termed, stands to the canon law (CANON LAW) in much the same relation that the Pandects of Justinian stand to the civil law. Further additions were subsequently made by Gregory IX., Boniface VIII., and other pontiffs, and in this manner a vast code was gradually elaborated which, serving as the framework of the ecclesiastical jurisdiction in every land, was associated with separate courts and professed by a distinct body of jurists. The canonists were naturally ardent defenders of the system from whence they derived their professional existence, and everywhere represented the faithful adherents of Rome.

Rise of new monastic orders.

Another movement at this period which gave effective aid in the diffusion of the papal influence and authority was the rise of the new religious orders—the Camaldules (*c.* 1012), the Cluniacs (*c.* 1048), the Carthusians (*c.* 1084) and the Cistercians (1098). Although each of these orders professed a distinct rule and a sanctity and austerity of life which put to shame the degenerate Benedictines, their presence was far from proving an unmixed benefit to the districts where they settled. They rejected the episcopal jurisdiction and purchased their local independence by complete and immediate subjection to the pope. Wherever, accordingly, their houses rose there was gathered a band of devoted adherents to Rome, ever ready to assert her jurisdiction in opposition to the ecclesiastical jurisdiction claimed by the secular clergy or the civil jurisdiction claimed by the temporal power.

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[1] [Not the second Œcumenical Lateran Council, but one known as the Easter Council.—AM. ED.]

[2] In assuming this name Hildebrand designed to imply that Gregory VI., whose title had been cancelled by Henry III., on account of simony, was a legitimate pontiff.

Paschal II.

On the death of Urban, Cardinal Rainerius, a native of Tuscany and a man of considerable learning and capacity, succeeded as PASCHAL II. (1099–1118). During the earlier years of his pontificate he is unfavorably distinguished by the manner in which he sanctioned, if he did not instigate, the cruel and unnatural revolt of the young prince Henry (afterwards the emperor Henry V.) against his father. The later years of Paschal's rule seem mainly a record of the nemesis which overtook a policy dictated by the most heartless and selfish ambition. "Paschal," says Milman, "is almost the only later pope who was reduced to the degrading necessity of being disclaimed by the clergy, of being forced to retract his own impeccable decrees, of being taunted in his own day with heresy, and abandoned as a feeble traitor to the rights of the church by the dexterous and unscrupulous apologists of almost every act of the papal see." One of the most memorable phases of this long process of humiliation is marked by the treaty of Sutri (Feb., 1111), when the young emperor compelled Paschal to surrender all the territorial possessions and royalties which the church had received either from the emperor or from the kings of Italy since the days of Charlemagne, together with numerous other political and fiscal privileges, while he himself renounced the right of investiture. The indignation of the ecclesiastical world compelled Paschal to retire from this treaty and ultimately, after long evasions, to become party to a second, whereby the former conditions were completely reversed. The emperor resumed the right of investiture, and that burning question again lit up the flames of war. Paschal being too far pledged by his own solemn oath, a metropolitan council assembled at Vienne assumed to itself the authority of excommunicating the emperor, declaring that the assertion of the rights of lay investiture in itself constituted a heresy. The great prelates of Germany rose in insurrection against the emperor. He retaliated by seizing on the vast possessions (comprising nearly a quarter of Italy) which Matilda, countess of Tuscany, at her death in 1115, had bequeathed to the Roman see. The pope and the cardinals responded by re-enacting the sentence of excommunication. Henry occupied Rome, and Pope Paschal died in the castle of St. Angelo, exhorting the cardinals with his latest breath to greater firmness than he himself had shown in maintaining the rights of the church. Paschal was the first of the pontiffs to discontinue the use of the imperial years in dating his acts and encyclicals, substituting instead the year of his own pontificate.

Calixtus II.

The short rule of CALIXTUS II. (1119–24), disgraced although it was by the savage revenge which he perpetrated on his rival the antipope, Gregory VIII., was characterized by wise and resolute administration. A Frenchman by birth, he was the first to establish those intimate relations with France which rendered that state the traditional ally of the Roman see, and culminated in the secession to Avignon. Germany, on the other hand, appears from this time as generally heading the antipapal party, espousing the cause of the antipope and siding with Ghibelline faction. But the chief event in the pontificate of Calixtus and one which may be looked upon as inaugurating a new era in the history of our subject, was the Concordat of Worms of the year 1122.

Concordat of Worms.

By this memorable treaty, which, accepted as the law of Christendom, seemed to promise an ultimate conclusion of the long struggle, an understanding was at last arrived at. The emperor ceded the right of investiture by the ring and the pastoral staff,—thereby renouncing that at which the church most demurred, the appearance of assuming to be in any way the transmitter of the spiritual succession, but retaining the right of granting church benefices or other property by the symbol of temporal power, the sceptre. The pope, on the other hand, consented that the election of bishops and abbots should take place according to canonical procedure in the presence of the emperor, but that neither bribery nor compulsion should be resorted to, and that, in the case of disputed elections, there should be a right of appeal to the metropolitan and provincial bishops. In Germany the investiture with the regalia by the sceptre was to precede the consecration, the dependence of the higher clergy being thus secured to the emperor; but in other countries the lay investiture was to take place within six months after consecration. In an appended clause a reservation was made which afterwards became a fruitful germ of controversy: the elected dignitary bound himself to discharge his feudal obligations to the emperor arising out of his investiture with the temporalities, "except in all things which are acknowledged to belong to the Roman Church."

Bernard of Clairvaux.

During the pontificate of INNOCENT II. (1130–43) the importance of the new relations established with France are to be seen in the all-commanding influence of BERNARD OF CLAIRVAUX (*q.v.*), the unswerving supporter of the papal claims, round whose career indeed the life of the Western Church for half a century may be said mainly to revolve. In the struggle arising out of his disputed election, with the antipope, Anacletus II., Innocent succeeded in gaining the support of Bernard, and through Bernard that of the emperor Lothair; and the narrative of his restoration to his see by the imperial forces, after an exile of four years, is one of the most dramatic episodes in papal history. Technically, at least, Ancletus had the better claim to the papacy, having been elected by a majority of the cardinals; but Innocent secured the support of Lothair by making over to him the territory bequeathed by the countess Matilda. In return for this concession, Lothair accepted the imperial crown from Innocent in the church of the Lateran, and acknowledged himself the pope's vassal,—in the language of the inscription recording the event, "Post homo fit Papæ, sumit quo dante coronam."

Renewal of the struggle with the empire.

The change in the imperial dynasty, involving as it did the setting aside of Lothair's son-in-law as emperor, revived the rivalry between the empire and the papacy; and the Ghibellines, or adherents of the Hohenstaufen (or Swabian) line, now represented a more distinctly defined party in opposition to the Guelfs, who sustained the traditional policy of the Saxon imperial line, and sided with the popes. Frederick Barbarossa, although he consented to receive the imperial crown at the hands of HADRIAN IV. (1154–59), required that pontiff altogether to disavow the notion of having conferred it as a *beneficium* upon a vassal, maintaining that, through the election of the princes, he held his crowns (both kingly and imperial) of God alone. During the pontificate of ALEXANDER III. (1159–81) Frederick supported the cause of the antipopes. A disputed election, in which the merits of the candidates are even yet more difficult to determine than in the election of Innocent II., gave rise to a series of counter claims, and Alexander, during his long pontificate, had to contend with four successive antipopes each backed by the imperial arms. Only the election of the first, Victor V. (antipope, 1159–64), however, had real canonical validity, the claims of the others having always been regarded by all orthodox Catholics as presumptuous.

It was during the latter part of Alexander's government that Rome achieved a great moral triumph in England in the reaction which followed upon the murder of Thomas Becket and the abrogation of the Constitutions of Clarendon. Eight years later the attention of all Christian Europe was riveted by the memorable occurrence which marked the consummation of the truce of Venice (1178), when Frederick Barbarossa prostrated himself before the aged pontiff and held his stirrup as he mounted his palfrey.

Innocent III.

Passing by the comparatively unimportant careers of the five popes whose names stand between those of Alexander and INNOCENT III. (1198–1216), we find ourselves at the stage which marks the culmination of the papal power. The august descent of this pontiff; his learning as a canonist and his commanding genius; the interdicts which he could venture to impose on great realms, whether ruled by the astute sagacity of a Philip Augustus or by the reckless folly of a John; his sentences of excommunication, hurled with deadly effect at emperor and at kings; the vigor with which he wrested whole provinces from the imperial domination—the march of Ancona and the duchy of Spoleto—to weld together into one compact whole the Patrimonium and the Romagna; the energy with which he repressed the heresies which threatened the unity of the church; the boldness with which he defined the doctrine of transubstantiation; his patience in working and waiting for opportunities, and the promptitude with which he seized the occasion when it arrived,—such are the features which combine to render the eighteen years' pontificate of Innocent III. a period of unrivalled lustre and importance in the history of the popedom. It was now that the papal power may be said to have effectually impressed its theory of sacerdotal government upon Europe; that the canon law, wherein that theory was elaborated, began to be taught in the universities which rose throughout Europe—Bologna, Padua, Paris, Orleans, Oxford, and Cambridge; that ecclesiastical discipline everywhere modelled itself on the practice of Rome; that the mendicant orders, especially those of St. Dominic and St. Francis of Assisi, with their irregular enthusiasm, skilfully converted by Innocent into a widely-diffused, untiring, and devoted propaganda, roused a new spirit alike in the universities and among the illiterate laity, and became a powerful instrument wherewith to coerce to obedience the episcopal order and the whole body of the secular clergy.

The emperor Frederick II.

The chief interest attaching to the pontificates of HONORIUS III. (1216–27), GREGORY IX. (1227–41), and INNOCENT IV. (1243–54) arises from their connection with the policy and career of Frederick II. (emperor 1210–50). To the whole traditions of the popedom Frederick was especially obnoxious, menacing on the one hand its standard of doctrine by his reputed skepticism, and its newly acquired possessions on the other by his schemes for the revival of imperial supremacy in Italy. In the sequel his designs were baffled by the ability and resolution of Gregory and Innocent; and at the general council of Lyons (1245) Frederick was deposed both from his imperial and his kingly dignities, and his subjects declared to be absolved from their fidelity. In this manner the power claimed by the Roman pontiff of deposing even kings received the implicit sanction of a general council. The empire, worsted in Italy, broke down in Germany. In 1268 Conradin, the grandson of Frederick and the last representative of the Hohenstaufen dynasty, was cruelly put to death by Charles of Anjou, and the long contest of the empire with the popedom came to an end.

Gregory X.

The policy of GREGORY X. (1271–76), a man of ability and moderation, deserves the praise of having apparently aimed at the general good of Christendom, so far, at least, as not incompatible with the overweening pretensions which he continued to uphold. Gregory endeavored to compose the bitter jealousies and long-continued strife of the Italian states by the establishment of a general protectorate under Charles of Anjou, king of Naples, and to reconcile Guelf and Ghibelline by concessions to the leaders of the latter party. He effected a temporary agreement with the Eastern Church; and he sought to put an end to the abuses and rivalries which now almost invariably accompanied each election to the pontificate by introducing a new method of proceeding on such occasions. In the meantime, the growing spirit of nationality had already received a striking exemplification in France by the enactment of the Pragmatic Sanction (1268). Of this measure, which has been described as the foundation of the Gallican liberties, it will here suffice to say that it consists of a series of enactments expressly directed against all those encroachments of the popedom with respect to collations to benifices, elections to bishoprics, simoniacal practices, ecclesiastical promotions, imposts, and other forms of exaction, such as we have already noted in their gradual growth. Shielded from criticism by the fact that it was sanctioned by the pious Louis IX., the loyal son of the church, the Pragmatic Sanction passed at the time unchallenged even by the papacy itself. Of the extent to which the latter was becoming more and more a political institution we have striking evidence in the brief pontificate of CELESTINE V. (1294). A hermit of the Abruzzi, of austere and holy life, he had been elected pope in the hope that his reputation for virtue might in some measure restore the character of his office. Something more, however, than mere sanctity and blamelessness were now necessary for the discharge of the duties of a position which by its associations demanded the exercise of statecraft, political intrigue, and a wide knowledge of affairs. In less than six months Celestine resigned an office for which by lack of experience and ability he was altogether unfitted, but leaving behind him a tradition of self-devoted and holy life which found expression in the institution of a new religious order, that of the Celestinians, afterwards blended with the Fraticelli, or Spiritual Franciscans. Upon BONIFACE VIII. (1294–1303) the signs of the times and the development of a spirit and of institutions incompatible with the pretensions of his predecessors were altogether lost. A man of considerable abilities, indomitable will, and imperious nature, he enunciated in yet more uncompromising terms the theory of the papal supremacy. In the memorable bull *Unam sanctam Ecclesiam* (18th Nov., 1302), he declared that the church could have but one head—a two-headed church would be a monstrosity; and he explained away the traditional interpretation of the symbolic meaning of the two swords, by affirming that the temporal sword wielded by the monarch was borne only at the will and by the permission of the pontiff (*ad nutum et patientiam sacerdotis*). Dazzled by the apparent success which attended his first measures, he was only confirmed in his policy by the resistance he encountered in France and England. In Philip the Fair, however, he was matched with an antagonist as resolute and unscrupulous as himself and one who better understood the tendencies of the age. In the struggle that ensued Philip had the whole French nation, including the episcopal order, on his side; the pontiff was worsted, and his humiliation and sense of defeat hastened his end.

The Pragmatic Sanction.

Boniface VIII.

Fall of the mediæval papacy.

With the death of Boniface fell also the papacy of the Middle Ages, both in theory and in fact: in theory, through the ascendency of counter views such as those put forth in the *De Monarchia* of Dante, and in the writings of Ægidius Colonna and John of Paris, which enforced the reasonableness and necessity of the supremacy of the political power; in fact, from the manner in which the French monarch succeeded, not only in repelling the papal pretensions but in eventually reducing the Roman see itself to be a mere instrument of his will and a submissive agent in the furtherance of his policy.

The popes at Avignon.

Their subservience to France.

Growth of abuses in the church.

The origin, the growth, the characteristics, the assumptions, and the downfall of the mediæval papacy having now been traced out, it remains to note, as concisely as practicable, the chief features in the later history of the institution. In the year 1305 Clement V. (1305–14), an Aquitanian by birth, was elected after long contention to the pontificate. He was invested with the tiara at Lyons, and subsequently (1309) transferred his court from Rome to Avignon. The pressure put upon him by King Philip is generally assigned as the cause of this step, but it is not improbable that he was only too glad to escape from the strife then waging between the two great factions, the Orsinis and the Colonnas, at Rome. At Avignon, for a period of nearly seventy years, derisively styled the "Babylonian captivity," pope after pope held his court. Degraded to a state of splendid vassalage to France, their luxury, pride, rapacity, and avarice became a by-word in Europe, while their complete subservience to the political aims of the French crown effectually alienated from them the good will and sympathy of England and Germany. When John XXII. (1316–34) sought to interfere in a double election to the empire, the diet at Frankfort denounced his whole policy in terms that startled Europe by their boldness; and the electoral union at Rense in 1338 passed a resolution declaring that "whoever was chosen by the electors became at once both king and emperor, and did not require that his election should be approved and sanctioned by the apostolic see." Other causes contributed effectually to lower the papacy in the estimation of Europe. Clement V. concurred in the infamous devices by which Philip procured the suppression of the Order of the Templars, and the barbarous cruelties inflicted on the noble victims produced in the popular mind a feeling of deepest aversion for the authors of those proceedings. The traffic in benefices was now again developing into a gigantic scandal and abuse. Annates and Peter's pence were exacted with an insatiable rapacity. Italy itself, indeed, torn between contending parties and impoverished by the interruptions to commerce, offered but a barren field for plunder, but in the countries north of the Alps the pope's emissaries were everywhere to be seen, ever intent on their errand of exaction. The wealth thus acquired was partly devoted towards extending the territorial possessions of the see; and Avignon and the county of Venaissin, purchased in 1348 from the crown of Provence, remained papal until the French Revolution. It is not a little significant that this increase in wealth and territory should have been concomitant with the sinking of the moral influence of the papacy to its lowest ebb. In England the civil power endeavored to check this system of extortion by re-enacting the Statutes of Præmunire and Provisors. In Germany the deep discontent to which it gave rise formed an important contributing element in the causes which brought about the Reformation. In France the luxury and gross immorality of the court at Avignon, described in graphic and scathing language by Petrarch, are assigned by other contemporary writers as conducing largely to the corruption of morals throughout the realm. Even among the religious orders themselves there began to be signs of insubordination, and the Fratricelli, or Spiritual Franciscans, who now took their rise, openly avowed that the principles which they professed were designed as a protest against the appalling degeneracy of the curia; while great scholars in the universities, like William of Occam and Marsilio of Padua, brought the dialectics and new philosophical tenets of the schools in the universities to bear with no little effect on the whole system of the popedom.

The great schism.

The outbreak of the great schism struck no less deeply at those sentiments of veneration and deference which had been wont to gather round the pontiff's chair. The majority in the college of cardinals were Frenchmen, and, on the death of Gregory XI. in 1378, it seemed only too probable that another Frenchman would be elected his successor. The discontent of the citizens of Rome at the withdrawal of the curia from the capital had now, however, reached a culminating point. This feeling, it is to be noted, was by no means one of mere sentiment and attachment to tradition, for the diversion of appeals, pilgrimages, deputations, and embassies, with their attendant influx of travellers, and of large streams of wealth and business from Rome to Avignon, had materially affected the prosperity of the former city. On the occasion of the new election the prevailing dissatisfaction found vent in menacing demonstrations on the part of the population, and even in scenes of actual violence. In order to appease the city the terrified cardinals determined on the unanimous election of an Italian, Prignani archbishop of Bari, who assumed the title of Urban VI. The election was singularly unfortunate. The new pontiff, intoxicated by his sudden and unexpected fortune, assumed such arrogance of demeanor and showed himself so altogether wanting in moderation and self-control that the cardinals put forth the plea that they had discharged their function as electors under intimidation, and declared the election invalid. In proceeding to elect another pontiff, their choice fell upon one of their own number, Robert of Geneva, known as Clement VII. (1378–94). For a period of thirty-eight years, Christian Europe was scandalized by the contentions of two rival popes, the one holding his court at Rome, the other at Geneva, each hurling anathemas, excommunication, and the foulest accusations at the other, and compared by Wyclif to "two dogs snarling over a bone"—a simile which in itself affords significant proof of the manner in which the popedom had fallen in the estimation of Christendom. The potentates of Europe, in declaring themselves "in the obedience," as it was termed, of one or the other pontiff, were swayed almost entirely by political considerations, in which jealousy of France was the predominant sentiment. Italy, Germany, Bohemia, England, Flanders, Hungary, and Poland, all declared themselves in the obedience of the pope at Rome; Scotland, Savoy, Lorraine, declared themselves, along with France, in that of the pope at Avignon. The Spanish kingdoms, which at first stood aloof, ultimately also decided, though from somewhat different motives, in favor of the latter pontiff. At last, at the commencement of the 15th century, an endeavor was made to prevail on both the reigning popes—Gregory XII. at Rome, Benedict XIII. at Avignon—to renounce their claims, with a view to the restoration of church union. The proposal was met by both popes with persistent and unscrupulous evasion. France, indignant at the subterfuges of Benedict, withdrew her support, and he accordingly retired to Perpignan. The cardinals attached to either court met together at Leghorn, and agreed to summon a general council, to meet at Pisa on the 25th March, 1409. In the meantime isolated scholars and divines throughout Europe, among the regular and the secular clergy alike, were pondering deeply the lesson taught by the papal history of the last six centuries, and in the place of the traditional theories of appeals to popes, to councils, or to emperors there was growing up another conception, that of the essential falsity of the axioms on which the theory of the papal supremacy had been built up, and of Scriptural authority as the only sure and final source of guidance in deciding upon questions of doctrine and morality.

The great councils.

But as yet, before ideas such as these had been sufficiently developed and events had prepared the popular mind for their reception, the remedy that most commended itself to the leading minds of Christendom was that of a true general council. Such was the idea which influential churchmen of the age—men like Peter D'Ailly, cardinal of Cambria, and John Gerson, chancellor of the university of Paris, who, while they deplored the discipline, still assented to the doctrines of the church—believed to be the best solution of the difficulties in which that church had become involved. The opinions of the doctors of the canon law and of theology at the universities had been taken, and at Oxford as in Paris it had been decided that a general council might be summoned even against the will of the pope, and that, when thus convened, its authority was superior to his.

Council of Pisa.

Such were the circumstances under which in 1409 the council of Pisa was summoned. The council enunciated the dogma of its own supremacy; it deposed the rival popes; it constituted the two separate bodies of cardinals a single conclave, and by this conclave a new pope, **Alexander** V. (1409–10) was elected. Schemes of general ecclesiastical reform were discussed; and then after a four months' session the assembly adjourned, to resume, at an interval of three years, its yet more memorable deliberations at Constance. In the intervening time, Alexander V. died, not without strong suspicion of his having been removed by poison through the machinations of his successor, the notorious Balthasar Cossa, who assumed the title of **John** XXIII. (1410–15), and took up his residence in Rome. It is with this pontiff that the gross abuse of indulgences is said to have first arisen.

Council of Constance.

In the year 1414 the council of Constance met, amid the most sanguine expectations on the part of religious Europe, but it achieved practically nothing in the direction of church reform. It deposed John XXIII., but **Martin** V. (1417–31), by whom he was succeeded, although in some respects an estimable pontiff, skilfully availed himself of the disturbances in Bohemia and the hostile inroads of the Turks to postpone all questions of reform to a future occasion. On the other hand, the actual results of its deliberations were reactionary in their tendency. The council burned John Huss, one of the first to assert the rights of the individual conscience in opposition to the prevailing hierarchical system; it crushed the party of reform in the university of Paris, and banished their great leader.

Council of Basel.

The council of Basel (1431–49), although it re-enunciated the principle of the superiority of a general council over the pope, found, when it sought to proceed to the more practical reforms involved in placing restrictions on the abuses practiced under the papal sanction, that it had assumed a task beyond its powers. Under the pretext of bringing about a reconciliation with the Eastern Church, and inviting its delegates to the deliberations of the council, **Eugenius** IV. (1431–47) proposed to transfer the place of meeting from Basel to some Italian city. The council, well knowing that such a measure would be fatal to its independence, refused its assent; Eugenius retaliated by dissolving the council; the council, by suspending the pope.

Council of Florence.

Thereupon Eugenius summoned another council at Ferrara, which was afterwards removed to Florence. The counsel of Basel, as a last resource, arrogated to itself the papal functions, and then proceeded to elect Amadeus, duke of Savoy, pope, with the title of **Felix** V.

Policy of the chief European powers.

In this extreme measure it failed, however, to carry with it the more influential European powers. Germany, after an ineffectual endeavor to mediate between the rival popes, assumed, in the first instance, an attitude of strict neutrality, but was ultimately won over by the crafty Æneas Sylvius (afterwards Pius II.) to conclude the notable Concordat of Vienna (1448). By this mercenary arrangement the newly-elected emperor, Frederick III., altogether renounced whatever advantages had, down to that time, been gained by the labors of the council of Basel, receiving in return from Nicholas V. certain concessions with respect to all episcopal elections in his own hereditary dominions, together with a hundred of the most valuable benefices, the visitatorial rights in relation to the monasteries, and a tenth of the monastic revenues. The policy adopted by France was of an altogether different character. She preferred to adjust her ecclesiastical liberties on the basis defined and sanctioned by the royal authority at the congress of Bourges. The Pragmatic Sanction there enacted was registered by the parliament of Paris, 13th July, 1439—thus becoming part of the statute law of France. In this celebrated manifesto the spirit of Gerson and the university of Paris spoke again; but, while its twenty-three provisions rendered it peculiarly obnoxious to the Roman see, the manner in which it set aside all royal nominations made it no less distasteful to the monarchy. Louis XI., feigning to yield to the pressure put upon him from Rome, abolished it, but it was re-enacted by Louis XII.

Concordat of Bologna.

Eventually, in the year 1516, amid the full flow of the advantages which he had gained by the victory of Marignano, Francis I. permitted the Pragmatic Sanction to be superseded by the Concordat of Bologna—a disastrous compromise of principles, wherein, while some important concessions were made to Leo X., the crown interference with the administration of the church was more effectually established than ever, and the independence of the Gallican clergy reduced to a shadow. The concordat made no mention of the councils of Constance, Basel and Bourges, or of their fundamental conception of the superiority of a general council over the pope; and it left the opportunity open for the reintroduction of annates. On the other hand, the monarchical authority achieved a signal triumph; and, although the parliament of Paris loudly protested, and even ventured to set aside some of the royal nominations subsequently made, its voice was silenced by a peremptory decree issued in the year 1527.

To return to the council of Basel. Although supported at first by the electors of Germany, it was, in the sequel, completely circumvented by the machinations of the able but unscrupulous Æneas Sylvius; and Pope Eugenius, at his death, seemed almost to have regained the allegiance of Christendom. Under **Nicholas** V. (1447–55), the work of reunion was brought to a completion. The council of Basel dissolved itself; and Felix V., laying aside his empty title and dignity, retired into Savoy, and was shortly after promoted to the rank of cardinal by Nicholas himself. The popedom was not destined ever again to witness the phenomenon of a rival pontiff; and no council since the council of Basel has ever ventured to assert its authority as superior to that of the Roman chair.

Definition of the papal supremacy at Florence.

At the council of Florence that theory had been definitely contravened (1439) by the enunciation of the following canon, in which the counter theory first received a complete and distinct exposition: "We define the holy apostolic see and the Roman pontiff to have primacy over the whole earth, and the Roman pontiff to be himself the successor of the blessed Peter, chief of the apostles, and the true vicar of Christ, and to exist as head of the whole church and father and teacher of all Christians; and that to him, in the blessed Peter, our Lord Jesus Christ has committed full power of feeding, governing, and directing the universal church, even as is [also][1] contained both in the acts of the œcumenical councils and in the sacred canons."

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[1] *Καθ' ὃν τρόπον καὶ ἐν τοῖς πρακτικοῖς τῶν οἰκουμενικῶν συνόδων καὶ ἐν τοῖς ἱέροις κάνοσι διαλαμβάνεται.* For a long time these words were correctly rendered in the Latin, "quem ad modum et in gestis œcumenicorum conciliorum et in sacris canonibus continetur," and the passage is invariably thus quoted by the 15th and early 16th century theologians. In the Roman edition of Abraham Cretensis, however, the obvious meaning of the Greek, viz., that the prerogatives of the pope are to be determined and exercised according to the canons of the ancient councils, is done

The curia and the popedom in the 15th century.

Thus re-established and confirmed in his own theory of his office and its functions, the Roman pontiff regained somewhat of his former hold on the estimation of Europe. There was also at the same time discernible a marked improvement, so far as regarded external decorum, in the associations of the curia; and, until the ascendency of the Borgias, the names of Nicholas V. (1447–55), Pius II. (1458–64), and Sixtus IV. (1471–84) redeemed the reputation of the Roman see, if not for sanctity, at least for learning. The last-named pontiff, however, lies under the imputation of having been the first to institute trials for witchcraft, an example which spread, in later times, far wider than the boundaries of Roman Catholicism itself. In the latter half of the 15th century the popedom retires altogether into the background of European history. The pretensions of the pontiff were not, indeed, in any way retracted or modified, but his actual policy was no longer commensurate with these, and the former weapons of the interdict and the anathema had fallen into disuse. The popes became little more than territorial princes, their political and ecclesiastical influence being exerted mainly with reference to the material interests of the States of the Church. It was one of the most baneful results of these changed external relations that each more ambitious pontiff—the Farnesi, the Borgias, the Della Roveres, and the Medici—aspired to found an hereditary sovereignty or principality in connection with his own family, and the most valuable possessions of the church were successively alienated. By the next pontiff the holders of such property would be not unjustly regarded as usurpers, and it would be the first aim of himself and his party to eject them from the lands and revenues thus acquired. In this manner deadly feuds were generated, which became hereditary in the different families, and proved an unfailing source of sanguinary feuds and bitter animosities.

The papal policy in Germany.

With the tacit surrender of the theory of the supremacy of general councils, the Holy Roman Empire itself came also virtually to an end; and Germany, broken up into a number of independent principalities, often involved in internecine strife, presented a striking contrast to the advances which France and Spain were making in the direction of consolidation and order. The papacy found a direct apparent advantage in fomenting this disunion, and in no country were the exactions of its emissaries more shameless or extortionate. Eventually, however, both these phases of its policy proved eminently detrimental to the Roman interests. For, while the unscrupulousness of its agents did much to foster a strong aversion to the tenets which they inculcated, and thus paved the way for the reception of Lutheran doctrines, the isolation to which each German state was reduced proved favorable to its freer action, and enabled it, in no small measure, to pursue that independent policy which, in several instances, materially aided the progress of the Reformation. The history of the popedom from this point (*c.* 1517) to the commencement of the council of Trent (1545) will be found in the article on the Reformation.

Council of Trent.

Increased hostility of the papacy to free thought.

The distinctive features of the doctrinal belief formulated by the council of Trent were mainly the outcome of Jesuit influences (see Jesuits); and, enforced as these tenets were by the terrorism of the Inquisition, the freedom of thought which during the revival of learning had passed comparatively unchallenged within the pale of the church was now effectually extinguished. But it must at the same time be admitted that, concurrently with this tendency to greater rigidity of doctrine, Roman Catholicism became characterized by far greater earnestness of religious teaching, displayed a remarkable activity in the cultivation of theological learning, and abolished, or sought to abolish, many glaring abuses. In this amendment, however, Rome had at first but small share. The Reformation movement within the church took its rise in Spain; and the purely political feeling which now constituted so considerable an element in the papal policy led each pontiff to regard with no little jealousy the overweening aggrandizement of the Spanish monarchy. Political considerations, in fact, sometimes prevailed over theological sympathies, Paul III. (1534–49), in endeavoring to trim his sails between the contending influences of France and Spain, more than once took side with the powers who were fighting the battle of Protestantism.

Financial difficulties and expedients.

While thus involved in antagonism to the chief of the Catholic powers, the Roman see found its difficulties not a little enhanced by the alienation of the revenues formerly derived from those countries which now professed the Protestant faith. Prior to the 16th century the States of the Church had enjoyed an almost unrivalled prosperity. That prosperity was mainly owing to their immunity from direct taxation. Nothing had contributed so much to the unpopularity of Hadrian VI. as his endeavor to levy a small hearth-tax, in order to replenish to some extent the coffers emptied by the prodigality of his predecessor. The loss of the revenues alienated by successive pontiffs was now aggravated by the failure of the supplies derived from the collection of Peter's pence and annates in Protestant countries. Even the sums levied in those kingdoms which continued to profess Catholicism suffered considerable diminution before they reached the Roman treasury, and the main source of revenue at this period appears to have been that represented by the sale of offices. In the serious financial embarrassment in which the curia now found itself involved, every expedient was had recourse to in order to meet the inevitable expenditure; and it is to the example of the papal treasury that Von Ranke attributes the commencement of national debts. In default of the contributions no longer levied in England, in the United Provinces, and in northern Germany, the pope found himself under the necessity of taxing his own territory; and in this manner the Romagna, once so prosperous, was crushed by a weight of taxation which ultimately embraced every article of merchandise. The farmer and the peasant left the land; and the papal provinces, formerly the most fertile and prosperous in Italy, degenerated into a series of ill-cultivated, unwholesome, and unproductive wastes.

Relations to the temporal power.

If left to rely solely on the loyalty of its adherents and the prevalent impression of its abstract merits, the position of the popedom at this period, viewed in connection with its financial difficulties, might well have seemed almost hopeless, had not its interests been so closely interwoven with those of the secular power. The latter indeed was frequently induced to connive at the papal exactions from the mere fact that it shared largely in the proceeds; and in France the very advantages gained by the crown led it to regard with complacency a system by which the royal influence and the royal revenues were alike so largely augmented. The temporal ruler was thus sometimes found a firm supporter of the popedom, even although involved in hostilities with the reigning pope.

Paul IV.

During the pontificate of Julius III. (1550–55), who dreamed away his closing years in the splendid palace and gardens which he had himself designed near the Porta del Popolo, the curia played a merely passive part in the great European drama; but with the accession of Cardinal Caraffa, who assumed the title of Paul IV. (1555–59), it became animated by another spirit. An energetic supporter

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away with by the change of *et* to *etiam;* and the sense of the passage (which thus becomes merely a confirmatory reference) is, that the prerogatives enumerated belonged to the pope, and were also recognized in the ancient councils.

of the doctrines already promulgated by the council of Trent, devoted to the cause of the church, but hating the Spaniard with the traditional hatred of a Neapolitan, his support was given entirely to the French interests in European politics. He proclaimed himself at once the liberator of Italy and the reformer of the church. In his plans of reform, although he relied mainly on the Inquisition, he included alike the monastic orders and the secular clergy.

Pius IV.

His successor, PIUS IV. (1559–65), although a man of different character, pursued a similar policy. The council of Trent assembled again under his auspices, but its discussions now concerned only points of Roman doctrine and discipline, and the rupture with the Protestant communions was complete.

Pius V.

With the accession of PIUS V. (1566–72), who had filled the office of chief inquisitor in Rome, the conditions of the papal policy had become less embarrassing. Spain now stood at the head of the Catholic powers, and England at the head of the Protestant. In France the issue of the deadly struggle that was being waged between the Huguenots and the League, which seemed likely to decide the religious destinies of Europe, was still doubtful. Philip II. accordingly appeared as the natural ally of the popedom, and Pius, having once accepted the position, remained true to this alliance throughout. The lavish expenditure of GREGORY XIII. (1572–85) brought back the former condition of financial embarrassment. He not only made large grants to aid the cause of Catholic education, and especially the newly-founded colleges of the Jesuits, but he systematically subsidized the powers who fought on the side of the church. Although the revenues of the papal states were again on the increase, the rate of exchange during Pope Gregory's pontificate was never once in their favor. At last the pressure became insupportable. The spirit of Guelf and Ghibelline revived. The Romagna rose in insurrection; and, eventually, the aged pontiff died broken-hearted amid the disorganization and lawlessness which surrounded him on every side. But already the tide of Protestantism was beginning to ebb; and the famous bull *In Cœna Domini*, which Gregory promulgated in 1584, enjoining the extirpation of the different heresies in Germany, indicated the growing weakness of the Lutheran communities.

Sixtus V.

The five years embraced by the pontificate of SIXTUS V. (1585–90), the last of the really great pontiffs, mark another great crisis in the history of the popedom. At his accession, the papal authority had dwindled to its narrowest limits, being recognized scarcely anywhere save in Spain and Italy, and in a few islands of the Mediterranean. To his tact, ability, and good sense, conjoined with the widespread activity of the Jesuits, and aided by the dissensions that prevailed among the Protestant sects, Catholicism was mainly indebted for the remarkable reaction in its favor which set in with the closing years of the 16th century—an episode of which the 7th book of Ranke's *History of the Popes* supplies a comprehensive sketch. Sixtus conciliated the great landed proprietors whom his predecessor had driven into insurrection by calling in question the validity of their title-deeds and by attempts to re-appropriate their lands; he repressed the prevailing brigandage with merciless severity; notwithstanding his lowly extraction, he succeeded in winning the favor of the great houses—the Colonnas and Orsinis; he developed the industries and manufactures of the States; no pontiff ever effected so much for the improvement and adornment of the capital; its population, which under Paul IV. had sunk to forty-five thousand, rose to one hundred thousand; "for the third time," says Ranke, "Rome stood forth to view as the chief city of the world." Another reform introduced by Sixtus was that by which the college of cardinals, before a fluctuating body, was definitely fixed at seventy. The inconsistencies of his foreign policy are probably to be partly explained by the fact that, although the promotion of the interests of the church was his most cherished object, he had conceived a thorough distrust of Philip II. At the same time, while he believed that those interests would be most effectually served by the establishment of peace and order, he necessarily regarded with aversion the revolutionary doctrines of the League, democratic in politics although ultramontane in doctrine. From Henry of Navarre, indeed, he could not withhold his tribute of admiration; and on the death of Henry III. he revoked the sentence of excommunication which he had pronounced against the great Huguenot leader, and by his general policy facilitated his return to the communion of the church. In like manner, although he sanctioned the scheme of the Spanish Armada, and even promised a magnificent subvention to the enterprise, as soon as he learned that, if successful, it might result in the annexation of England to the crown of Spain, he withdrew his support, and, when the failure of the expedition was known, could not conceal his satisfaction.

From the time of Sixtus V. the chief importance and interest of Papal history are to be found in its relations to France and Spain and to the Jesuit order (see JESUITS, vol. xiii. pp. 659–664) and, somewhat later, to Jesuitism and Jansenism (see JANSENISM, vol. xiii. p. 576) combined.

Henry IV. of France.

During the rest of the reign of Henry IV. France witnessed a virtual triumph of Gallican principles; and, although he himself became a humble suppliant for readmission within the communion of the Roman Church, it was only to give more effectual expression to the principles of religious toleration.

Edict of Nantes.

The edict of Nantes (1598) was promulgated, in fact, in defiance of the strongly expressed disapproval of CLEMENT VIII. (1592–1605). The permission accorded to the Jesuits to return to France (1603) was a measure resolved upon by Henry in opposition to the advice of both De Thou and Sully. He appears to have been actuated simply by motives of expediency, but his expectations proved singularly fallacious. The Jesuits turned the opportunity thus afforded them to signal account, and succeeded in establishing a powerful ascendency in France throughout the 17th and the first half of the 18th century. The pontificate of Clement was distinguished by two other events, the one memorable in politics, the other in literature. Of these, the former was the reversion of the duchy of Ferrara, claimed from the house of Este by the apostolic see as an escheated fief; the other was the publication of the greater part of the *Annales Ecclesiastici* of Baronius, a work of immense labor and research, which, although it could not stand the test of later criticism, rendered material support to the pretensions of the papacy.

Annales of Baronius.

Baronius himself always maintained that the papacy was more indebted to France than to any other European power; and on the death of Clement his claim to the papal chair was strongly supported by the French party in the conclave, his election being, however, lost through the opposition of the party of Spain.

Paul V.

It was chiefly by skilful manœuvring that, after the few days' pontificate of LEO XI., the election of the Cardinal Borghese, as PAUL V. (1605–21), was carried, notwithstanding the opposition of the same party. Paul's election had really been in no small measure owing to the fact that his previous career had not happened to involve him in enmity with any of the cardinals. It is stated that Cardinal Bellarmine would have been chosen in his place, but the conclave dreaded the consequences of raising a Jesuit to the papal chair. Paul affected, however, himself to regard his election as owing to the special intervention of Providence, and assumed the air and demeanor which he held suitable to one divinely commissioned to restore the pontifical office to its former dignity. No pontiff ever insisted with more inflexible rigor on the attributes and exclusive powers of his office. In the measures which he initiated for the purpose of extending the influence and possessions of the church, Paul soon found himself involved in a conflict with the powerful and flourishing republic of Venice.

The republic of Venice.

He accused the Signory of opposing the institution of monastic and other religious foundations, of conniving at the alienation of ecclesiastical property and at the suspension of the authority of the ecclesiastical courts. Finding those whom he addressed less amenable to his wishes than he anticipated, he proceeded to lay the whole republic under an interdict. Such a sentence rendered it obligatory on the religious orders throughout the province to discontinue all the customary religious services; the republic, however, enjoined them, under pain of banishment, to continue those services as before. The Jesuits, along with two other newly-founded orders, the Capuchins and the Theatines, alone ventured to disobey, and were banished from the province. A fierce controversy ensued, in which the conduct of the republic was vindicated by the able pen of Fra Paolo Sarpi (better known as "Father Paul"), while Baronius and Bellarmine defended the cause of Rome.

Fra Paolo Sarpi.

By Englishmen at that time resident in Italy, such as Sir Henry Wotton and the eminent Bedell (afterwards bishop of Ardagh), and by the English court, the contest was watched with lively interest as affording hopes of an Italian Reformation. The quarrel was skilfully fomented by Spain, and actual hostilities were averted only by the mediation of Henry IV. of France. The later years of Paul's pontificate present him in the more favorable light of a reformer of many abuses which had crept into the law-courts of the States, and the author of numerous improvements in the capital. He enlarged both the Vatican and the Quirinal; and the Borghese family from his time ranked as one of the wealthiest in the city.

Gregory XV.

The protection extended to the Jesuits by Paul was continued by his successor, **Gregory XV.** (1621–23), and was well repaid by their devotion and energy as propagandists. Gradually, in kingdom after kingdom, in principality after principality, the ground won by Protestantism, whether of the Lutheran or the Reformed confession, was in a great measure recovered.

Services rendered by the Jesuits.

In Bohemia, in Silesia, and in Moravia the Protestant ministers, if not put to death or imprisoned, were driven out, their churches closed, and their congregations forbidden to assemble. Even in the United Provinces numerous converts were made, and a footing regained for Catholic teaching which has never since been lost, while in Asia and in America new territories were won which might fairly seem to compensate the church for all that had been wrested from it in the Old World. The cordial co-operation of the curia with the society of Jesus was suspended, however, during the pontificate of **Urban VIII.** (1623–44).

Urban VIII.

A man of resolute and imperious nature, his conception of his own prerogatives is indicated by his memorable retort, when, on one occasion, he was confronted with a quotation from the pontifical constitutions, that the dictum of a living pope was worth more than those of a hundred dead ones. He claimed, indeed, the promptest deference for his decisions; while the college of cardinals, which he but rarely assembled in consistory, was treated by him with little respect. A Florentine by birth, he had witnessed in his earlier years the bitter struggle between the popedom and Spain; and it had become the cherished design of his life to render the States powerful and independent, and himself, as pontiff, the representative of a formidable political confederation. To this end he deemed it essential to prevent the duchy of Mantua from falling into the hands of a ruler who represented an influence antagonistic to, or independent of, Spain; and in pursuit of this policy he sought the aid of Richelieu. It was the time when the great cardinal was maturing his designs against the house of Hapsburg; and, somewhat singularly, the popedom was thus brought into political alliance with the statesman who was aiming at the overthrow of the very power to which Roman Catholicism had been most indebted for its restoration. In the policy of Richelieu and that of Urban there was indeed a similar inconsistency. The former, while he persecuted the Huguenots at home, allied himself with Protestant powers like England, the United Provinces, and the northern German principalities; the latter, while he had recourse to the most rigorous measures for the suppression of Protestantism in Germany, allied himself with the power on which that Protestantism mainly relied for support. It is scarcely too much to affirm to say that Protestantism, in the first half of the 17th century, owed its very existence on the Continent to the political exigencies of the popedom. During Urban's pontificate, in the year 1634, the duchy of Urbino was incorporated, like Ferrara, into the papal dominions, which now extended from the Tiber to the Po, uninterrupted save by the little republic of San Marino.

Innocent X.

The policy of **Innocent X.** (1644–55) was a complete reversal of that of his predecessor, whose family he persecuted with implacable animosity. So injurious indeed were the effects of the contentions produced by these family feuds on the peace and prosperity of the city that **Alexander VII.** (1655–67) on his election took an oath before the crucifix that he would never receive his kindred in Rome. Not less serious were the dissensions produced by the strife of political parties. We find an English visitor to Rome, during Innocent's pontificate, deeming it prudent to place himself under the protection of two cardinals—the one representing the French, the other the Spanish faction. In Innocent's eyes the treaty of Westphalia assumed the aspect of a twofold disaster; in the humiliation which it inflicted on the house of Hapsburg; and in the distinctness with which it proclaimed the superiority of the state over the church, by the declaration that all ordinances of the canon or civil law which might be found to be at variance with the provisions of the treaty should be considered null and void. Innocent even went so far as to denounce the treaty and to threaten those who assented to its provisions with excommunication—a menace treated with contemptuous indifference even by the Catholic powers.

Relations with France during reign of Louis XIV.

Throughout the reign of Louis XIV., indeed there existed a perfect understanding between that monarch and the Jesuits; and with their support he could set the pope himself at defiance with impunity. Louis asserted more unreservedly than any of his predecessors the royal privileges known as the *droit de regale*. By this ancient right the crown claimed, whenever a bishopric was vacant, both the revenues and the distribution of patronage attached to the see as long as the vacancy continued. But in the southern provinces of Guienne, Languedoc, Provence, and Dauphiné this right had hitherto never been enforced. In an edict issued in 1673, however, Louis declared that the *droit de regale* would in future be enforced throughout the whole extent of the royal dominions. It was in vain that Innocent protested and threatened to excommunicate those who espoused the royal claims. Louis, who was supported by the great mass of the French clergy, remained firm; and nine years later a further blow was aimed at papal predominance by the promulgation of the famous *Declaratio Cleri Gallicani*. In this notable manifesto, which was drawn up at St. Germains in 1682 and revised by Bossuet, a formal denial was given to the theory that the pope had any power over the temporalities of kings; the superiority of a general council over the pope was once again affirmed; the administration of the affairs of the church by the pontiff, it was declared, ought in all cases to be subject to

Innocent XI.

the canon law, and the papal authority to be exercised exclusively in connection with questions of dogma, but even in such matters the decisions of the pontiff were not infallible and were subject to revision. Innocent XI. (1676–89), who had in the meantime succeeded to the papal chair, declared these resolutions to be null and void, and severely censured the French bishops who had assented to them. His reputation for integrity and a genuine desire to reform the church gave additional force to his protest. Among other measures for restoring order in Rome he had deprived the French ambassador of the much-abused right of asylum which, by long tradition, attached to the embassy and its extensive precincts, and afforded shelter to many of the most desperate characters in the city. The ambassador refused to yield up the privilege, and Innocent thereupon excommunicated him. Louis now seized upon Avignon, took the papal nuncio prisoner, and convened a general council. It was even believed that he had at one time conceived the design of creating the archbishop of Paris, who seconded and approved his policy, patriarch of France, and thus severing the last ties that bound the Gallican Church to the popedom. The courage and resolution which Innocent exhibited under these trying circumstances were by no means inspired solely by the conviction of the justice of his cause. Perhaps at no period are the interests and sympathies of religious parties to be found presenting a more complicated study. All Europe at this time was watching with alarm the rapid aggrandizement of the French monarchy; and Innocent, in his desire to see some check placed on that aggrandizement, was even far from wishing that the Huguenots should be expelled from France. With William of Orange he openly avowed his sympathy, and it was from secret papers in the cabinet of his minister of state that Louis, through the agency of a spy, first learned the prince's designs upon England. While the Jesuits, again, were co-operating with Louis in his assertion of the Gallican liberties, the Protestant powers were giving indirect support to the maintenance of the papal pretensions. From the Jesuits Louis also received valuable aid in the question of the Spanish succession; and it is to their machinations that contemporary writers ascribe the fact that the Bourbon, Philip of Anjou, was named by Charles II. as the heir to the Spanish monarchy.

The virtues and milder wisdom of Innocent XII. (1691–1700) won from Louis what the unconciliatory attitude of his two predecessors, Innocent XI. and Alexander VIII. (1689–91) had not been able to obtain. In 1693 Louis himself notified to the pontiff that the "Declaration" would no longer be imposed as obligatory on the Gallican clergy. Innocent responded by giving his assent to the above-mentioned disposition of the Spanish crown by Charles II. Other circumstances concurred to bridge over the breach which for half a century had separated the French monarchy from the popedom. The revocation of the edict of Nantes (1685) had conciliated both the curia and the Jesuits; and in 1699 the feeling of accord between the French monarch and Innocent was confirmed by the condemnation of Fénelon's *Maximes des Saints*. While Protestantism was being crushed in France, Catholicism was obtaining in other countries the immunities which it would not grant. In 1697 the elector Frederick Augustus II. consented to declare himself a Catholic in order to gain the crown of Poland, and by this means a certain toleration was secured for Roman doctrine among a population bigotedly attached to Lutheranism. In 1713 the celebrated constitution *Unigenitus Dei Filius* promulgated by Clement XI. (1700–21) not only proved a death-blow to Jansenism, but involved in nearly the same fate that party which had hitherto fought the battle of liberalism in the Gallican Church. "All the extravagances," says a recent writer, "engendered by Jansenism in its later and more questionable developments recoiled, however unjustly, upon the system of ecclesiastical policy vindicated by Gerson, De Marca, and Bossuet. Jansenism became manifestly dangerous to public order and the security of the state; Gallicanism, in the view of a despotic Government, seemed involved in the same odious category; and it was deemed necessary, in consequence, to visit both with an impartial exhibition of the same persecuting rigor" (Jervis, *Church of France*, ii. 278). Many of the Jansenists, driven from France, retired to Utrecht, a church which, without professing Jansenist principles, long continued to uphold the standard of doctrine fixed by Tridentine canons in opposition to the dangerous advance of Jesuitism. The Jansenists were always distinguished by their resolute opposition to the theory of papal infallibility, and with their fall a chief obstacle to the promulgation of that dogma was removed.

The bull *Unigenitus*.

Expulsion of the Jansenists from France.

Decline of the popedom in political importance.

But, while, with respect to the acceptance of doctrine, the losses of the 16th century were thus materially retrieved, the popedom was sinking rapidly in political importance. Its influence in the Italian peninsula dwindled to within the limits of the States of the Church; and the dynastic succession in Naples and Sicily, in Parma and Piacenza, underwent a total change without the curia or the pontifical interests being in any way consulted. The results of the War of the Spanish Succession disappointed in every way the hopes of Clement XI.; and his chagrin, when he found himself compelled to recognize the pretensions of the archduke Charles to the Spanish crown, was intense. The manner in which the conclusion of the war demonstrated the growing power of England was again a sinister omen for the permanence of the papal system.

Increasing unpopularity of the Jesuit order.

The order to whose efforts, notwithstanding an exceptional experience in France, the popedom had in other countries been largely indebted was also destined to a signal reverse. The conviction had long been growing up in the chief cities of the Continent that wherever the representatives of Jesuitism obtained a footing the cause of public order and domestic peace was placed in jeopardy. And, while in distant lands, the vaunted successes of the Jesuit missionaries too often represented the diffusion of a merely nominal Christianity, their activity as traders was a constant source of irritation to the mercantile communities. We find, accordingly, the statesmen of Catholic Europe exhibiting, in the middle of the 18th century, a remarkable unanimity in their estimate of Jesuitism as a mischievous element in society, and also showing an increasing determination to bring all ecclesiastical institutions more and more under the control of the civil power. Carvalho, the Portuguese minister, who had himself become involved in a deadly struggle with the order at court, called upon Benedict XIV. (1740–58) to take measures for enforcing fundamental reforms among the whole body. Benedict, who recognized perhaps more fully than any other pontiff of the century the signs of the times, and who introduced not a few salutary reforms in the general relations of the curia, was far from disinclined for the task, but died before his schemes could be put in operation. His successor, Clement XIII. (1758–69), on the other hand, professed to discern in the Jesuit body the surest stay of the church, and in 1765 gave his formal sanction to the peculiar form of devotion which they had introduced, known as the worship of the Sacred Heart. In 1768 he condemned their expulsion from France as "a grievous injury inflicted at once upon the church and the holy see." The dissensions fomented by their agency at the Bourbon courts continued, however, to increase; and in 1769 the representatives of the chief Catholic powers at

Clement XIV. decrees the suppression of the order.

Pius VI.

Treatise of "Febronius."

Policy of the emperor Joseph II.

the Roman court received instructions to present each a formal demand that the Jesuit order should be secularized and abolished. Clement, who had vainly appealed to the empress Maria Theresa for the exertion of her influence, died suddenly of apoplexy on the day preceding that on which a consistory was to have been held for the purpose of giving effect to the demands of the powers. It was expressly with the view that he should carry out the task which his predecessor had sought to evade that Cardinal Ganganelli, Clement XIV. (1769–74), was raised to the pontifical chair, chiefly through the Bourbon interest. Originally a Franciscan friar, and a man of retiring unworldly disposition, the new pontiff was painfully embarrassed by the responsibilities attaching to the policy which he was expected to carry out. At length, after four years spent in balancing conflicting evidence and overcoming the scruples of his own mind, he issued the brief *Dominus et Redemptor Noster*, for the suppression of the order, which he declared to have merited its ruin by "its restlessness of spirit and audacity of action." The remorse which he was said to have subsequently exhibited, combined with his sudden and mysterious end, were not without considerable effect upon his successor, Pius VI. (1775-99), who observed the utmost caution in carrying out the decree of Clement, and devoted his main efforts during his long pontificate to diverting the mind of Christendom from questions of doctrine to others of a practical and more pleasing character. The austere simplicity which had distinguished the Roman court in the time of Clement was exchanged for more than regal pomp and magnificence, while the pontiff's own subjects were benefited by the draining of the Pontine marshes, a work of immense labor, whereby a vast district extending along the sea coast south of Rome was converted from an unhealthy swamp into a plain that subserved in some measure the purposes both of agriculture and commerce. That the suppression of the Jesuit order had been attended with no little danger to the interests of the Roman see was clearly shown by the progress which liberal opinions now began to make in Germany. The valuable researches of Muratori, which appeared in the earlier half of the 18th century had thrown a flood of light on all the circumstances of the development of the mediæval papacy, and his labors as an editor had served, at the same time, to render the successive contemporary writers accessible for the first time to the ordinary scholar. In the year 1763 the famous treatise of Nicholas von Hontheim, suffragan bishop of Treves, published under the pseudonym of "Febronius," produced a profound impression. It was entitled *On the State of the Church and the Legitimate Power of the Roman Bishop*, and was mainly devoted to pointing out how largely the false decretals, and the application of their doctrines, had been made to subserve the later pretensions of Rome, and more especially her claims to assert the supremacy of the pontiff over general councils. On the accession of Joseph II, in 1780, to the throne of Austria, a new era commenced throughout the empire. Half the monasteries and friaries were suppressed. The Bulls of *Unigenitus* and *In Cœna Domini* were declared null and void within the limits of the empire. Toleration was extended to Protestant sects and to members of the Greek Church; and the introduction of papal dispensations within the Austrian dominions was declared unlawful unless it could be shown that they were obtained without payment. Pius VI. vainly endeavored to divert the emperor from his policy of reform by a personal visit to Vienna in 1782. He was received with enthusiasm by the populace, but with coldness by the emperor, and by Prince Kaunitz, the emperor's chief adviser, with absolute rudeness.

The French Revolution.

Abolition of the papal government.

A few years later the outbreak of the French Revolution seemed to portend for the popedom a like fate to that which had overtaken the Jesuit order. A movement which abolished tithes, rejected Catholicism as the state religion, and confiscated the property of the church and the monastic orders in France was not likely, when its representatives appeared in Italy, to deal leniently with papal institutions. The demeanor of the National Assembly towards Pius himself had not been disrespectful; but the outrages on religious sentiment and decency itself perpetrated by the Convention drove the alarmed pontiff into the arms of Austria, with whom and the several reigning Italian princes he hastily concluded an offensive league. In the Italian campaign he met accordingly with no mercy at the hands of the Directory, and of Bonaparte acting as their representative. In 1797, first of all at Bologna and subsequently at Tolentino, the most rigorous conditions were imposed. The pontiff was compelled to cede to France not only Avignon and the Venaissin, but also the legations of Bologna, Ferrara, and the Romagna—an extent of territory representing fully a third of the papal dominions; while at the same time a heavy pecuniary contribution was levied. Shortly after the peace of Tolentino (February, 1797) Pius was seized with an illness which seemed likely, at his advanced time of life, to prove fatal; and Napoleon, in anticipation of his death, gave instructions that no successor to the office should be elected, and that the papal government should be abolished. The sequel, however, having disappointed these expectations, the French ambassador in Rome proceeded through his agents to foment an insurrection—a design for which the demoralized condition of the capital afforded unusual facilities. The outbreak that ensued was immediately made the pretext for abolishing the existing rule, and in its place the Roman republic was proclaimed (15th February, 1798). Neither his estimable character nor his advanced years served to shield the dethroned pontiff from wanton cruelty and indignities. He was treated as virtually a prisoner, his private property confiscated, and at last, after having been removed from one place of confinement to another, he expired at Valence, in August, 1799, at the age of eighty-two.

Pius VII.

Restoration of the popedom by Bonaparte.

It was under the protection of a schismatic power,—that of the emperor of Russia,—that after, a lapse of eight months, Pius VII. (1800–23) was elected pope at Venice. To ordinary observers the condition of the papacy at this time seemed almost hopeless; and the skill with which those who guided its policy converted the very theories and events of the Revolution itself into a ladder whereby to regain the ancient vantage-ground is in its way not less remarkable than that contemporary career of military genius which was before long destined to so sudden an eclipse. Latin Christendom, observes Bunsen, seems throughout its history to have been ever vacillating between two extremes—that of the grossest superstition and that of the profoundest skepticism, of bigotry and of atheism. It can scarcely, indeed, be doubted that the tolerance and indifference, the results of contempt with respect to all religious questions, which followed upon the Revolution largely favored the reintroduction of Roman doctrine. By the curia itself the experiences of the past were interpreted in a manner eminently favorable to its own pretensions; the altar, it was asserted, was ever the surest support of the throne, and the spiritual authority claimed by the supreme pontiff afforded the best security for the maintenance of really free institutions. Pius VII., who as Cardinal Chiaramonte had at one time affected to approve of democratic principles, succeeded in gaining the good will of Bonaparte, and his accession was shortly followed by the concordat of 1801. The

First Consul had already astonished the world by the startling change of opinion to which he gave expression in the Declaration of Milan, to the effect that "society without religion is like a ship without a compass"; and, having now resolved on the restoration of a monarchical form of government, he effected an apparent reconciliation with the Roman pontiff in order to strengthen his own hands. Catholicism was re-established as the state religion of France; but the confiscated property of the church was not restored, while the pretended reintroduction of the papal authority was deprived of all real validity by appending to the concordat certain "articles organiques" which effectually debarred the pontiff from the exercise of any real jurisdiction within the realm. In the concordat made with the Italian republic in 1803 the canon law was revived as the code whereby all questions not provided for in new articles were to be decided. Notwithstanding that he warmly resented the manner in which he had been duped, Pius was ultimately prevailed upon by the consummate address of Talleyrand to crown Napoleon as emperor in Paris. The immediate result of this imprudent act, as regarded the popedom, was the assertion of imperial rights in Rome itself on the part of the new emperor, and a demand that the pontiff should henceforth make common cause with him against the enemies of France. On his refusal Pius was made a prisoner, and the temporal sovereignty of the Roman see declared to be at an end.

Abolition of the temporal power.

At Fontainebleau, in 1813, a new concordat was wrung from the infirm and aged pontiff (whose position and treatment strongly recalled those of his predecessor), and he was compelled to surrender almost the last remnants of his authority in France and to disown all claim to rank as a temporal ruler. Pius VII. survived, however, not only to witness the overthrow of his oppressor, but to regain with the Restoration both his spiritual and temporal prerogatives; and it was a notable feature in the proceedings that his resumption of the traditional pontifical rights in connection with the legations was effected, in opposition to the wishes of Austria, with the support of England. He regained his chair, indeed, amid the best wishes of the Protestant powers,—a sympathy which, had he chosen to throw his influence into the scale that favored advancement and reform, he might have retained unimpaired to the close of his pontificate. His policy, however, was thenceforth altogether reactionary. On the one hand he suppressed the circulation of the Scriptures in the vernacular; on the other, by a bull of 7th August, 1814, he recalled the Jesuits, who since their dispersion in Latin Christendom had transferred the scene of their labors to Prussia and Russia.

Successors of Pius VII.

In other respects Pius's administration of his office was exemplary, and the same may be said of that of his successors, LEO XII. (1823–29), PIUS VIII. (1829–30), and GREGORY XVI (1831–46). The adversities arising out of the Revolution had proved a salutary discipline. Nepotism ceased to disgrace the papal court. Ecclesiasticism itself assumed another tone: its morality was pure; its zeal in the performance of its duties conspicuous.

The *Parti Prêtre.*

In France there arose a new school known as the *Parti Prêtre*, the school of Chateaubriand, Lamennais, and Montalembert, which rejected the ancient Gallican claims and principles, and everywhere inculcated loyalty and submission to Rome as the first duty of the Catholic.

Reaction in Germany and elsewhere.

In Germany neither the enlightened and strenuous efforts of Wessenberg nor the statesmanlike policy of Metternich could produce concerted action among the several states, which were accordingly eventually reduced to the necessity of each making separate terms with the curia on an independent basis. The result, in nearly all cases, was that, in reconstructing its ecclesiastical organization, and endeavoring at the same time to establish a certain *modus vivendi* in its diplomatic relations with Rome, each state was compelled to make concessions which largely favored the re-establishment of ultramontane institutions. The signal failure of Wessenberg, in his administration of the see of Constance, to reintroduce the principles advocated by "Febronius," may be cited as one of the most notable instances of the defeat of liberal principles. In the Netherlands and in Silesia similar reactionary movements took place. In England, the Catholic Emancipation Act (1829), although conceived in a spirit of conciliation, proved, in the embittered relations then existing with Ireland, of little avail, and in reality only imparted fresh strength to the machinations of the ultramontane party. The main facts in the history of the popedom from this period will be found under the head of PIUS IX. (1846–77), pp. 166–9, *supra.*

The following list taken from Gams (*Series Episcoporum Romanæ Ecclesiæ*) gives the succession of the pontiffs as accepted by the Roman Church and recorded in its registers.

List of the Pontiffs of the Roman Church.

Date of Election or Consecration.		Date of Death.
*c.*41	B. PETRUS	29 vi, *c.* 65–67
*c.*67	S. Linus	† 23 ix, *c.* 79
*c.*79	S. Cletus (*Anacletus*)	† 26 iv, *c.* 91
*c.*91	S. Clemens I.	† 23 xi, *c.* 100
*c.*100	S. Evaristus	† 26 x, *c.* 109
*c.*109	S. Alexander	† 3 v, *c.* 119
*c.*119	S. Sixtus (*Xystus*)	† 6 iv, *c.* 126
? 128	S. Telesphorus	† 5 i, ·137
*c.*138	S. Hyginus	† 11 i, 142
*c.*142	S. Pius	† 11 vii, *c.* 156
*c.*157	S. Anicetus	† 17 iv, 167
168	S. Soter	† 22 iv, *c.* 176
177	S. Eleutherus	† 26 v, 189
*c.*190	S. Victor I.	† 20 iv, *c.* 202
*c.*202	S. Zephyrinus	† 26 viii, 217
218	S. Callixtus I.	† 14 x, 222
222	S. Urbanus I.	† 25 v, 230
230	S. Pontianus	*res.* 28 ix, 235
235 (21 xi, ord.)	S. Anterus	† 3 i, 236
236	S. Fabianus	† 20 i, 250
251 (iii, el.)	S. Cornelius	† 14 ix, 253
253 el.	S. Lucius	† 5 iii, 254
254 (12 v ?, el.)	S. Stephanus I.	† 2 viii, 257
257 viii	S. Sixtus (*Xystus*) II.	† 6 viii, 258
259 22 vii, el.	S. Dionysius	† 26 xii, 268
269 5 i, el.	S. Felix	† 30 xii, 274
275 *c.* 5 i	S. Eutychianus	† 8 xii, 283
283 17 xii	S. Gaius	† 22 iv, 296
296 30 vi	S. Marcellinus	† (?25 x), 304
307 el.	S. Marcellus	† 15 i, 309
309 iv, el.	S. Eusebius	† 17 viii, 309
310 2 vii	S. Melchiades (*Miltiades*)	† 11 i, 314
314 31 i	S. Sylvester	† 31 xii, 335
336 18 i	S. Marcus	† 7 x, 336
337 6 ii, el.	S. Julius	† 12 iv, 352
352 22 v	S. Liberius	† 24 ix, 366
366 ix	S. Damasus	† 10 xii, 384
384 xii	S. Siricius	† 26 xi, 398
398 xi–xii	S. Anastasius I.	† *vert anno* 401-2
402	S. Innocentius I.	† 12 iii, 417
417 18 iii, cs.	S. Zosimus	† 26 xii, 418
418 28 xii	S. Bonifacius I.	† 4 ix, 422
422 *c.* 10 ix	S. Cœlestinus I.	† *c.* 26 vii, 432
432 31 vii	S. Sixtus III.	† 18 viii, 440
440 viii. el.	S. Leo I.	† 10 xi, 461
461 12 xi, cs.	S. Hilarus	† 21 ii, 468
468 25 ii, cs.	S. Simplicius	† 2 iii, 483
483	S. Felix III.	† *c* 25 ii, 492
492 1 iii, cs.	S. Gelasius	† 19 xi, 496
496 *c.* 24 xi, cs.	S. Anastasius II.	† *et sep.* 19 xi, 498
498 22 xi	S. Symmachus	† *et sepult.* 19 vii, 514
514 20 vii, cs.	S. Hormisdas	† *sepult.* 7 viii, 523
523 13 viii	S. Joannes I.	† 18 v, 526
526 12 vii, cs.	S. Felix IV.	† *sepel.* 12 x, (?) 530
530 17 ix. el.	Bonifacius II.	† *sepel.* 17 x, 532
532 31 xii, cs.	Joannes II.	† *sepel.* 27 v, 535
535 3 vi, cs.	S. Agapetus I.	† 22 iv, 536
536 8 vi, cs.	S. Silverius, *exul*	† *sepel.* 20 vi, *c.* 538
537 29 iii. cs.	Vigilius	† 7 vi, 555
555 *p.* 7 vi, cs.	Pelagius I.	† 3 iii, 560
560 14 vii, cs.	Joannes III.	† *sepel.* 13 vii, 573
574 3 vi, cs.	Benedictus I.	† 31 vii, 578
578 27 xi, cs.	Pelagius II.	† *sepel.* 6 ii, 590
590 3 ix, cs.	S. Gregorius I.	† *sepel.* 12 iii, 604
604 13, ix, cs.	Sabinianus	† 22 ii, 606
607 19 ii, cs.	Bonifacius III.	† *sepel.* 12 xi, 607
608 15 ix, cs.	S. Bonifacius IV.	† *sepel.* 25 v, 615
615 19 x, cs.	S. Deusdedit	† *sepel.* 8 xi, 618

Date of Election or Consecration.			Date of Death.	
619	23 xii, cs.	Bonifacius V.	† *sepel.* 25 x,	625
625	3 xi, cs.	Honorius I.	† *sepel.* 12 x,	638
640	28 v, cs.	Severinus	† *sepel.* 2 viii,	640
640	25 xii, cs.	Joannes IV.	† *sepel.* 12 x,	642
642	24 xi, cs.	Theodorus I.	† *sepel.* 14 v,	649
649	vi–vii, cs.	S. Martinus	† *exul.* 16 ix,	655
654	10 viii, cs.	S. Eugenius I.	† *sepel.* 3 vi,	657
657	30 vii, cs.	S. Vitalianus	† *sepel.* 27 i,	672
672	11 iv, cs.	Adeodatus	† *sepel.* 16 vi,	676
676	2 xi, cs.	Donus	† *sep.* 11 iv,	678
678	vi–vii, cs.	S. Agatho	† *sep.* 10 i,	681
682	17 viii, cs.	S. Leo II.	† *sep.* 3 vii,	683
684	26 vi, cs.	S. Benedictus II.	† *sep.* 8 v,	685
685	23 vii, cs.	Joannes V.	† 2 viii,	686
686	21 x, cs.	Conon	† *sepel.* 22 ix,	687
687	x–xii, el.	S. Sergius I.	† *sepel.* 8 ix,	701
701	30 x, cs.	Joannes VI.	† *sepel.* 10–11 i,	705
705	1 iii, cs.	Joannes VII.	† *sep.* 18 x,	707
708	18 i (?)	Sisinnius	† *sep.* 7 ii,	708
708	25 iii, cs.	Constantinus I.	† 9 iv,	715
715	19 v, cs.	S. Gregorius II.	† *sepel.* 11 ii,	731
731	11 ii, el.	S. Gregorius III.	† *sep.* 29 xi,	741
741	3 xii, cs.	S. Zacharias,	† *sep.* 15 iii,	752
752	iii, el.	Stephanus II.	† *ex.* iii,	752
752	*ex.* iii, el.	Stephanus III.	† *sep.* 26 iv,	757
757	29 v. cs.	S. Paulus I.	† 28 vi,	767
767	5 vii, cs.	Constantinus II.	*depos.* 6 viii,	768
768	7 viii, cs.	Stephanus IV.	† 1 ii,	772
772	1 ii, el.	Hadrianus I.	† 25 xii,	795
795	26 xii, el.	S. Leo III.	† *sep.* 12 vi,	816
816	vi, el.	Stephanus V.	† 24 i,	817
817	25 i, cs.	S. Paschalis I.	† *c.* 14 v,	824
824	v–vi	Eugenius II.	† viii,	827
827		Valentinus	† *ex. ann.*	827
827	*ex. ann.*	Gregorius IV.	† i,	844
844	i	Sergius II.	† 27 i,	847
847	10 iv, cs.	S. Leo IV.	† 17 vii,	855
855	29 ix, cs.	Benedictus III.	† 7 iv,	858
858	24 iv, cs.	S. Nicolaus I.	† 13 xi,	867
867	14 xii, cs.	Hadrianus II.	† *c.* 1 xii,	872
872	14 xii	Joannes VIII.	† 15 xii,	882
882	*c.* xii	Marinus I. [or Martin-	† *c.* v,	884
884	*c.* v, el.	Hadrianus III. us II.]	† *c.* viii–ix,	885
885	*c.* ix, el.	Stephanus VI.	† *c.* ix,	891
891	*c.* ix	Formosus	† 23 v.	896
896	*c.* 23 v, el.	Bonifacius VI.	† *c.* 6 vi.	896
896	*a.* 11 vi, intrs.	Stephanus VI. (VII.)	*amot.* † vii,	897
897	vii, cs.	Romanus	† *c.* xi,	897
897	*c.* xi	Theodorus II.	† *post* 20 *dies*	
898	*c.* vi, cs.	Joannes IX.	† vii,	900
900	6–26 vii	Benedictus IV.	† viii,	903
903	*c.* viii	Leo V.	† *c.* ix,	903
903	*c.* x	Christophorus	*amot.* i,	904
904	29 i, cs.	Sergius III.	† *p.* 4 ix,	911
911	*c.* ix, cs.	Anastasius	† *c.* xi,	913
913	*c.* xi, cs.	Lando	† *c.* v,	914
914	15 v, cs.	Joannes X.	† *in carcere*	929
928	*c.* vii, cs.	Leo VI.	† *c.* ii,	929
929	*c.* ii, cs.	Stephanus VIII.	† 15 iii,	931
931	*c* iii, cs.	Joannes XI.	† i,	936
936	*a.* 9 i, cs.	Leo VI (VII).	† vii,	939
939	*a.* 19 vii, cons	Stephanus IX.	† *c.* x,	942
942	*a.* 11 xi, cons.	Marinus II. [or Martin-	† *c.* iv,	946
946	*c.* iv	Agapetus II. us III.]	† *c.* 8 xi,	955
955	*c.* xi, cs.	Joannes XII. (*amot.* 4 xii, 963)	† 14 v,	964
963	4 xii, el.	Leo VIII.	† *c.* iii,	965
964	v, el.	Benedict V.	*exul.*	965
965	1 x, cs.	Joannes XIII.	† 6 ix,	972
973	19 i, cs.	Benedict VI.	† *occis.* vii,	974
974	x	Benedictus VII.	† x,	983
983	*ex. ann.*	Joannes XIV.	† *occis.* 20 viii,	984
984		Bonifacius VII.	† vii,	985
985	1 ix, cs.	Joannes XV.	† *in.* iv,	996
996	3 v, cs.	Gregorius V.	† ii,	999
999	*in.* iv, cs.	Sylvester II. (*Gerbert*)	† 12 v,	1003
1003	13 vi, cs.	Joannes XVII. (*Sicco*)	† 7 xii,	1003
1003	25 xii, cs.	Joannes XVIII.	† vi,	1009
1009	*p.* 20 vi, cs.	Sergius IV.	† 16–22 vi,	1012
1012	22 vi, cs.	Benedict VIII.	† 7 iv,	1024
1024	24 vi-15 vii, cs	Joannes XIX.	† i,	1033
1033	i, cs.	Benedictus IX.	*resignat.* 1 v,	1045
1045	1 v, intr.	Gregorius VI.	*resignat.* 20 xii,	1046
1046	25 xii, cs.	Clemens II.	† 9 x,	1047
1048	17 vii, cs.	Damasus II.	† 9 viii,	1048
1049	12 ii, cs.	S. Leo IX.	† 19 iv,	1054
1055	13 iv, cs.	Victor II.	† 28 vii,	1057
1057	2 viii, el.	Stephanus X.	† 29 iii,	1058
1058	5 iv, el.	Benedict X.	*expuls. c.* i,	1059
1059	24 i, cs.	Nicolaus II.	† 27 vii,	1061
1061	1 x, el.	Alexander II.	† 21 iv,	1073
1073	22 iv, el.	S. Gregorius VII.	† 25 v,	1085
1086	24 v, el.	Victor III.	† 16 ix.	1087
1088	12 iii, el.	Urbanus II.	† 29 vii,	1099
1099	13 viii, el.	Paschalis II.	† 21 i,	1118
1118	24 i, el.	Gelasius II.	† 29 i,	1119
1119	2 ii, el.	Calixtus II.	† 13–14 xii,	1124
1124	15–16 xii, el.	Honorius II.	† 14 ii,	1130
1130	14 ii, el.	Innocentius II.	† 24 ix,	1143
1143	26 ix, el.	Cœlestinus II.	† 8 iii,	1144
1144	12 iii, el.	Lucius II.	† 15 ii,	1145
1145	15 ii, el.	Eugenius III.	† 8 vii,	1153
1153	12 vii, cs.	Anastasius IV.	† 3 xii,	1154
1154	4 xii, el.	Hadrianus IV.	† 1 ix,	1159
1159	7 ix, el.	Alexander III.	† 30 viii,	1181
1181	1 ix	Lucius III.	† 25 xi,	1185
1185	25 xi	Urbanus III.	† 20 x,	1187
1187	21 x, el.	Gregorius VIII.	† 17 xii,	1187
1187	19 xii, el.	Clemens III.	† iii,	1191
1191	30 iii, el.	Cœlestinus III.	† 8 i,	1198
1198	8 i	Innocentius III.	† 16 vii,	1216
1216	18 vii	Honorius III.	† 18 iii,	1227
1227	19 iii	Gregorius IX.	† 21 viii,	1241
1241	x	Cœlestinus IV.	† 17–18 xi,	1241
1243	25 vi	Innocentius IV.	† 13 xii,	1254
1254	25 xii	Alexander IV.	† 25 v,	1261
1261	29 viii	Urbanus IV.	† 2 x,	1264
1265	5 ii	Clemens IV.	† 29 xi,	1268
1271	1 ix	Gregorius X.	† 11 i,	1276
1276	23 ii, cs.	Innocentius V.	† 22 vi,	1276
1276	12 vii, el.	Hadrianus V.	† 17 viii,	1276
1276	13 ix	Joannes XXI.	† 16 v,	1277
1277	25 xi	Nicolaus III.	† 22 viii,	1280
1281	22 ii	Martinus IV.	† 28 iii,	1285
1285	2 iv	Honorius IV.	† 3 iv,	1287
1288	15 ii	Nicolaus IV.	† 4 iv,	1292
1294	5 vii	S. Cœlestinus V. († 19 v, 1296)		
			res. 13 xii,	1294
1294	14 xii	Bonifacius VIII.	† 11 x,	1303
1303	22 x	Benedictus XI.	† 7 vii,	1304
1305	5 vi	Clemens V.	† 20 iv,	1314
1316	7 viii	Joannes XXII.	† 4 xii,	1334
1334	20 xii	Benedictus XII.	† 25 iv,	1342
1342	7 v, el.	Clemens VI.	† 6 xii,	1352
1352	18 xii	Innocentius VI.	† 12 ix,	1362
1362	28 x	Urbanus V.	† 19 xii,	1370
1370	30 vii	Gregorius XI.	† 27 iii,	1378
1378	8 iv	Urbanus VI.	† 15 x,	1389
[1378	20 ix	Clemens VII. *antipapa Aven.*	† 16 ix,	1394
1394	28 ix	Benedict XIII. (*amot.* 26 vii) 1417		
			† 23 v,	1423]
1389	2 xi	Bonifacius IX.	† 1 x,	1404
1404	17 x	Innocentius VII.	† 6 xi,	1406
1406	2 xii	Gregorius XII. († 1419)	*resignat.* 4 vii,	1415
1409	26 vi	Alexander V.	† 3 v,	1410
1410	17 v	Joannes XXIII. († 22 xi, 1419)		
			amot. 24 v,	1415
1417	11 xi	Martinus V.	† 20 ii,	1431
1431	3 iii	Eugenius IV.	† 23 ii,	1447
1447	6 iii	Nicolaus V.	† 24 iii,	1455
1455	8 iv	Calixtus III.	† 6 viii,	1458
1458	19 viii	Pius II.	† 15 viii,	1464
1464	31 viii	Paulus II.	† 28 vii,	1471
1471	9 viii	Sixtus IV.	† 12 viii,	1484
1484	24 viii	Innocentius VIII.	† 25 vii,	1492
1492	11 viii	Alexander VI.	† 18 viii,	1503
1503	22 ix	Pius III.	† 18 x,	1503
1503	1 xi	Julius II.	† 21 ii,	1513
1513	15 iii	Leo X.	† 1 xii,	1521
1522	9 i	Hadrianus VI.	† 14 ix,	1523
1523	19 xi	Clemens VII.	† 25 ix,	1534
1534	13 x	Paulus III.	† 10 xi,	1549
1550	8 ii	Julius III.	† 23 iii,	1555
1555	9 iv	Marcellus II.	† 30 iv,	1555
1555	23 v	Paulus IV.	† 18 viii,	1559
1559	25 xii	Pius IV.	† 9 xii,	1565
1566	17 i, cs.	S. Pius V.	† 1 v,	1572
1572	26 v	Gregorius XIII.	† 10 iv,	1585
1585	1 v, cs	Sixtus V.	† 27 viii,	1590
1590	15 ix, el.	Urbanus VII.	† 27 ix,	1590
1590	5 xii	Gregorius XIV.	† 15 x,	1591
1591	29 x, el.	Innocentius IX.	† 30 xii,	1591
1592	30 i, el.	Clemens VIII.	† 5 iii,	1605
1605	1 iv, el	Leo XI.	† 27 iv,	1605
1605	16 v, el.	Paulus V.	† 28 i,	1621
1621	9 ii	Gregorius XV.	† 8 vii,	1623
1623	6 viii, el.	Urbanus VIII.	† 29 vii,	1644
1644	15 ix	Innocentius X.	† 7 i,	1655
1655	7 iv	Alexander VII.	† 22 v,	1667
1667	20 vi	Clemens IX.	† 9 xii,	1669
1670	29 iv	Clemens X.	† 22 vii,	1676
1676	21 ix	Innocentius XI.	† 12 vii,	1689
1689	6 x	Alexander VIII.	† 1 ii,	1691
1691	12 vii	Innocentius XII.	† 27 ix,	1700
1700	23 xi, el.	Clemens XI.	† 19 iii,	1721
1721	8 v	Innocentius XIII.	† 7 iii,	1724
1724	29 v	Benedictus XIII.	† 21 ii,	1730
1730	12 vii	Clemens XII.	† 6 ii,	1740
1740	17 viii	Benedictus XIV.	† 3 v,	1758
1758	6 vii	Clemens XIII.	† 2 ii,	1769
1769	19 v	Clemens XIV.	† 22 ix,	1774
1775	15 ii	Pius VI.	† 29 viii,	1799
1800	14 iii	Pius VII.	† 20 viii,	1823
1823	28 ix	Leo XII.	† 10, ii,	1829
1829	31 iii	Pius VIII.	† 30, xi,	1830
1831	2 ii	Gregorius XVI.	† 1, vi,	1846
1846	16 vi, el.	Pius IX.	† 3 vi,	1877
1877	vi, el.	Leo XIII.		

Authorities.—The great tomes known as the *Annales Ecclesiastici* of Baronius, continued by Raynaldus, 42 vols. fol. (1738-56), represents a laborious but uncritical collection of materials from the earliest times down to the Reformation. The continuation by A. Theiner, embracing the period 1572-85, is of higher value. In a critical investigation of the original sources, the great work of F. Maassen, *Geschichte der Quellen und der Literatur des canonischen Rechts in Abendlande* (1871 *sq.*) is indispensable. Milman's *History of Latin Christianity* continues to be the fullest and most impartial source of information in English from the 1st to the 15th century; this may be supplemented by Gregorovius, *Geschichte der Stadt Rom im Mittelalter vom 5ten bis 16ten Jahrhundert*, 8 vols. (1859-72), which throws considerable light on the political and social relations of the city and the papal States; and also by Thomas Greenwood, *Cathedra Petri, a political History of the great Latin Patriarchate*, 6 vols. (1856-65). This latter work, although published subsequently to the first edition of Milman, was written before it, and, according to the author, without reference to its pages; it deserves the praise of being, at least in the earlier volumes, a piece of learned and laborious research on the part of a layman of considerable acquirements and candid disposition. In a comparison of the views and treatment of the two foregoing works, Wm. von Giesebrecht's *Geschichte der deutschen Kaiserzeit*, 5 vols. (5th ed. now publishing), will be found useful. *A History of the Papacy during the period of the Reformation*, by Canon Creighton (only partly published), promises to furnish a valuable account of this period, derived from the original sources. From the Reformation, Leopold von Ranke, *Die römischen Päpste in den letzten vier Jahrhunderten*, 3 vols. (7th ed., 1878), is the classic work. A translation of the first edition into English by Sarah Austin appeared in 1840, and has been frequently reprinted. H. Geffcken, *Church and State*, translated by E. F. Taylor, 2 vols. (1877), supplies additional illustration, more especially of the relations in Germany. Nippold, *Handbuch der neuesten Kirchengeschichte*, 2 vols. (1880-83), traces the subject from the Reformation to the present time. The difficulties attaching to the first commencement, the earlier chronology, and the episcopal succession are elaborately treated by R. A. Lipsius, *Die Quellen der römischen Petrussage* (1872), and *Chronologie der römischen Bischöfe bis zur Mitte des vierten Jahrhunderts* (1869). For the abstract treatment of the subject, Thomassin, *Vetus et nova Ecclesiæ Disciplina* (1773), supplies the views of the moderate adherent of the Gallican Church as opposed to the ultramontanists; while the classic though somewhat antiquated discussion by Bingham in his *Antiquities of the Christian Church* (1st ed., 1708-22) gives the corresponding view of the moderate Anglican. The treatise of R. Baxmann, *Die Politik der Päpste, von Gregor I. bis auf Gregor VII.*, 2 vols. (1868-69), is of considerable merit. The *Regesta Pontificum Romanorum*, edited by Jaffe and Potthast, 3 vols., gives a kind of *catalogue raisonné* of the pontifical briefs, letters and encyclicals from 67 to 1304 A.D. Of the letters themselves no complete collection has appeared; the volume edited by Coustant (1796) comes down only to 437, the more recent collection by Thiel embraces only the period 461-523. The Bulls of Innocent IV. and Benedict XI. have recently been edited from the original MSS. in the Vatican, the former by M. Élie Berger, the latter by M. Grandjean. For information on technical points involving the relations of the popedom to the canon law and the church at large, see J. F. von Schultz, *Lehrbuch des katholischen Kirchenrechts*, 2 vols. (1856-60). The manual by F. Walter, *Lehrbuch des Kirchenrechts aller christlichen Confessionen* (14th ed., 1871), of which the first edition appeared in 1822, illustrates the departure from the older ecclesiastical code which took its rise in the anti-Febronian movement. The abuses that rose out of the papal nepotism are depicted by Gregorio Leti (a convert from Romanism in the 17th century) in a well-known volume—"*Il Nipotismo di Roma, or the History of the Pope's Nephews from the time of Sixtus IV. to the death of Alexander VII.*, in two parts: written originally in Italian and Englished by W. A., London, 1669." The tombs of the pontiffs and the associations they recall are admirably described by Gregorovius in a little volume entitled *Die Grabdenkmäler der Päpste* (2d ed., 1881).
(J. B. M.)

POPLAR (*Populus*), the name of a small group of arborescent amentaceous plants, belonging to the order *Salicaceæ*. The catkins of the poplars differ from those of the nearly allied willows in the presence of a rudimentary perianth, of obliquely cup-shaped form, within the toothed bracteal scales; the male flowers contain from eight to thirty stamens; the fertile bear a one-celled (nearly divided) ovary, surmounted by the deeply cleft stigmas; the two-valved capsule contains several seeds, each furnished with a long tuft of silky or cotton-like hairs. The leaves are broader than in most willows, and are generally either deltoid or ovate in shape, often cordate at the base, and frequently with slender petioles vertically flattened. Many of the species attain a large size, and all are of very rapid growth. The poplars are almost entirely confined to the north temperate zone, but a few approach or even pass its northern limit, and they are widely distributed within that area; they show, like the willows, a partiality for moist ground, and often line the river sides in otherwise treeless districts. The number of species cannot be very accurately defined—several, usually regarded as distinct, being probably merely variable forms of the same type. All yield a soft easily-worked timber, which, though very perishable when exposed to weather, possesses sufficient durability when kept dry to give the trees a certain economic value.

Of the European kinds, one of the most important and best marked forms is the White Poplar or Abele, *P. alba*, a tree of large size, with rounded spreading head and curved branches, which, like the trunk, are covered with a grayish-white bark, becoming much furrowed on old stems. The leaves are ovate or nearly round in general outline, but with deeply waved, more or less lobed and indented margins and cordate base; the upper side is of a dark-green tint, but the lower surface is clothed with a dense white down, which likewise covers the young shoots—giving, with the bark, a hoary aspect to the whole tree. As in all poplars, the catkins expand in early spring, long before the leaves unfold; the ovaries bear four linear stigma lobes; the capsules ripen in May. A nearly related form, which may be regarded as a sub-species, *P. canescens*, the Gray Poplar of the nurseryman, is distinguished from the true abele by its smaller, less deeply cut leaves, which are gray on the upper side, but not so hoary beneath as those of *P. alba*; the pistil has eight stigma lobes. Both trees occasionally attain a height of 90 feet or more but rarely continue to form sound timber beyond the first half-century of growth, though the trunk will sometimes endure for a hundred and fifty years. The wood is very white, and, from its soft and even grain, is employed by turners and toy-makers, while, being tough and little liable to split, it is also serviceable for the construction of packing cases, the lining of carts and wagons, and many similar purposes; when thoroughly seasoned it makes good flooring planks, but shrinks much in drying, weighing about 58 lb per cubic foot when green, but only 33½ lb when dry. The white poplar is an ornamental tree, from its graceful though somewhat irregular growth, and its dense hoary foliage; it has, however, the disadvantage of throwing up numerous suckers for some yards around the trunk.

The gray and white poplars are usually multiplied by long cuttings; the growth is so rapid in a moist loamy soil that, according to Loudon, cuttings 9 feet in length, planted beside a stream, formed in twelve years trunks 10 inches in diameter. Both these allied forms occur throughout central and southern Europe, but, though now abundant in England, it is doubtful whether they are there indigenous. *P. alba* suffers much from the ravages of wood-eating larvæ, and also from fungoid growths, especially where the branches have been removed by pruning or accident; trunks have occasionally acquired a diameter of 3 feet and upwards.

The aspens form an important section, of which the Common Aspen of Europe, *P. tremula*, may be taken as the type—a tall fast-growing tree with rather slender trunk, and gray bark becoming rugged when old; the orbicular leaves, toothed on the margin, and slightly downy when young, are afterwards smooth, dark-green on the upper and grayish-green on the lower surface; the long slender petioles, much flattened towards the outer end, allow of free lateral motion by the slightest breeze, giving the foliage its well-known tremulous character.

The aspen is an abundant tree in the northern parts of Britain, even as far as Sutherland, and is occasionally found in the coppices of the southern counties, but in these latter habitats seldom reaches any large size; throughout northern Europe it abounds in the forests, in Lapland flourishing even in 70° N. lat., while in Siberia its range extends to the Arctic Circle; in Norway its upper limit is said to coincide with that of the pine; trees exist near the western coast having stems 15 feet in circumference. The wood of the aspen is very light and soft, though tough; it is employed by coopers, chiefly for pails and herring-casks; it is also made into butchers' trays, pack-saddles, and various articles for which its lightness recommends it; sabots are also made of it in France, and in mediæval days it was valued for arrows, especially for those used in target practice; the bark is used for tanning in northern countries; cattle and deer browse greedily on the young shoots and abundant suckers. Aspen wood makes but indifferent fuel, but charcoal prepared from it is light and friable, and has been employed in gunpowder manufacture. The powdered bark is sometimes given to horses as a vermifuge; it possesses likewise tonic and febrifugal properties, containing a considerable amount of salicin. The aspen is readily propagated either by cuttings or suckers, but has been little planted of late years in Britain. *P. trepida*, or *tremuloides*, is closely allied to the European aspen, being chiefly distinguished by its more pointed leaves; it is a native of most parts of Canada and the United States, extending northwards as far as Great Slave Lake. The American Aspen is a smaller tree than *P. tremula*, seldom rising to a greater height than 30 feet, and rarely forming timber of any value; the wood burns better in the green state than that of most trees, and is often used by the hunters of the northwest as fuel; split into thin layers, it was formerly employed in the States for bonnet and hat making; the bark is of some value as a tonic and febrifuge. *P. grandidentata*, the Large-leaved American Aspen, is a tree of larger growth, with ovate or roundish leaves deeply and irregularly serrated on the margin. The wood is strong, and considered durable for indoor use; it is also employed in some districts for fences; split into slender strips, it has been applied to the manufacture of hats, like that of the Canadian aspen.

Some of the most valuable trees of the genus belong to a section remarkable for the elongation of the fertile catkins, which become lax towards maturity. *P. nigra*, the Black Poplar. one of the most important of this group, is a tree of large growth, with dark deeply-furrowed bark on the trunk, and ash-colored branches; the smooth deltoid leaves serrated regularly on the margin, are of the deep green tint which has given name to the tree; the petioles, slightly compressed, are only about half the length of the leaves. The black poplar is common in central and southern Europe and in some of the adjacent parts of Asia, but, though abundantly planted in Britain, is probably not there indigenous. The wood is of a yellowish tint. In former days this was the prevalent poplar in Britain, and the timber was employed for the purposes to which that of other species is applied, but has been superseded by *P. monilifera* and its varieties; it probably furnished the poplar-wood of the Romans, which, from its lightness and soft tough grain, was in esteem for shield-making; in continental Europe it is still in some request; the bark, in Russia, is used for tanning leather, while in Kamchatka it is sometimes ground up and mixed with meal; the gum secreted by the buds was employed by the old herbalists for various medicinal purposes, but is probably nearly inert; the cotton-like down of the seed has been converted into a kind of vegetable felt, and has also been used in paper-making. A closely related form is the well-known Lombardy Poplar, *P. fastigiata*. remarkable for its tall cypress-like shape, caused by the nearly vertical growth of the branches. Probably a mere variety of the black poplar, its native land appears to have been Persia or some neighboring country; it was unknown in Italy in the days of Pliny, while from remote times it has been an inhabitant of Kashmir, the Punjab, and Persia, where it is often planted along roadsides for the purpose of shade; it was probably brought from these countries to southern Europe, and derives its popular name from its abundance along the banks of the Po and other rivers of Lombardy, where it is said now to spring up naturally from seed, like the indigenous black poplar. It was introduced into France in 1749, and appears to have been grown in Germany and Britain soon after the middle of the last century, if not earlier. The Lombardy poplar is valuable chiefly as an ornamental tree, its timber being of very inferior quality; its tall erect growth renders it useful to the landscape gardener as a relief to the rounded forms of other trees, or in contrast to the horizontal lines of the lake or river-bank where it delights to grow. In Lombardy and France tall hedges are sometimes formed of this poplar for shelter or shade, while in the suburban parks of Britain it is serviceable as a screen for hiding buildings or other unsightly objects from view; its growth is extremely rapid, and it often attains a height of 100 feet and upwards, while from 70 to 80 feet is an ordinary size in favorable situations.

P. canadensis, the "Cotton-wood" of the western prairies, and its varieties are perhaps the most useful trees of the genus, often forming almost the only arborescent vegetation on the great American plains. The *P. canadensis* of Michaux, which may be regarded as the type of this group, is a tree of rather large growth, with rugged gray trunk, and with the shoots or young branches more or less angular; the glossy deltoid leaves are sharply pointed, somewhat cordate at the base, and with flattened petioles; the fertile catkins ripen about the middle of June, when their opening capsules discharge the cottony seeds which have given the tree its common western name; in New England it is sometimes called the "River Poplar." The cotton-wood timber. though soft and perishable, is of value in its prairie habitats, where it is frequently the only available wood either for carpentry or fuel; it has been planted to a considerable extent in some parts of Europe, but in England a kindred form, *P. monilifera*, is generally preferred from its larger and more rapid growth. In this well-known variety the young shoots are but slightly angled, and the branches in the second year become round; the deltoid short-pointed leaves are usually straight or even rounded at the base, but sometimes are slightly cordate; the capsules ripen in Britain about the middle of May. This tree is of extremely rapid growth, and has been known to attain a height of 70 feet in sixteen years; the trunk occasionally acquires a diameter of from 3 to 5 feet, and, according to Emerson, a tree near New Ashford, Massachusetts, measured 20 feet 5 inches in circumference; it succeeds best in deep loamy soil, but will flourish in nearly any moist but well-drained situation. The timber is much used in some rural districts for flooring, and is durable for indoor purposes when protected from dry-rot; it has, like most poplar woods, the property of resisting fire better than other timber. The native country of this sub-species has been much disputed; but, though still known in many British nurseries as the "Black Italian Poplar," it is now well ascertained to be an indigenous tree in many parts of Canada and the States, and is probably a mere variety of *P. canadensis;* it seems to have been first brought to England from Canada in 1772. In America it seldom attains the large size it often acquires in England, and it is there of less rapid growth than the prevailing form of the western plains; the name of "cotton-wood" is locally given to other species. *P. macrophylla* or *candicans*, commonly known as the Ontario Poplar, is remarkable for its very large heart-shaped leaves, sometimes 10 inches long; it is found in New England and the milder parts of Canada, and is frequently planted in Britain; its growth is extremely rapid in moist land; the buds are covered with a balsamic secretion. The true Balsam Poplar, or Tacamahac, *P. balsamifera*, abundant in most parts of Canada and the northern States, is a tree of rather large growth, often of somewhat fastigiate habit, with round shoots and oblong-ovate sharp-pointed leaves, the base never cordate, the petioles round, and the disk deep glossy green above but somewhat downy below. This tree, the "liard" of the Canadian voyageur, abounds on many of the river sides of the northwestern plains; it occurs in the neighborhood of the Great Slave Lake and along the Mackenzie river, and forms much of the drift-wood of the Arctic coast. In these northern habitats it attains a large size; the wood is very soft; the buds yield a gum-like balsam, from which the common name is derived; considered valuable as an anti-scorbutic, this is said also to have diuretic properties; it was formerly imported into Europe in small quantities, under the name of "baume focot," being scraped off in the spring and put into shells. This balsam gives the tree a fragrant odor when the leaves are unfolding. The tree grows well in Britain, and acquires occasionally a considerable size. A very closely allied variety abounds in Siberia and Dauria, chiefly distinguished by its wider leaves, rounded growth, and the darker tint of its wood; a kind of wine, esteemed as a diuretic, is prepared in Siberia from the buds. Its fragrant shoots and the fine yellow green of the young leaves recommend it to the ornamental planter. It is said by Aiton to have been introduced into Britain about the end of the 17th century. (C. P. J.)

POPLIN or Tabinet is a mixed textile fabric consisting of a silk warp with a weft of worsted yarn. As the weft is in the form of a stout cord, the fabric has a ridged structure, like rep, which gives depth and softness to the lustre of the silky surface. Poplins are used for dress purposes, and for rich upholstery work. The manufacture is of French origin; but it was brought to England by the Huguenots, and has long been specially associated with Ireland. The French manufactures distinguish between *popelines unies* or plain poplins and *popelines à dispositions* or *Ecossaises*, equivalent to Scotch tartans, in both of which a large trade is done with the United States from Lyons.

POPOCATEPETL (Aztec *popocani*, "smoking," *tepetl*, "mountain"), a burning mountain in Mexico, in 18° 59′ 47″ N. lat. and 98° 33′ 1″ W. long., which along with the neighboring and somewhat lower summit of Ixtaccihuatl (Aztec "White Woman") forms the southeastern limit of the great valley in which the capital is built. As it lies in the province of Puebla, and is the great feature in the view from that city, it is also called the Puebla Volcano. With the single exception of Mount Elias in Alaska, Popocatepetl appears to be the highest peak in North America, rising as it does in a regular snow-covered cone to an altitude of 17,853 feet. The main mass of the mountain consists of andesite, but porphyry, obsidian, trachyte, basalt, and other similar rocks are also represented. Between the pine forest (*Pinus occidentalis*), which ceases at a height of 12,544 feet, and the snow limit, 14,960 feet, there lies a tract of loose sand, largely composed of grains of sulphur, which renders the ascent tedious and at times dangerous, though the first 1600 feet can be accomplished on horseback. On the summit is an enormous crater measuring 5000 feet across and with a sheer depth of 2000 feet. The vapors rising from the solfataras, the mixture of sulphur yellow and ash gray in the caldron, the dazzling snow on the edges of the crater walls, and the deep blue of the sky above produce the most indescribable effects of color. The highest point of the mountain is a softly rounded eminence about 30 feet only from the rim. Sulphur from the crater is regularly worked by a number of Indians who have their huts at the foot of the cone, at a height of 12,000 feet. The material is shot down a slide for a distance of between 2000 and 3000 feet, and the workmen also avail themselves of this means of descent. At the foot of the east slope of Popocatepetl stretches a vast lava field—the Malpays of Atlachayacatl, which gives birth to the Rio Atlaco. According to Humboldt, it rises from 60 to 80 feet above the plain, and extends 18,000 feet from east to west with a breadth of 6000 feet. The date of its formation must be of great antiquity. There have been only two or three moderate eruptions during the last 300 years, though smoke continually issues from the crater, and from time to time vast showers of cinders and stones are shot up.

In 1519 Cortes sent a party of ten men to climb a smoking mountain which was evidently Popocatepetl; and in 1522 Francisco Montaño not only reached the summit but had himself let down into the crater a depth of 400 or 500 feet. No second ascent of the mountain is recorded till April (see Brantz Mayer, *Mexico*, vol. ii.) and November, 1827. Other ascents have been made in 1834, 1848, and subsequent years.

POPPÆA SABINA. See Nero.

POPPY OIL is obtained by pressure from the minute seeds of the garden or opium poppy, *Papaver somniferum* (see Opium, vol. xvii. p. 809). The white-seeded and black-seeded varieties are both used for oil-pressing; but, when the production of oil is the principal object of the culture, the black seed is usually preferred. The qualities of the oil yielded by both varieties and the proportion they contain (from 50 to 60 per cent.) are the same. By cold pressure seeds of fine quality yield from 30 to 40 per cent. of virgin or white oil (*huile blanche*), a transparent limpid fluid with a slight yellowish tinge, bland and pleasant to taste, and with almost no perceptible smell. On second pressure with the aid of heat an additional 20 to 25 per cent. of inferior oil (*huile de fabrique* or *huile rousse*) is obtained, reddish in color, possessed of a biting taste, and a linseed-like smell. The oil belongs to the linoleic or drying series, having as its principal constituent linolein; and it possesses greater drying power than raw linseed oil. Its specific gravity at 15° C. is 0.925; it remains limpid at —15° C., but forms a thick white mass at —20° C., which does not again become fluid till the temperature rises to —2° C. Poppy oil is a valuable and much used medium for artistic oil painting. The fine qualities are largely used in the north of France (*huile de œillette*) and in Germany as a salad oil, and are less liable than olive oil to rancidity. The absence of taste and characteristic smell in poppy oil also leads to its being much used for adulterating olive oil. The inferior qualities are principally consumed in soap-making and varnish-making, and for burning in lamps. The oil is very extensively used in the valley of the Ganges and other opium regions for food and domestic purposes. By native methods in India about 30 per cent. of oil is extracted, and the remaining oleaginous cake is used as food by the poor. Ordinary poppy-oil cake is a valuable feeding material, rich in nitrogenous constituents, with an ash showing an unusually large proportion of phosphoric acid. The seed of the yellow-horned poppy, *Glaucium luteum*, yields from 30 to 35 per cent. of an oil having the same drying and other properties as poppy oil; and from the Mexican poppy, *Argemone mexicana*, is obtained a non-drying purgative oil useful as a lubricant and for burning.

POPULATION. The phenomena of population are the product of physical forces the nature of which it will be necessary to investigate. It will, however, be convenient to consider population, in the first place, as a statical phenomenon, that is, to observe and classify the principal features it presents, without attempting to investigate the system of causes of which they are the effects. Thereafter the dynamical aspects of the subject, namely, the general laws governing the forces whose joint action has produced population, will receive attention.

I. Population, *statically* considered, may be defined as "the totality of human beings existing within a given area at a given moment of time." This definition is identical with that adopted by Haushofer (p. 87), except that that eminent authority thought it unnecessary to add the clause relating to time. The totality just mentioned is ascertained in modern times and by civilized nations by the statistical operation known as the Census (*q.v.*). It is usual to obtain by means of a census a good deal of information beyond the bare fact of the number of persons whose existence is, for the purposes of the census, taken cognizance of. Part of this information is obtained for purposes connected with the administration of the state, such as that contained in replies to questions as to the religion, profession, etc., of the individuals numbered. But these facts, though highly important, are not facts of population strictly speaking. There are two very important characteristics common to all considerable populations—namely, the approximate constancy of the distribution of the population as regards sex and age. A census which did not distinguish between the number of male and the number of female persons composing the population of which it takes cognizance would be seriously defective. Inquiries as to the height and the girth round the chest of individuals are usually made in countries where military service is compulsory, and the degree of prevalence of bodily defects, such as blindness and deafness, is also noted for similar reasons; but such inquiries are the work of specialists, official and other, and in any case are not included in the information obtained from a census. The age of each individual is, however, easily obtained in the course of the operations of the census. We shall now briefly set forth the general characteristics of a population, examined at a particular point of time and without reference to similar phenomena at previous points of time.

Population of the World.—The total population of the world is, to a large extent, an estimate, inasmuch as in some countries a proper census has never been taken, while in many the interval that has elapsed since the last operation is so long as to reduce it to the level of serving as a basis for a calculation in which estimates play a large part.

So great, indeed, is the uncertainty in which all such calculations are involved that an eminent French statistician, M. Block, abandons all attempt to deal with the problem, dismissing the subject in the following note (*Traité*, etc., p. 401),—"Nous abstenons de donner le chiffre de l'ensemble de la population de la terre; personne ne connait ce chiffre." With this view of the matter we entirely agree, without, however, any disparagement to the valuable work done by Behm and Wagner, who have made the population of the earth their special study, and are under no illusions as to the accuracy of the results they have to offer. The work of these two eminent men of science has at any rate drawn attention to the *lacunæ* in our present knowledge, besides arranging and coördinating the great multiplicity of well-ascertained facts at our disposal. As civilization advances the area of the unknown or partially known, which is at present large, will gradually diminish.

TABLE I.—*Estimates of the Population of the World.*

Author of Estimate.	Year.	Number (in Millions).
Riccioli	1660	1,000
Süssmilch	1742	950-1,000
Voltaire	1753	1,600
Volney	1804	437
Pinkerton	1805	700
Fabri	1805	700
Malte-brun	1810	640
Morse	1812	766
Graberg v. Hemsö	1813	686
Balbi	1816	704
Reichard	1822	732
Hassel	1824	938
Stein	1833	872
Fränzl	1838	950
V. Rougemont	1838	850
Omalius d'Halloy	1840	750
Bernoulli	1840	764
V. Roon	1840	864
Berghaus	1842	1,272
Balbi	1843	739
Kolb	1868	1,270
Behm and Wagner	1880	1,456
" "	1882	1,434

Table I. (*supra*), taken from Haushofer's work (*Lehr- u. Handbuch*, p. 90, note 1), will show how greatly the estimates of the world's population have varied since people first began to make them. We venture to say that any person of fair intelligence and ordinary education would, even without any statistical training, come to the conclusion that there was nothing certain to be known on the subject which these figures profess to illustrate. The fact that Behm and Wagner's latest estimate is less than that published by them two years previously shows how difficult the subject is. We should add that the reasons given by them for this discrepancy, for even a tyro would have expected a slight increase, are quite satisfactory, and add to our confidence in that part of the investigation for which they profess to give figures approximating to accuracy.

According to Behm and Wagner (*Die Bevölkerung der Erde*, vii.) the following (Table II.) may be taken as the population of the sections of the world indicated in June, 1882:[1]

	Area in Square Kilometres.	Inhabitants.		
		Number.	Per Sq. Kilo.	Per Sq. Mile.
Europe	9,730,576	327,743,400	34.0	88.0
Asia	44,580,850	795,591,000	18.0	46.6
Africa	29,823,253	205,823,200	7.0	18.1
America	38,473,138	100,415,400	2.6	6.7
Australasia	...	...	...	...
Polynesia	8,952,855	4,232,000	0.5	1.3
Polarregions	4,478,200	82,500	...	...
Total	136,038,872	1,433,887,500	10.5	27.1

Sex.—The obstacles which make it difficult to attain even an approximate statement of the population of the world prevent us from obtaining any accurate knowledge whatever as to the sexual constitution of that population. We have, however, tolerably accurate information on this subject for most of the countries of Europe, for the United States, and for Canada. From the figures available it is evident that no general proposition can be laid down on the subject of the normal proportion of females to males, except that in so-called "old" countries there is usually a slight excess of the former.

TABLE III.—*Statement of the Number of Females living in the undermentioned Countries for every Thousand Males in the Year mentioned* (Haushofer, p. 216):

	Year.	Females to each 1000 Males.
German Empire	1875	1,036
England and Wales	1871	1,054
Scotland	"	1,096
Ireland	"	1,044
Denmark	1870	1,026
Norway	1865	1,036
Sweden	1870	1,067
Austria	1869	1,041
Hungary	"	1,002
Italy	1870	989
Switzerland	"	1,046
France	1872	1,008
Belgium	1866	995
Holland	1869	1,029
United States	1870	972
Canada	"	939

The census of England and Wales for 1881 gave 1055 females to 1000 males. A slight tendency to an increase in the proportion is perceptible in some countries, and to decrease in others, as the following table (IV.) given by Wappäus and quoted by Haushofer (p. 217) will show. The reader will observe that Wappäus's figures are the proportions to 100, not to 1000, as in Table III.

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[1] For more minute information see *Petermann's Mittheilungen*, "Ergänzungsheft" No. 69.

	Year.	Females to 100 Males.		Year.	Females to 100 Males.
England..	1851	104.16	Sweden........	1850	106.40
Scotland..	"	110.02	France.........	1851	101.12
Ireland...	"	103.37	Belgium........	1846	100.47
Denmark	1850	103.30	Holland........	1849	103.96
Norway..	1855	104.14	United States.	1850	95.05

The 1880 census of the United States states the proportion of females to males at 96.54 per cent., which is rather smaller than that shown in 1870 (97.2 per cent.); but immigration is still a potent factor in the growth of the population of that country.

With regard to the causes of the excess of females, as in most other social phenomena, our knowledge is very small at present. The reason for the broad distinction between Europe and North America is pretty obvious. New countries are continually receiving many male and fewer female immigrants. Probably also, life being very rough in the more unsettled portions of such countries, the rate of mortality among females is a little higher than in places where women can receive more protection from hardship. On the other hand, even in Europe men run many risks to which women are not exposed. The subject is a very interesting one, but cannot be adequately treated except at much greater length than is possible here, and we must refer our readers to special works for further information.

TABLE V.—*Statement of the "Age Scale" (Altersaufbau) of the Population in each of the undermentioned Countries; showing by Semi-Decennial Periods up to 30 Years, and Decennial Periods subsequently, the Number of Persons of each Age out of every Thousand Persons in the Population.*

		0-5.	5-10.	10-15.	15-20.	20-25.	25-30.	30-40.	40-50.	50-60.	60-70.	70-80.	80-90.	Over 90
German Empire.........	1875	134	112	102	95	83	76	134	103	84	51	21	4	0.2
England....................	1871	135	119	107	96	88	78	128	100	73	47	22	5	0.4
Scotland..................	"	136	120	111	100	87	76	122	96	71	49	25	6	0.6
Ireland.....................	"	120	105	103	116	106	71	103	99	83	61	23	8	1.1
Denmark..................	1870	124	107	102	93	81	75	130	114	85	56	26	6	0.4
Norway.....................	1865	135	119	106	94	81	70	131	107	67	52	29	7	0.7
Sweden.....................	1870	118	116	106	91	79	73	131	119	85	51	26	5	0.3
Austria.....................	1869	130	108	99	93	85	82	138	113	84	47	16	3	0.2
Hungary....................	"	147	115	108	95	82	86	141	106	70	37	11	2	0.3
Italy.........................	1870	115	109	100	90	87	77	134	115	84	57	24	6	0.6
Switzerland..............	"	113	106	97	84	81	80	141	119	89	61	24	4	0.2
France.....................	1872	93	91	87	84	88	72	139	125	104	72	36	7	0.4
Belgium....................	1866	120	105	92	88	84	78	132	112	89	66	27	6	0.4
Holland.....................	1869	130	109	94	92	79	78	135	113	84	53	26	5	0.3
Average for Europe.......		121	108	100	92	87	78	134	112	85	55	24	5	0.4
United States...........	1871	140	124	123	105	96	80	128	93	59	33	14	3	0.4
Canada......................	1861	174	132	123	117	17		110	76	49	29	12	3	0.5
General average..........		125	111	104	94	166		133	108	81	52	22	5	0.4

Age.—The characteristics of a population from the point of view of age, which German writers term "Altersaufbau," can only be treated very generally. Table V., *supra*, is quoted by Haushofer (p. 213) from Von Scheel's *Handbuch der Statistik*.

This "age scale" shows us the proportion in which persons of various categories of age are found combined to form populations. The general characteristics of the groups are tolerably obvious. It must be remembered that after thirty years the periods are decennial. The difference between the age scale of Europe and that of North America is considerable. In the latter, owing mainly to the fact that emigrants are usually young, a much larger proportion of the population than in Europe are under thirty years of age. On the other hand the age scale of France presents a feature of an opposite kind, namely, a deficiency of persons under fifteen years of age, and an excess of those over forty, as compared with the average of Europe. This conformation of the age scale may be compared with that of Hungary, where the number of children is larger and the number of persons over forty less than the average. It is probable that the smaller number of children in the one case and the larger in the other directly lead respectively to a smaller infant mortality in France than in Hungary. As M. Block observes (*Traité*, p. 409), "Nous avons moins d'enfants; mais, grâce à une moindre mortalité dans le jeune âge, nous avons plus d'adults." It is obvious that *cæteris paribus* it is easier to pay the requisite attention to the rearing of a small number of children than to do the same for a larger number.

Careful inquiries into age scales are of very recent origin, the data required for evaluating those relating to earlier periods being absent. Moreover, erroneous statements as to their age are made by a much larger number of persons than might be supposed, sometimes from carelessness or ignorance, but also intentionally. The tendency of women over twenty-five to understate their age, combined with overstatements of age by girls and young women under twenty, always tends to make the twenty to twenty-five section of the age scale unduly large (see *Census of England and Wales*, 1881, vol. iv., "General Report"). We must regard even the age scales now in existence as merely first approximations, for it is evident that observations obtained from several censuses must be reduced and combined before we can feel certain that accidental causes of error have been eliminated. This is all the more necessary as the age scale of any given population cannot be regarded as fixed, any more than the magnitude of the population itself, both being liable to modifications arising out of the varying dynamical conditions existing at different periods. And this brings us to the second portion of our inquiry, in which we shall indicate in the most general way the nature of the proximate causes which underlie the phenomena of population considered as a fact existing at a particular moment of time.

II. Population, *dynamically* considered, is the result of two pairs of opposing forces, whose combined action may, for convenience, be theoretically conceived of as balancing each other, but which never do so balance as a matter of fact. A comparison of two successive censuses invariably shows some "movement of population." In nearly all civilized countries the movement shown is one of growth when the body of population examined is large. The population of a village or a small town may, quite conceivably, show a reduction in number for the period between two censuses, but this can hardly be the case with a large town, and still less with a nation, unless as the consequence of some great calamity such as an earthquake or a pestilence or a change in the climatic or economic conditions of the country inhabited. A great war, of course, produces a certain retardation of the rate of increase. Although some of the uncivilized peoples of the world are rapidly disappearing, the tendency of the population of the whole world is evidently to increase—at what rate it is impossible to say, for reasons already mentioned; and our inquiry will, therefore, be confined to peoples regarding whose population we have comparatively accurate information for an adequate number of years.

The causes of the movement of population are internal and external. The internal arise out of the numerical relation between the births and deaths of a given period, there being an increase when there are more births than deaths, a decrease in the contrary case. Haushofer expresses this by a formula which is sometimes convenient: "There is an increase where the intervals between successive births are smaller than those between successive deaths" (p. 115). The external are immigration and emigration. The intensity of these two forces operating on population depends on a variety of causes, into which we do not propose to enter. Generally speaking, it may be said that "new" countries, where the density of population is small, attract immigrants from countries in which the density of population is great. The density of population is expressed by the figure denoting the number of inhabitants per square mile (or square kilometre) of the territory they occupy. For a discussion of the various political, social, and economic causes which determine density of population, we must refer our readers to the works of Haushofer (p. 173) and Block (p. 456). Before analyzing the components of the movement of population it will be useful to examine briefly that movement itself, and ascertain what is its normal rate in civilized countries. The mode of expressing this rate which is most commonly adopted in the exposition of statistics of population is to state the number of years in which a given population "doubles itself." It is not a very scientific method of expressing the facts, since it assumes that the rate of a few years will continue for a period of many years, but, in deference to custom, we give a table constructed in accordance with it.

TABLE VI.—*Statement of the Yearly Rate of Increase of the Population of the undermentioned Countries during the following Periods, with the Number of Years in which the said Populations would double themselves, on the supposition that the rates remain unchanged* (Wappäus, quoted by Haushofer).

	Basis of Calculation.		Approximate Doubling Years.
	Years.	Annual Percentage of Increase.	
Norway	1845–55	1.15	61
Denmark	1845–55	0.89	71
Sweden	1850–55	0.88	79
Saxony	1852–55	0.84	83
Holland	1840–49	0.67	103
Sardinia	1838–48	0.58	119
Prussia	1852–55	0.53	131
Belgium	1846–56	0.44	158
Great Britain	1841–51	0.23	302
Austria	1842–50	0.18	385
France	1851–56	0.14	405
Hanover	1852–55	0.002	3,152

We now proceed to give a table (VII.) constructed by Signore Luigi Bodio on the best principles, which shows the annual rates of increase of a number of countries, for two distinct periods, taking account of the important changes of frontier which have occurred during the whole period covered by the table. If this rectification had not been made it is obvious that the figures resulting from the observations of the two periods would not have been comparable in the case of Italy and several other states (Block, p. 405; Haushofer, p. 120). We may mention that the actually observed yearly rate of increase in the population of England and Wales between 1871 and 1881 was 1.44 per cent. of the population in 1871.

	Period Observed.	Yearly Rate of Increase.	Period Observed.	Yearly Rate of Increase.
France	1800–60	0.48	1860–77	0.35
Italy	1800–61	0.61	1861–78	0.71
United Kingdom	1801–61	0.98	1861–78	0.92
England and Wales	1801–61	1.37	1860–75	1.24
Ireland	1801–61	0.17	1861–78	0.46[1]
Denmark	1801–60	0.93	1860–78	1.11
Sweden	1800–60	0.82	1860–78	1.15
Norway	1800–60	0.99	1860–78	0.86
Russia in Europe	1851–63	1.20	1863–75	1.11
Austria (Cisleithan)	1830–60	0.64	1860–78	0.86
Hungary	1830–60	0.27	1860–77	0.55
Switzerland	1837–60	0.59	1860–78	0.60
Prussia (without recent annexations)	1820–61	1.21	1861–75	0.98
Prussia (with recent annexations)	1830–61	1.16	1861–75	0.83
Bavaria	1818–61	0.55	1861–78	0.54
Saxony	1820–61	1.41	1861–78	1.56
Würtemberg	1834–61	0.34	1861–78	0.76
Holland	1795–1859	0.71	1859–77	0.95
Belgium	1831–60	0.48	1860–78	0.82
Portugal	1801–61	0.39	1861–74	1.17
Spain	1800–60	0.66	1860–77	0.35
Poland	1823–58	0.72	1858–77	1.95
Greece	1821–61	1.22	1861–77	0.97
Servia	1834–59	1.92	1859–78	1.19
United States	1860–70	2.04	1870–80	2.61

It must be noted that, while the table may be relied on so far as Signior Bodio's treatment of the data goes, the data for the earlier part of the century are very defective, and the results deduced from them must be regarded as less trustworthy than those for the more recent of the two periods.

The above tables of increase of population include the effects of immigration and emigration, regarding which we have nothing further to say in this article, as the causes of these phenomena are too heterogeneous for general treatment. Moreover, except in comparatively unimportant cases—unimportant, that is, from our point of view, but by no means so from the standpoint of the statesman—the effects of these two causes are small, the main cause of the growth of population being the internal forces already mentioned, namely, the birth-rate and the death-rate.

During the earlier half of the century the rate of increase in the United States ranged from 2¾ to 3 per cent. per annum in the successive decades from census to census. The increase in the population of the United States has hitherto depended so much on immigration that at present inquiries into the normal birth and death-rates of that country are very difficult, except in the eastern States. Of the total population, 50,442,066, as shown in the census of 1880, no less than 6,619,943, or over 13 per cent., were foreigners. The fact already mentioned, that the proportion of women to men is unusually low, serves to remind us that normal phenomena of population must not as yet be looked for in the American Union.

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[1] Decrease.

The Birth-Rate.—The birth-rate of a population is the proportion borne by the number of births in a year to the number of the population. It might seem that it is easy to obtain this rate, but as a matter of fact it is practically impossible to do so. It is not difficult to ascertain, with sufficient accuracy, the number of births; the difficulty is to ascertain what is the number of the population, for that number is never the same for two days together. It is obvious that it would never do to evaluate the birth-rate of the United Kingdom, say for 1885, by means of the figures obtained in the census taken on April 4, 1881, and the error would be greater next year, and greater still the year after. The growth of the population since the last census must, therefore, be taken into account; but, even when it has been decided to adopt this plan, there is the difficulty of fixing on the date up to which the additions are to be made. The usual practice is to take the population of a date as near as possible to the middle of the year for which the birth-rate is required as the basis for the calculation. We mention these difficulties as a caution to students of statistics. The following table (VIII.) quoted by Haushofer, p. 123, is taken from Bodio's *Movimento dello Stato Civile* (Rome, 1880); the figures for the minor countries have been omitted, and the still-births are excluded:

	Period Observed.	Average Yearly Number of Births to 100 Inhabitants.
Italy	1865-78	3.70
France	1865-77	2.58
England and Wales	1865-78	3.56
Scotland	"	3.52
Ireland	"	2.67
Prussia	"	3.87
Bavaria	"	3,94
Saxony	"	4.17
Austria	"	3.88
Hungary	1865-77	4.18
Switzerland	1870-78	3.08
Belgium	1865-78	3.21
Holland	1865-77	3.56
Sweden	1865-78	3.04
Spain	1865-70	3.57
Greece	1865-77	2.88
Roumania	1870-77	3.04
Russia in Europe[1]	1867-75	4.95
Poland	1865-77	4.23

The birth-rate in different countries is influenced by various circumstances into which it is not possible to enter at length. The most important circumstance is the proportion borne by the number of women of child-bearing age to the whole population. There are other circumstances which must be kept in mind in comparing the birth-rates of different countries, such as the character of the age scale as a whole, and the density of population, besides climatic and other physical characteristics of the environment of the populations examined. The birth-rate is high in new countries, where there is always a larger proportion of young men than in old states, and where the proportion of women of child-bearing age is also large. The latter circumstance is, we may point out, quite consistent with the statement already made, that in new countries the proportion of women to men is smaller than in old ones. For an unusually large proportion of the total number of women in new countries are young.

Some facts relating to the absolute number of births may here be briefly referred to. The most important of these is its composition as regards sex. We have already seen that in most populations there are more women than men. This is not a consequence of there being more girls born than boys, for the fact is just the contrary. The following table (IX.) shows the number of male births to every 100 female births which took place in the undermentioned countries during the periods stated (*Movimento*, etc., p. 126; Haushofer, p. 218):

Countries.	Period of Observation.	Boys born for 100 Girls.
Italy	1865-78	104
France	1866-77	103
England and Wales	1865-78	104
Scotland	1865-75	106
Ireland	1865-78	106
Prussia	1865-78	104
Bavaria	1865-78	103
Austria	1865-78	106
Hungary	1865-77	104
Switzerland	1872-78	99
Belgium	1865-78	102
Holland	1865-77	102
Sweden	1865-78	106
Spain	1865-70	104
Greece	1870-77	94
Roumania	1870-77	105
Russia in Europe	1867-74	105
Servia	1865-78	111

On the somewhat anomalous figures we must observe that those relating to Greece and Servia are possibly to be explained by the hypothesis of inaccurate returns. We may add that, if a distinction is made between legitimate and illegitimate children, it is usually found that the excess of male births is greater among the latter. In countries therefore, where the proportion of illegitimate to legitimate births is high there will usually be a higher proportion of male to female births than in countries where there are not relatively so many illegitimate births (Block, p. 429).

Interesting inquiries have been made into the facts regarding the distribution of births during the year, showing that there are, as a rule, more births in some months than in others, and also as to the influence high prices for the primary necessaries of life have on the number of births (Mayr, p. 235).

The Death-Rate.—The death-rate of a population is the proportion borne by the number of deaths in a year to the number of the population. The population is to be reckoned as has been already described in dealing with the birth-rate. This very important statistical quantity is sometimes confused with another relating to the same phenomenon,—namely, the mean duration of life. The difficulties in obtaining an accurate death-rate are, if anything, greater than in the case of the birth-rate.

TABLE X.—*Statement of the Average Annual Death-rate in the undermentioned Countries, during the Years stated, excluding Still-births* (*Movimento*, in Haushofer, p. 137).

Countries.	Period Observed.	Average Yearly Number of Deaths to 100 Inhabitants.
Italy	1865-78	2.99
France	1865-77	2.40
England and Wales	1865-78	2.20
Scotland	1865-78	2.21
Ireland	1865-78	1.72
Prussia	1865-78	2.72
Bavaria	1865-78	3.09
Austria	1865-78	3.18
Hungary	1865-77	3.80
Switzerland	1870-78	2.38
Belgium	1865-78	2.32
Holland	1865-77	2.49
Sweden	1865-78	1.92
Spain	1865-70	3.12
Greece	1865-77	2.09
Roumania	1870-77	2.65
Russia in Europe	1867-75	3.67

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[1] Excluding Poland.

This table is sufficient for our purpose, which is to give a general idea as to the death-rate of these countries. Much more accurate approximations are, however, needed for actuarial purposes, and very elaborate valuations of the death-rate will be found in G. F. Knapp's work *Ueber die Ermittelung der Sterblichkeit* (Leipsic, 1868). Great pains have been taken by most civilized states to obtain accurate figures as to the mortality of the population, and the literature dealing with the subject is of great extent.

We must now show how the death-rate is usually composed as regards age. The following table (XI.) shows the number of persons out of every hundred deaths who died at the undermentioned ages in each of the countries named (Haushofer, p. 143; quoted from the *Movimento*):

	Italy, 1872–77.	France, 1866–77.	England, 1866–70.	Prussia, 1875–77.	Bavaria, 1871–77.	Austria, 1865–77.	Switzerland, 1873–77.	Spain, 1865–70.	Russia in Europe, 1870–74.
0– 1	26.73	18.79	24.76	32.20	40.47	31.80	26.21	22.93	36.21
1– 5	21.04	10.51	15.73	16.19	9.77	16.20	8.11	25.20	21.12
5–10	4.60	2.98	3.84	4.04	2.87	4.38	2.62	3.73	5.00
10–15	2.08	1.76	1.97	1.66	1.00	1.91	1.59	1.98	2.07
15–20	2.17	2.49	2.59	1.85	1.22	2.14	2.13	2.39	2.06
20–30	5.46	7.30	8.14	4.83	4.10	5.37	5.58	5.62	4.76
30–40	5.14	6.40	6.42	5.34	4.65	5.70	6.54	5.90	4.97
40–50	5.45	6.90	6.68	5.62	5.13	6.44	7.17	6.89	5.63
50–60	6.63	8.83	7.02	7.49	7.31	7.84	9.43	7.24	6.23
60–70	8.82	12.75	8.32	8.91	10.67	8.84	13.22	8.62	6.38
70–80	8.14	14.50	9.72	8.07	9.55	6.74	12.39	6.68	4.14
80–90	3.83	6.21	7.60	2.79	3.20	2.35	4.08	2.50	1.06
90–100	0.37	0.57	2.09	0.27	0.23	0.24	0.27	0.81	0.16
Over 100.	0.01	0.01	0.12	0.02		0.01	...	0.01	0.02
Unknown.	0.03	...	...	0.72	0.06	0.04	...	...	0.19

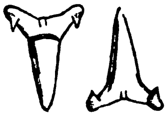
It will be seen that from nearly one-fifth to nearly one-third of the deaths were those of children less than twelve months old. The very high proportion of deaths at this age in Bavaria was some years ago made the subject of a special inquiry by Dr. Mayr, and it was found to be largely due to the bad mode of bringing up infants peculiar to certain localities (Mayr, pp. 91, 319).

The composition of the death-rate in regard to sex must be touched on briefly. As we have seen, more boys are born than girls. Owing, however, to the greater mortality among the former their number is rapidly reduced during the first few years of life, so that at any given moment the population is composed as stated in the age scales. The exact mode in which a given number of persons born in the same year disappears by death is shown in the elaborate tables of mortality used by actuaries. These tables are different for different countries and for males and females. Very elaborate tables of survival were prepared for the British Government in 1883–84 for calculating annuities.

We cannot here deal with what is known as the "population question." Any adequate discussion of that highly important subject would involve considerations outside the limits of this article. The "population question" is a question of conduct, while the present article seeks only to point out certain well-ascertained facts regarding the phenomenon of superorganic evolution called population. The facts in question are general, and, though sufficient to indicate the nature of the phenomenon, and the broad divisions which are most convenient for its further investigation, are quite insufficient as the basis for the formation of any ethical judgment regarding the actions of the individuals composing the population.

Among the works that may be consulted to the greatest advantage by the student are the following: the numerous works of the late Dr. William Farr, F.R.S., formerly registrar-general; various works by Dr. W. A. Guy, F.R.S.; those of Adolphe Quetelet; various monographs by Dr. Ernst Engel, and other eminent statists in the official publications of the Prussian Statistical Office; various publications of the Italian Statistical Bureau; the publications of the International Congress of Statistics. Systematic treatment of the whole subject of population will be found in the following works: Bertillon, *Mouvements de la Population dans divers États de l'Europe*, Paris, 1877; Maurice Block, *Traité théorique et pratique de statistique*, Paris, 1570; L. Bodio, *Movimento dello stato civile*, Rome, 1878 (publication of the Italian Statistical Bureau); A. Gabaglio, *Storia e teoria della statistica*, Milan, 1880; M. Haushofer, *Lehr- und Handbuch der Statistik*, Vienna, 1882. (W. HO.)

PORBEAGLE, the name of a shark (*Lamna cornubica*), mentioned in the works of older British authors as "Beaumaris Shark." The short and stout form of its body contrasts strikingly with its much attenuated tail, which, however, is strengthened by a keel on each side and terminates in a large and powerful caudal fin. The snout is pointed, and the jaws are armed with strong lanceolate teeth, each of which bears a small cusp on each side of the base (see Fig.). The teeth are not adapted for cutting, like the flat triangular teeth of man-eating sharks, but rather for seizing and holding the prey, which consists chiefly of various kinds of fishes and cephalopods. In the upper jaw there are from thirteen to sixteen teeth on each side, the third being remarkable for its small size; in the lower jaw from twelve to fourteen. The gill-openings are very wide. The porbeagle attains to a length of 10 or 12 feet, and is a pelagic fish, not rare in the North Atlantic and Mediterranean, and frequently wandering in pursuit of its prey to the British and more rarely to the American shores. The same species has been found in Japan and New Zealand, and perhaps also on the coast of California, so that the completion of the evidence as to its cosmopolitan range is merely a matter of time. Other closely-allied species (*L. spallanzanii*, *L. glauca*) are known to occur in the southern parts of the Atlantic, from the Mediterranean to the Cape of Good Hope. Very little is known of the mode of propagation of the porbeagle, beyond the isolated statement by Pennant that two embryos were found in a female. No opportunity should be lost of making further observations on this point, and of preserving if possible the fœtuses in their enveloping tunics.



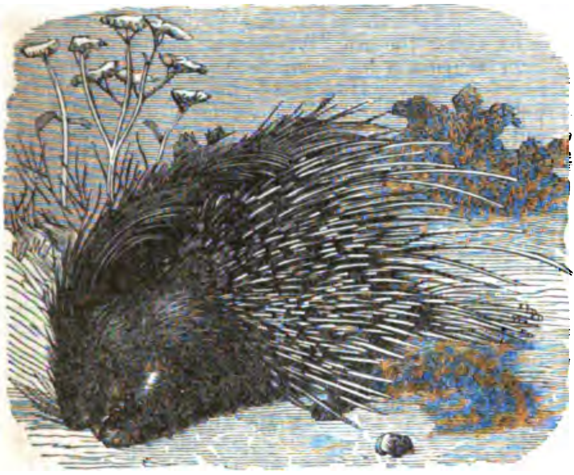
Upper and lower tooth of *Lamna*.

PORCELAIN. See POTTERY.

PORCUPINE. This word, derived from the French *porc-épic*, "or spiny pig," is applied to the members of the *Hystricidæ*, a family of rodents whose most prominent peculiarity is their covering of long stout spines, which form a highly efficient protection against enemies, and which are better developed in this family than in any other mammal. Zoologically the porcupines are allied to the cavies, chinchillas, agoutis, etc., and with them form the great section *Hystricomorpha* or porcupine-like rodents (see MAMMALIA, vol. xv. p. 425).

The *Hystricidæ* are readily divisible into two subfamilies according to their geographical distribution, the *Hystricina* or True Porcupines being confined to the Old World, and the *Synetherina* to the New. The *Hystricina* are distinguished by their semi-rooted molars, imperfect collar-bones, cleft upper lips, rudimentary pollices, smooth soles, six mammæ, and by many important cranial characters. They range over the south of Europe, the whole of Africa, India, and the Malay Archipelago as far eastwards as Borneo. They are all stout heavily-built animals, with blunt rounded heads, fleshy mobile snouts, and coats of thick cylindrical or flattened spines, which form the whole covering of their body, and are not intermingled with ordinary hairs. Their habits are strictly terrestrial. Of the three genera in this section, the first and best-known is *Hystrix*, characterized by its curiously-inflated skull, in which the nasal chamber is often considerably larger than the brain-case, and by its short tail, tipped with numerous slender stalked open quills, which make a loud rattling noise whenever the animal moves. Its longest-known member is the Common Porcupine (*H. cristata*), which occurs throughout the south of Europe and North and West Africa, but is replaced in South Africa by *H. africæ-australis*, and in India by the Hairy-nosed Porcupine (*H. leucura*), whose habits are described in the following notice extracted from Jerdon's *Mammals of India*.

> "*Hystrix leucura* is found over a great part of India, from the lower ranges of the Himalayas to the extreme south, but does not occur in lower Bengal, where it is replaced by *H. bengalensis*. It forms extensive burrows, often in societies, in the sides of hills, banks of rivers and nullahs, and very often in the bunds of tanks, and in old mud walls, etc., etc. In some parts of the country they are very destructive to various crops, potatoes, carrots, and other vegetables. They never issue forth till after dark, but now and then one will be found returning to his lair in daylight. Dogs take up the scent of the porcupine very keenly, and on the Nilghiris I have killed many by the aid of dogs, tracking them to their dens. They charge backwards at their foes, erecting their spines at the same time, and dogs generally get seriously injured by their strong spines, which are sometimes driven deeply into the assailant. The porcupine is not bad eating,—the meat, which is white, tasting something between pork and veal."



Porcupine.

Besides the three large crested species of *Hystrix* above mentioned, there are some four or five smaller species without nuchal crests occurring in northeast India and in the Malay region, from Nepal to Borneo. The second genus of Old-World porcupines is *Atherura*, the Brush-tailed Porcupines, much smaller animals than the last, with long tails tipped with bundles of peculiar flattened spines. Of the three species two are found in the Malay region and one in West Africa. *Trichys*, the last genus, contains but one Bornean species, *T. lipura*, externally very like an *Atherura*, but differing from the members of that genus in many important cranial characteristics.

The New-World porcupines, the *Synetherina*, have rooted molars, complete collar-bones, uncleft upper lips, tuberculated soles, no trace of a pollex, and four mammæ only. Their spines are to a great extent mixed with long soft hairs; they are less strictly nocturnal in their habits; and, with one exception, they live entirely in trees, having in correspondence with this long and powerful prehensile tails. They consist of three genera, of which the first is formed by the common Canadian Porcupine (*Erethizon dorsatus*), a stout heavily-built animal, with long hairs almost or quite hiding its spines, four anterior and five posterior toes, and a short stumpy tail. It is a native of the greater part of Canada and the United States, wherever there is any remnant of the original forest left. *Synetheres*, the second genus, contains some eight or ten species, known as Tree Porcupines, and found throughout the tropical parts of South America, one of them extending northwards into Mexico. They are of a lighter build than the ground porcupines, are covered with short, close, many-colored spines often mixed with hairs, and their tails are always prehensile. Their hind feet have only four toes, owing to the suppression of the hallux, but instead they have a peculiar fleshy pad on the inner side of the foot, between which and the toes boughs and other objects can be firmly grasped as with a hand. The last genus is *Chætomys*, distinguished by the shape of its skull and the greater complexity of its teeth. It contains only one species, *C. sub-spinosus*, a native of the hottest parts of Brazil.

PORDENONE, IL (1483–1539), whose correct name was GIOVANNI ANTONIO LICINIO, or LICINO, was an eminent painter of the Venetian school. He was commonly named Il Pordenone from having been born in 1483 at Corticelli, a village near Pordenone—a city of Italy, in the province of Udine (Friuli). He himself ultimately dropped the name of Licinio, having quarreled with his brothers, one of whom had wounded him in the hand; he then called himself Regillo, or De Regillo. His signature runs "Antonius Portunaensis," or "De Portunaonis." He was created a cavaliere by Charles V.

As a painter Licinio was a scholar of Pellegrino da S. Daniele, but the leading influence which governed his style was that of Giorgione; the popular story that he was a fellow-pupil with Titian under Giovanni Bellini is incorrect. The district about Pordenone had been somewhat fertile in capable painters, but Licinio excelled them all in invention and design and more especially in the powers of a vigorous chiaroscurist and flesh-painter. Indeed, so far as mere flesh-painting is concerned he was barely inferior to Titian in breadth, pulpiness and tone, and he was for a while the rival of that great painter in public regard. The two were open enemies, and Licinio would sometimes affect to wear arms while he was painting. He excelled Giorgione in light and shade and in the effect of relief, and was distinguished in perspective and in portraits; he was equally at home in fresco and in oil color. He executed many works in Pordenone and elsewhere in Friuli, and in Cremona and Venice as well. At one time he settled in Piacenza, where is one of his most celebrated church pictures, St. Catherine disputing with the Doctors in Alexandria; the figure of St. Paul in connection with this picture is his own portrait. He was formally invited by Duke Hercules II. of Ferrara to that court; here soon afterwards, in 1539, he died, not without suspicion of poison. His latest works are comparatively careless and superficial, and generally he is better in male figures than in female—the latter being somewhat too sturdy—and the composition of his subject-pictures is scarcely on a level with their other merits. Pordenone appears to have been a vehement, self-asserting man, to which his style as a painter corresponds, and his morals were not unexceptionable. Three of his principal scholars were Bernardino Licinio, named Il Sacchiense, his son-in-law Pomponio Amalteo, and Giovanni Maria Calderari.

The following may be named among Pordenone's works: the picture of S. Lorenzo Giustiniani and other Saints, originally in S. Maria dell' Orto, Venice; a Madonna and Saints, in the Venice academy; the Woman taken in Adultery, in the Berlin museum; the Annunciation, at Udine, regarded by Vasari as the artist's masterpiece, now damaged by restoration. In Hampton Court is a duplicate work, the Painter and his Family; and in Burghley House are two fine pictures now assigned to Pordenone—the Finding of Moses and the Adoration of the Kings. These used to be attributed to Titian and to Bassano respectively.

PORIFERA. See SPONGES.

PORISM. The subject of porisms is perplexed by the multitude of different views which have been held by famous geometers as to what a porism really was and is. This article must therefore be limited to a short historical account (1) of the principal works of the Greek mathematicians which we know to have been called *Porisms*, and (2) of some of the principal contributions to the elucidation of these works, and conjectures as to the true signification of the term.

The treatise which has given rise to the controversies on this subject is the *Porisms* of Euclid, the author of the *Elements*. For as much as we know of this lost treatise we are indebted to the *Collection* of Pappus of Alexandria, who mentions it along with other geometrical treatises, and gives a number of lemmas necessary for understanding it. Pappus states that the porisms of Euclid are neither theorems nor problems, but are in some sort intermediate, so that they may be presented either as theorems or as problems; and they were regarded accordingly by many geometers, who looked merely at the form of the enunciation, as being actually theorems or problems, though the definitions given by the older writers showed that they better understood the distinction between the three classes of propositions. The older geometers, namely, defined a theorem as *τὸ προτεινόμενον εἰς ἀπόδειξιν αὐτοῦ τοῦ προτεινομένου*, a problem as *τὸ προβαλλόμενον εἰς κατασκευὴν αὐτοῦ τοῦ προτεινομένου*, and finally a porism as *τὸ προτεινόμενον εἰς πορισμὸν αὐτοῦ τοῦ προτεινομένου*. Pappus goes on to say that this last definition was changed by certain later geometers, who defined a porism on the ground of an accidental characteristic as *τὸ λεῖπον ὑποθέσει τοπικοῦ θεωρήματος*.

Proclus gives a definition of a porism which agrees very well with the fact that Euclid used the same word *πόρισμα* in his *Elements* for what is now called by the Latin name "corollary." Proclus's definition is *Τὸ δὲ πόρισμα λέγεται μὲν ἐπὶ προβλημάτων τίνων, οἷον τὰ Εὐκλείδει γεγραμμένα πορίσματα. Λέγεται δὲ ἰδίως, ὅταν ἐκ τῶν ἀποδεδειγμένων ἄλλο τι †συναφανῇ [συναποφανῇ (?)] θεώρημα, μὴ προθεμένων ἡμῶν, ὃ καὶ διὰ τοῦτο πόρισμα κεκλήκασι ὥσπερ τι κέρδος ὂν τῆς ἐπιστημονικῆς ἀποδείξεως πάρεργον* (Procl., *Comment. Eucl.*, p. 58; cf. p. 80).

Pappus gives a complete enunciation of a porism derived from Euclid and an extension of it to a more general case. This porism, expressed in modern language, asserts that, *Given four straight lines of which three turn about the points in which they meet the fourth, if two of the points of intersection of these lines lie each on a fixed straight line, the remaining point of intersection will also lie on another straight line*; or, *If the sides of a triangle are made to turn each about one of three fixed points in a straight line, and if two of the vertices are made to move on two fixed straight lines, taken arbitrarily, the third vertex describes a third straight line*. The general enunciation applies to any number of straight lines, say $(n+1)$, of which n can turn about as many points fixed on the $(n+1)$th. These n straight lines cut, two in two, in $\frac{n(n-1)}{2}$ points, $\frac{n(n-1)}{2}$ being a triangular number whose side is $(n-1)$. If, then, they are made to turn about the n fixed points, so that any $(n-1)$ of their $\frac{n(n-1)}{2}$ points of intersection lie on $(n-1)$ given fixed straight lines, then each of the remaining points of intersection $\frac{(n-1)(n-2)}{2}$ in number, describes a straight line. Pappus gives also a complete enunciation of one porism of the first book of Euclid's treatise. This may be expressed thus: If about two fixed points, P, Q, we make turn two straight lines meeting on a given straight line L, and if one of them cut off a segment AM from a fixed straight line AX, given in position, we can determine another fixed straight line BY, and a point B fixed on it, such that the segment BM′ made by the second moving line on this second fixed line measured from B has a given ratio λ to the first segment AM. The rest of the enunciations given by Pappus are incomplete, and he merely says that he gives thirty-eight lemmas for the three books of porisms, and these include 171 theorems.

The lemmas which Pappus gives in connection with the porisms are interesting historically, because he gives (1) the fundamental theorem that the cross or anharmonic ratio of a pencil of four straight lines meeting in a point is constant for all transversals; (2) the proof of the harmonic properties of a complete quadrilateral; (3) the theorem that, if the six vertices of a hexagon lie three and three on two straight lines, the three points of concourse of opposite sides lie on a straight line.

During the last three centuries this subject seems to have had great fascination for mathematicians, and many geometers have attempted to restore the lost porisms. Thus Albert Girard expresses in his *Traité de Trigonométrie* a hope that he will be able to restore them. About the same time Fermat wrote a short work under the title *Porismatum Euclidæorum renovata doctrina et sub forma isagoges recentioribus geometris exhibita*. He seems to have concerned himself only with the character and object of Euclid's work; but though he seems to assert that he has restored the work, the examples of porisms which he gives have no connection with those propositions indicated by Pappus. Fermat's idea of a porism was that it is nothing more than a locus. We may next mention Halley, who published the Greek text of the preface to Pappus's seventh book with a Latin translation, but with no comments or elucidations, remarking at the end that he has not been able to understand this description of porisms, which (he maintains) is made unintelligible by corruptions and lacunæ in the text. Robert Simson was the first to throw real light on the subject. His first great triumph was the explanation of the only three propositions which Pappus indicates with any completeness. This explanation was published in the *Philosophical Transactions* in 1723; but Simson did not stop there. After his first success he set himself to investigate the subject of porisms generally, and the result appears in a work entitled *De porismatibus tractatus; quo doctrinam porismatum satis explicatam et in posterum ab oblivione tutam fore sperat auctor*. This work, however, was not published until after Simson's death; it appeared at Glasgow in 1776 as part of a volume, *Roberti Simson, matheseos nuper in academia Glasguensi professoris, opera quœdam reliqua*. Simson's treatise, *De porismatibus*, begins with definitions of theorem, problem, datum, porism, and locus. Respecting the porism Simson says that Pappus's definition is too general, and therefore he will substitute for it the following: "Porisma est propositio in qua proponitur demonstrare rem aliquam vel plures datas esse, cui vel quibus, ut et cuilibet ex rebus innumeris non quidem datis, sed quæ ad ea quæ data sunt eandem habent relationem, convenire ostendendum est affectionem quandam communem in propositione descriptam. Porisma etiam in forma problematis enuntiari potest, si nimirum ex quibus data demonstranda sunt, invenienda proponantur." A locus (says Simson) is a species of porism. Then follows a Latin translation of Pappus's note on the porisms, and the propositions which form the bulk of the treatise. These are Pappus's thirty-eight lemmas relating to the porisms, ten cases of the proposition concerning four straight lines, twenty-nine porisms, two problems in illustration, and some preliminary lemmas. Playfair's memoir (*Trans. Roy. Soc. Edin.*, vol. iii., 1794) may be said to be a sort of sequel to Simson's treatise, having for its special object the inquiry into the probable origin of porisms,—that is, into the steps which led the ancient geometers to the discovery of them. Playfair's view was that the careful investigation of all possible particular cases of a proposition led to the observation that (1) under certain conditions a problem becomes impossible; (2) under certain other conditions, indeterminate or capable of an infinite number of solutions. These cases could be enunciated separately, were in a manner intermediate between theorems and problems, and were called "porisms." Playfair accordingly defined a porism thus: "A proposition affirming the possibility of finding such conditions as will render a certain problem indeterminate or capable of innumerable solutions." This definition, he maintained, agreed both with Pappus's account and Simson's definition, the obscurity of which he attempts to remedy by the following translation: "A porism is a proposition in which it is proposed to demonstrate that one or more things are given, between which and every one of innumerable other things not given, but assumed according to a given law, a certain relation, described in the proposition, is to be shown to take place."[1] This definition of a porism appears to be most generally accepted, at least in England. However, in *Liouville's Journal de mathématiques pures et appliquées* (vol. xx., July, 1855) P. Breton published *Recherches nouvelles sur les porismes d'Euclide*, in which he propounded a different theory, professedly based on the text of Pappus, as to the essential nature of a porism. This was followed in the same journal by a controversy between Breton and A. J. H. Vincent, who disputed the interpretation given by the former of the text of Pappus, and declared himself in favor of the idea of Schooten, put forward in his *Mathematicæ exercitationes* (1657), in which he gives the name of "porism" to one section. According to Schooten, if we observe the various numerical relations between straight lines in a figure and write them down in the form of equations or proportions, then the combination of these equations in all possible ways, and of new equations thus derived from them, leads to the discovery of innumerable new properties of the figure, and here we have a porism. It must be admitted that, if we are to judge of the meaning by the etymology of the name, this idea of a porism has a great deal to recommend it. We must, however, be on our guard against applying, on this view, the term "porism" to the *process* of discovery. The Greek word *πόρισμα* should no doubt strictly signify the *result* obtained, but the name is still indicative of the process. The porism is the result as obtained by the process, which is itself the cause of the name. So great an authority as Chasles wrote in 1860 (*Les trois livres de porismes d'Euclide*) that, in spite of the general assent which Playfair's theory met with he considered it to be unfounded.

The *Porisms* of Euclid are not the only representatives of this class of propositions. We know of a treatise of Diophantus which was entitled *Porisms.* But it is uncertain whether these lost *Porisms* formed part of the *Arithmetics* or were an independent treatise. Diophantus refers to them in the *Arithmetics* in three places, introducing a proposition assumed as known with the words *ἐχομεν ἐν τοίς πορίσμασιν*. These propositions are not, however, all similar in form, and we cannot by means of them grasp what Diophantus understood to be the nature of a porism. So far as we can judge of his treatise it seems to have been a collection of a number of ordinary propositions in the theory of numbers, some of them being mere algebraical identities. Again, Diophantus should probably be included among the *νεώτεροι* who are said to have substituted a new definition for that of the ancients, looking only to accidental not essential characteristics of a true porism. And yet, in so far as Diophantus's *Porisms* had no connection with geometry, they do not in the least conform to the second definition of Pappus.

We have by no means exhausted the list of writers who have propounded theories on the subject of porisms. It must, however, suffice merely to mention the chief among the rest of the contributions to the subject. These are, besides the papers of Vincent and Breton, the following books or tracts on the *Porisms* of Euclid: Aug. Richter, *Porismen nach Simson bearbeitet* (Elbing, 1837); Ch. Housel, "Les Porismes d'Euclide," in *Liouville's Journal de mathématiques pures et appliquées* (2d ser., vol. i., 1856); M. Cantor, "Ueber die Porismen des Euklid und deren Divinatoren," in *Schlömilch's Zeitsch. f. Math. u. Phy.*, 1857, and *Literaturzeitung*, 1861, p. 3 *sq.;* Th. Leidenfrost, *Die Porismen des Euklid* (Programm der Realschule zu Weimar, 1863); Fr. Buchbinder, *Euclids Porismen und Data* (Programm der kgl. Landesschule Pforta, 1866). (T. L. H.)

POROS, or **Poro** ("The Ford"), an island off the east coast of the Morea, separated at its western extremity by only a narrow channel from the mainland at Trœzen, and consisting of a mass of limestone rock and of a mass of trachyte connected by a slight sandy isthmus. The town, which is at the head of an eparchy with 5414 inhabitants (1879), has its "houses perched among the volcanic rocks," and looks down on the beautiful harbor between the island and the mainland on the south, which between 1830 and 1877 was the seat of a national arsenal.

The ancient Calauria, with which Poros is identified, was given, according to the myth, by Apollo to Poseidon in exchange for Delos; and it became in historic times famous for a temple of the sea-god, which formed the centre of an amphictyony of seven maritime states—Hermione, Epidaurus, Ægina, Athens, Prasiæ, Nauplia, and Orchomenus. It was there that Demosthenes took sanctuary with "gracious Poseidon," and, when this threatened to fail him, sought the more inviolable asylum of death. The building was of Doric architecture and lay on a plateau near the middle of the limestone part of the island, which now contains a monastery. In the neighborhood of Poros-Calauria are two small islands, the more westerly of which contains the ruins of a small temple, and is probably the ancient Sphæria[2] or Hiera mentioned by Pausanias as the seat of a temple of Athena Apaturia. It was at Poros that the English, French, and Russian plenipotentiaries met in 1828 to discuss the basis of Greek government.

See Chandler, *Travels;* Leake, *Morea;* Le Bas, *Voyage archéologique;* Curtius, *Peloponnesos;* Pouillon-Boblaye, *Recherches;* Bursian, *Geographie von Griechenland;* and Rangabé, "Ein Ausflug nach Poros," in *Deutsche Revue*, 1883.

PORPHYRY, a name originally applied to a reddish or purple rock (*πορφύρεος*, purple) found in upper Egypt, principally at Jebel Dokhan, and much used by the ancients as a decorative stone. This porphyry, the *porfido rosso antico* of Italian antiquaries, consists of a dark crimson or chocolate-colored felsitic base, with disseminated crystals of white felspar, probably oligoclase. It was a favorite material with Roman sculptors under the lower empire, and notwithstanding its excessive hardness was worked into large sarcophagi and other objects, ornamented in some cases in elaborate relief. This porphyry was also ingeniously used for the lower part of the busts of Roman emperors, the head being executed in another material, while the porphyry was used for the drapery, the color of the stone suggesting that of the imperial purple. The antique red porphyry is often confounded with the *rosso antico*, which, being merely a red marble, is a much softer stone.

The term "porphyry" has been gradually extended to a variety of rocks which contain distinct crystals of any mineral sprinkled through a fine-grained ground. Among the best known of the ancient porphyries is the *porfido verde antico*, or *lapis Lacedæmonius*, a beautiful rock with pale-green crystals of labrador-felspar, found at Mount Taygetus in the Morea. The meaning of the word "porphyry" has become so vague, in consequence of its application to many rocks widely differing from each other in composition, that there is a tendency among modern petrologists to abandon its use as a substantive, and merely to retain the adjective "porphyritic" as a convenient designation for all rocks which exhibit a structure like that of the ancient porphyry. Any rock, whatever its mineralogical composition, may therefore become porphyritic by containing isolated crystals developed in a compact or micro-crystalline matrix. Among the finest rocks of this class in Britain are the porphyritic granites of Cornwall and of Shap in Westmoreland; the elvans, or quartz-porphyries (see vol. x. p. 208), which occur as dykes cutting through the slates and granites of Cornwall; the peculiar rock termed "luxullianite" (see vol. xi. p. 44); and the green and red porphyritic felstones of Cumberland. A beautiful brown porphyritic felstone occurs at Buchan Ness, on the coast of Aberdeenshire; while a rock closely resembling the antique green porphyry is found on Lambay Island, near Dublin. For a description of porphyrite, see vol. x. p. 209.

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[1] This view of porisms is known exclusively by the name of Playfair, though, as he himself says, Dugald Stewart had several years before defined a porism to be "a proposition affirming the possibility of finding one or more of the conditions of an indeterminate theorem."

[2] Some writers identify Calauria with one-half only of Poros, and consider that the other half was in antiquity a separate island, to be identified with Sphæria.

PORPHYRY (*c.* 233–306). See **Neoplatonism**, vol. xvii. p. 346 *sq.*

PORPOISE (sometimes spelled **Porpus** and **Porpesse**). The word is apparently derived from the French *porc* and *poisson*, or the Italian *porco* and *pesce*, and thus corresponds with some of the English vernacular appellations, "hog-fish," "sea-hog," "herring-hog," and the German *Meerschwein*, whence the usual modern French name of the animal, *marsouin*. "Porpoise" is commonly used by sailors to designate all the smaller cetaceans, especially those numerous species which naturalists call "dolphins;" but in scientific language it is restricted to a particular form constituting the genus *Phocæna* of Cuvier, of which the Common Porpoise of the British seas, *Phocæna communis*, Cuvier (*Delphinus phocæna*, Linnæus), is the type. The essential characters by which the genus is separated from the other members of the order *Cetacea* are described in the article **Mammalia** (vol. xv. p. 402).

The common porpoise, when full grown, attains a length of 5 feet or a little more. The dimensions of an adult female specimen from the English Channel were as follows: length in straight line from nose to median notch between the flukes of the tail, 62½ inches; from the nose to the anterior edge of the dorsal fin, 29 inches; height of dorsal fin, 4½ inches; length of base of dorsal fin, 8 inches; length of pectoral fin, 9¼ inches; breadth of pectoral fin, 3½ inches; breadth of tail flukes, 13 inches. The head is rounded in front, and differs from that of the true dolphins in not having the snout produced into a distinct "beak" separated from the frontal eminence by a groove. The under jaw projects about half an inch beyond the upper one. The aperture of the mouth is tolerably wide, and is bounded by stiff immobile lips, and curves slightly upwards at the hinder end. The eye is small, and the external ear represented by a minute aperture in the skin, scarcely larger than would be made by the puncture of a pin, situated about 2 inches behind the eye. The dorsal fin is placed near the middle of the back, and is low and triangular. The pectoral fins are of moderate size and slightly falcate. The horizontally-expanded caudal fin is of the form common to all *Cetacea*. The external surface, as in the rest of the order, is smooth, shining, and devoid of hair, though in the fœtal condition a few bristles are found near the nose. The upper parts are dark gray, or nearly black, according to the light in which they are viewed, and the state of moisture or otherwise of the skin; the under parts are pure white. The line of demarcation between these colors is not distinct, washes or splashes of gray encroaching upon the white on the sides, and varies somewhat in different individuals. Usually it passes from the throat (the anterior part of which, with the whole of the under jaw, is dark) above the origin of the pectoral fin, along the middle of the flank, and descends again to the middle line before reaching the tail. Both sides of the pectoral and caudal fins are black. The anterior edge of the dorsal fin is often furnished with a row of small rounded horny spines or rather tubercles of very variable number, which have been thought to indicate a specific distinction between the animals possessing them (*Phocæna tuberculifera*, Grey) and those without them, but this has not been confirmed by other characters. One of the most characteristic anatomical distinctions between the porpoise and other members of the *Delphinidæ* is the form of the teeth, which (numbering twenty-three to twenty-six on each side of each jaw), instead of the usual conical, sharp-pointed, recurved shape, all have expanded, flattened, spade-like crowns, with more or less marked vertical grooves, giving a tendency to a bilobed or often trilobed form (see Fig. 2).

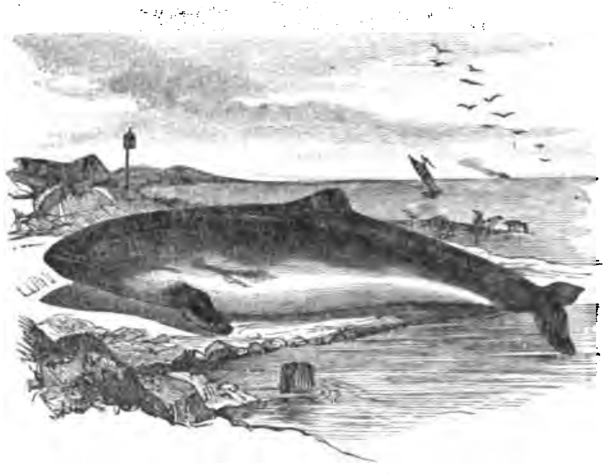

Fig. 1.—*Phocæna communis.*

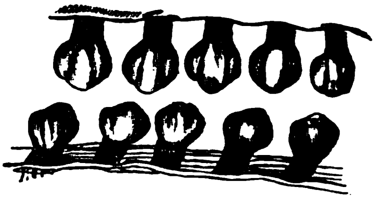

Fig. 2.—Teeth of Porpoise. Twice natural size.

The porpoise is sociable and gregarious in its habits, being usually seen in small herds, and frequents coasts, bays, and estuaries rather than the open ocean. It is the commonest cetacean in the seas around the British Isles, and not unfrequently ascends the river Thames, having been seen as high up as Richmond; it has also been observed in the Seine at Neuilly, near Paris. It frequents the Scandinavian coasts, entering the Baltic in the summer; and it is found as far north as Baffin's Bay, and as far west as the coasts of the United States. Southward its range is more limited than that of the common dolphin, as, though very common on the Atlantic coasts of France, it is not known to enter the Mediterranean.

It feeds on fish, such as mackerel, pilchards, and herrings, of which it devours large quantities, and, following the shoals, is often caught by fishermen in the nets along with its prey. In former times it was a common and esteemed article of food in England and in France, but is now rarely if ever eaten, being commercially valuable when caught only for the oil obtained from its blubber. Its skin is sometimes used for leather and boot-thongs, but the so-called "porpoise hides" are generally obtained from a different and larger species of cetacean, the *Beluga* of the northern seas.

A closely similar if not identical species from the American coast of the North Pacific has been described under the name of *Phocæna vomerina*, and another from the mouth of the Rio de la Plata as *P. spinipennis*. Another nearly allied form is *Neomeris phocænoides*, a small species from the

Indian Ocean and Japan, with teeth of the same form as those of the common porpoise, but fewer in number (eighteen to twenty on each side of each jaw) and of larger size and more distinctly notched or lobed on the free edge. It is distinguished from the common porpoise externally by its entirely black color and the complete absence of a dorsal fin.

PORPORA, Niccola (or Niccolo) Antonio (1686–1767), operatic composer and teacher of singing, was born in Naples on 19th August, 1686, and educated at the Conservatorio di Santa Maria di Loreto by Gaetano Greco and Francesco Mancini. His first opera, *Basilio*, was produced at Naples, his second, *Berenice*, at Rome. Both were very successful, and he followed them up by innumerable compositions of like character; but his fame rests chiefly upon his power of teaching singing—an art in which he has never been surpassed, if even equalled. At the Conservatorio di San Onofrio and the Poveri di Gesu Cristo he trained the finest voices of the age. Farinelli—the greatest singer who ever lived—Caffarelli, Mingotti, Salimbeni, and other celebrated vocalists owed all they ever knew to his teaching. Still his numerous engagements did not tempt him to forsake composition. In 1725 he visited Vienna, but the emperor Charles VI. disliked his florid style, especially his constant use of the *trillo*, and refused to patronize him. After this rebuff he settled in Venice, teaching regularly in the schools of La Pietà and the Incurabili. In 1728 he removed to Dresden, where he was received with great cordiality by the electoral princess Maria. In 1729 he was invited to London as a rival to Handel; but his visit was an unfortunate one. Little less disastrous was his second visit to England in 1734, when even the presence of his pupil, the great Farinelli, failed to save the dramatic company known as the "Opera of the Nobility" from ruin. In order to fulfil his English engagement he procured a release from that previously contracted in Dresden; but he finally quitted London in 1736, and again settled in Venice. There he remained until 1745, when he returned to Vienna in the suite of the Venetian ambassador, giving lessons in 1754 to the young Joseph Haydn, and returning in 1759 to his birthplace, Naples. From this time Porpora's career was a series of misfortunes. His last opera, *Camilla*, failed; and he became so miserably poor that the expenses of his funeral were paid by subscription. Yet at the moment of his death (1767) Farinelli and Caffarelli were living in princely splendor on fortunes for which they were indebted to the excellence of the old maestro's teaching.

Porpora was a learned scholar, an accomplished linguist, and a genial wit. Some excellent stories are told in illustration of this last-named characteristic. His compositions are masterly and brilliant, but less remarkable for depth of feeling than for technical display. The style of his oratorios and cantatas is far more elevated than that of his numerous operas.

PORSENA or Porsenna, king of Clusium. See Etruria, vol. viii. p. 558, and Rome.

PORSON, Richard (1759–1808), in some respects the greatest of modern Greek scholars, was born on Christmas Day, 1759, at East Ruston, near North Walsham, in Norfolk, the eldest son of Mr. Huggin Porson, parish clerk of the place. His mother was the daughter of a shoemaker named Palmer, of the neighboring village of Bacton. He was sent first to the village school at Bacton, kept by Mr. John Woodrow, and afterwards to that of Happisburgh, kept by Mr. Summers. Here his extraordinary powers of memory and aptitude for arithmetic were soon discovered; his skill in penmanship, which attended him through life, was very much due to the care of Mr. Summers, who became early impressed with his abilities, and long afterwards stated that during fifty years of scholastic life he had never come across boys so clever as Porson and his two brothers. He was well grounded in Latin by Mr. Summers, remaining with him three years. His father also took great pains with his education, making him repeat at night the lessons he had learned in the day. He would frequently repeat without making a mistake a lesson which he had learned one or two years before and had never seen in the interval. For books he had only what his father's cottage supplied—a book or two of arithmetic, Greenwood's *England*, Jewell's *Apology*, an odd volume of Chambers's *Cyclopædia* picked up from a wrecked coaster, and eight or ten volumes of the *Universal Magazine*.

The brilliant promise of the parish clerk's son naturally became known to the clergyman; and when he was eleven years old the Rev. T. Hewitt, the curate of East Ruston and two neighboring villages, took charge of his education, keeping him and one of his brothers at his house at Bacton during the week, and sending them home for the Sunday. Mr. Hewitt taught him with his own boys, taking him through the ordinary Latin authors, Cæsar, Terence, Ovid, and Virgil; before this he had made such progress in mathematics as to be able to solve questions out of the *Ladies' Diary*. In addition to this Mr. Hewitt brought him under the notice of Mr. Norris of Witton Park, who sent him to Cambridge and had him examined by Professor Lambert, the two tutors of Trinity, Postlethwaite and Collier, and the well-known mathematician Atwood, then assistant tutor; the result was so favorable a report of his knowledge and abilities that Mr. Norris determined to provide for his education so as to fit him for the university. This was in 1773. It was found impossible to get him into Charterhouse, and he was entered on the foundation of Eton in August, 1774.

Of his Eton life Porson had not very pleasant recollections, but he was a popular boy among his schoolfellows; and two dramas he wrote for performance in the Long Chamber are still remembered. His marvellous memory was of course noticed; but at first he seems to have somewhat disappointed the expectations of his friends, as his composition was weak, and his ignorance of quantity kept him behind several of his inferiors. He went to Eton too late to have any chance of succeeding to a scholarship at King's College. In 1777 he suffered a great loss from the death of his patron Mr. Norris; but contributions from Etonians to aid in the funds for his maintenance at the university were readily supplied, and he found a successor to Mr. Norris in Sir George Baker, the well-known physician, who was at that time president of the college of physicians. And chiefly through his means Porson was entered of Trinity College, Cambridge, as a pensioner on 28th March, 1778, and commenced his residence there soon afterwards, matriculating in April of that year. It is said that what first biased his mind towards critical researches was the gift of a copy of Toup's *Longinus* by Dr. Davies, the headmaster of Eton, for a good exercise; but it was Bentley and Dawes to whom he looked as his immediate masters. His critical career was begun systematically while an undergraduate; and it was doubtless during the period of his residence at Cambridge that his marvellous stores of learning were laid up for future use. He became a scholar of Trinity College in 1780, won the Craven university scholarship in 1781, and took his degree of B.A. in 1782, as third senior optime, obtaining soon afterwards the first chancellor's medal for classical studies. The same year he was elected Fellow of Trinity College, a very unusual thing for a junior bachelor of arts, as the junior bachelors were very rarely allowed to be candidates for fellowships, a regulation which lasted from 1667, when Isaac Newton was elected, till 1818, when Connop Thirlwall became a fellow. Porson graduated M.A. in 1785.

Having thus early secured his independence, he turned his thoughts to publication. The first occasion of his appearing in print was in a short notice of Schutz's *Æschylus* in *Maty's Review*, written in 1783. This review contains several other essays by his hand; especially may be mentioned the reviews of Brunck's *Aristophanes* (an admirable specimen of clear and vigorous English, and containing a very able summary of the Greek comic poet's chief excellences and defects), Weston's *Hermesianax*, and Huntingford's *Apology for the Monostrophics.* But it was to the tragedians, and especially to Æschylus, that his mind was then chiefly directed. He began a correspondence with David Ruhnken, the veteran scholar of Leyden, requesting to be favored with any fragments of Æschylus that Ruhnken had come across in his collection of inedited lexicons and grammarians, and sending him, as a proof that he was not undertaking a task for which he was unequal, some specimens of his critical powers, and especially of his restoration of a very corrupt passage in the *Supplices* (673–677) by the help of a nearly equally corrupt passage of Plutarch's *Eroticus.* As the syndics of the Cambridge press were proposing to re-edit Stanley's *Æschylus*, the editorship was offered to Porson; but he declined to undertake it on the conditions laid down, namely, of reprinting Stanley's corrupt text and incorporating all the variorum notes, however worthless. He was especially anxious that the Medicean MS. at Florence should be collated for the new edition, and offered to undertake the collation at an expense not greater than it would have cost if done by a person on the spot; but the syndics refused the offer, the vice-chancellor (then Mr. Torkington, master of Clare Hall) observing that Mr. Porson might *collect* his MSS. at home.

In 1786 a new edition of Hutchinson's *Anabasis* of Xenophon being called for, Porson was requested by the publisher to supply a few notes, which he did in conjunction with the Rev. W. Whiter, editor of the *Etymologicon universale.* These give the first specimen of that neat and terse style of Latin notes in which he was afterwards to appear without a rival. They also show already his intimate acquaintance with his two favorite authors, Plato and Athenæus, and a familiarity with Eustathius's commentary on Homer.

The next year, 1787, the *Notæ breves ad Toupii Emendationes in Suidam* were written, though they did not appear till 1790 in the new edition of Toup's book published at Oxford. These first made Porson's name known as a scholar of the first rank, and carried his fame beyond England. The letters he received from Heyne and Hermann, still preserved in the library of Trinity College, and written before his *Euripides* was published, afford a sufficient proof of this. In his notes he does not hesitate to point out the errors of Toup and others; at the same time he speaks of Toup's book as "opus illud aureum," and states that his writing the notes at all is due to the admiration he had for it. They contain some very brilliant emendations of various authors; but the necessity of having Toup's own notes with them has prevented their ever being reprinted in a separate form.

During this year, in the *Gentleman's Magazine*, he wrote the three letters on Hawkins's *Life of Johnson* which have been reprinted by Mr. Kidd in his *Tracts and Criticisms of Porson*, and in the volume of Porson's *Correspondence.* They are admirable specimens of the dry humor so characteristic of the writer, and afford also proofs of his intimate acquaintance with Shakespeare and the other English dramatists and poets. In the same periodical, in the course of the years 1788 and 1789, appeared the *Letters to Archdeacon Travis, on the spurious verse* 1 *John* v. 7 (collected in 1790 into a volume), which must be considered to have settled the question as to the spuriousness of the verse forever. Gibbon's verdict on the book, that it was "the most acute and accurate piece of criticism since the days of Bentley," may be considered as somewhat partial, as it was in defence of him that Porson had entered the field against Travis. But in the very masterly sketch of Gibbon's work and style in the preface Porson does not write in a merely flattering tone. It is to be wished that on such a subject the tone of levity had been modified. But Porson says in his preface that he could treat the subject in no other manner, if he treated it at all: "To peruse such a mass of falsehood and sophistry and to write remarks upon it, without sometimes giving way to laughter and sometimes to indignation, was, to me at least, impossible." Travis has no mercy shown him, but he certainly deserved none. One is equally struck with the thorough grasp Porson displays of his subject, the amount of his miscellaneous learning, and the humor that pervades the whole. But it was then the unpopular side: the publisher is said to have lost money by the book; and one of his early friends, Mrs. Turner of Norwich, cut down a legacy she had left Porson to £30 [$145.80], on being told that he had written what was described to her as a book against Christianity.

During the years that followed he continued to contribute to the leading reviews, writing in the *Monthly Review* the articles on Robertson's *Parian Chronicle*, Edward's *Plutarch*, and Payne Knight's *Essay on the Greek Alphabet.* He gave assistance to Beloe in one or two articles in the *British Critick*, and probably wrote also in the *Analytical Review* and the *Critical Review.*

In the year 1792 his fellowship was no longer tenable by a layman; and, rather than undertake duties for which he felt himself unfit, and which involved subscription to the Articles (though he had no difficulty as to signing a statement as to his conformity with the liturgy of the Church of England when elected Greek professor), he determined not to take holy orders, which would have enabled him to remain a fellow, and thus deprived himself of his only means of subsistence. He might have been retained in the society by being appointed to a lay fellowship, one of the two permanent lay fellowships which the statutes then permitted falling vacant just in time. It is said that this had been promised him, and it was certainly the custom in the college always to appoint the senior among the existing laymen, who otherwise would vacate his fellowship. But the master (Dr. Postlethwaite), who had the nomination, used his privilege to nominate a younger man (John Heys), a nephew of his own, and thus Porson was turned adrift without any means of support. A subscription was, however, got up among his friends to provide an annuity to keep him from actual want; Mr. Cracherode, Mr. Cleaver Banks, Dr. Burney, and Dr. Parr took the lead, and enough was collected to produce about £100 [$486] a year. He accepted it only on the condition that he should receive the interest during his lifetime, and that the principal, placed in the hands of trustees, should be returned to the donors at his death. When this occurred they or their survivors refused to receive the money, and the Porson prize at Cambridge was founded with this sum to perpetuate his name.

After the loss of his fellowship he continued chiefly to reside in London, having chambers in Essex Court, Temple,—occasionally visiting his friends, such as Dr. Goodall at Eton and Dr. Parr at Hatton. It was at Dr. Goodall's house that the *Letters to Travis* were written, and at one period of his life he spent a great deal of time at Hatton. While there he would generally spend his mornings in the library, and for the most part in silence; but in the evenings, especially if Parr were away, he would collect the young men of the house about him, and pour forth from the rich stores of his memory torrents of every kind of literature—"pages of Barrow, whole letters of Richardson, whole scenes of Foote, favorite pieces from the periodical press." The charms of his society are described as being then irresistible. "Nothing," said one of his friends, could be more gratifying than a tête-à-tête with him; his recitations from Shakespeare, and his ingenious etymologies and dissertations on the roots of the English language were a high treat." "Nothing," says another, "came amiss to his memory; he would set a child right in his twopenny fable-book, repeat the whole of the moral tale of the Dean of Badajos, or a page of Athenæus on cups, or Eustathius on Homer." An anecdote is told of his repeating the *Rape of the Lock*, making observations as he went on, and noting the various readings; of which one of the company said, "had it been taken down from his mouth and published, it would have made the best edition of that poem yet in existence."

In 1792 the Greek professorship at Cambridge became vacant by the resignation of Mr. Cooke. To this Porson was elected without opposition, and he continued to hold it till his death. The duties then consisted in taking a part in the examinations for the university scholarships and classical medals. It was said he wished to give lectures; but lecturing was not in fashion in those days, and he did far more to advance the knowledge and study of the Greek language by his publications than he could have done by any amount of lecturing. It must be remembered that the emoluments of the professorship were only £40 [$194.40] a year. The authors on which his time was chiefly spent were the tragedians, Aristophanes, Athenæus, and the lexicons of Suidas, Hesychius, and Photius. This last he twice transcribed (the first transcript having been destroyed by a fire at Perry's house, which deprived the world of much valuable matter that he had written on the margins of his books) from the original among the Gale MSS. in the library of Trinity College. Of the brilliancy and accuracy of his emendations on Aristophanes, the fragments of the other comic poets, and the lexicographers he had a pleasing proof on one occasion when he found how often in Aristophanes he had been anticipated by Bentley, and on another when Schow's collation of the unique MS. of Hesychius appeared and proved him right in "an incredible number" of instances.

In 1795 there appeared from Foulis's press at Glasgow an edition of Æschylus in folio, printed with the same types as the Glasgow Homer, without a word of preface or anything to give a clue to the editor. Many new readings were inserted in the text with an asterisk affixed, while an obelus was used to mark many others as corrupt. It was at once recognized as Porson's work; he had superintended the printing of a small edition in two vols. 8vo, but this was kept back by the printer and not issued till 1806, still without the editor's name. There are corrections of many more passages in this edition than in the folio; and, though the text cannot be considered as what would have gone forth if with his name and sanction, yet more is done for the text of Æschylus than had been accomplished by any preceding editor. It has formed the substratum for all subsequent editions. It was printed from a copy of Pauw's edition corrected, which is still preserved in the library of Trinity College.

Soon after this, in 1797, appeared the first instalment of what was intended to be a complete edition of Euripides,—an edition of the *Hecuba*.

In the preface he pointed out the correct method of writing several words previously incorrectly written, and gave some specimens of his powers on the subject of Greek metres. The notes are very short, almost entirely critical; but so great a range of learning, combined with such felicity of emendation whenever a corrupt passage was encountered, is displayed that there was never any doubt as to the quarter whence the new edition had proceeded. He expressly avoided the office of interpreter in his notes, which may well be wondered at on recollecting how admirably he did translate when he condescended to that branch of an editor's duties: "si quis erat locus Anglice exhibendus," says Dobree, "tum vero omnes in stuporem dabat."

His work, however, did not escape attack; Gilbert Wakefield had already published a *Tragœdiarum Delectus*; and, conceiving himself to be slighted, as there were no mention of his labors in the new *Hecuba*, he wrote a "diatribe extemporalis" against it, a tract which for bad taste, bad Latin, and bad criticism it would not be easy to match. And Gottfried Hermann of Leipsic, then a very young man, who had also written a work on Greek metres, which Dr. Elmsley has styled "a book of which too much ill cannot easily be said," issued an edition of the *Hecuba*, in which Porson's theories were openly attacked. Porson at first took no notice of either, but went on quietly with his Euripides, publishing the *Orestes* in 1788, the *Phœnissæ* in 1799, and the *Medea* in 1801, the last printed at the Cambridge press, and with the editor's name on the title-page. But there are many allusions to his antagonists in the notes on such points as the final ν, the use of accents, etc.; and on v. 675 of the *Medea* he holds up Hermann by name to scorn in caustic and taunting language. And it is more than probable that to Hermann's attack we owe the most perfect of his works, the supplement to the preface to the *Hecuba*, prefixed to the second edition published at Cambridge in 1802. Porson's dislike of composition made him indolent, but he came forward now in his own defence, and probably of all the pieces of minute criticism that have appeared on those subjects the first place must be given to this. The beauty of the style, the steps by which the reader is carried on from one point to another, and the richness of illustration make it one of the most entertaining of diatribes. The metrical laws promulgated are laid down clearly, illustrated with an ample number of examples, and those that militate against them brought together and corrected, so that what had been beyond the reach of the ablest scholars of preceding times is made clear to the merest tyro. It is here that the laws of the iambic metre are fully explained, and the theory of the pause stated and proved, which had been only alluded to in the first edition. A third edition of the *Hecuba* appeared in 1808, and he left corrected copies of the other plays, of which new editions appeared soon after his death; but these four plays were all that was accomplished of the projected edition of the poet. Porson lived six years after the second edition of the *Hecuba* was published, but his natural indolence and procrastination led him to put off carrying on the work till death put a stop to this and all other literary projects. He found time, however, to execute his collection of the Harleian MS. of the *Odyssey*, published in the Greenville *Homer* in 1801, and to present to the Society of Antiquaries his wonderful conjectural restoration of the Rosetta stone.

In 1806, when the London Institution was founded (then in the Old Jewry, since removed to Finsbury Circus), he was appointed principal librarian with a salary of £200 [$972] a year and a suit of rooms; and thus his latter years were made easy as far as money was concerned.

Among his most intimate friends was Perry, the editor of the *Morning Chronicle;* and this friendship was cemented by his marriage with Perry's sister, Mrs. Lunan, in November, 1796. The marriage was a happy one for the short time it lasted, as Porson became more attentive to times and seasons, and would have been weaned from his habits of drinking; but she sank in a decline a few months after her marriage (12th April, 1797), and he returned to his chambers in the Temple and his old habits. Perry's friendship was of great value to him in many ways; but it induced him to spend too much of his time in writing for the *Morning Chronicle;* indeed he was even accused of "giving up to Perry what was meant for mankind," and the existence of some of the papers he wrote there can be only deplored.

For some months before his death he had appeared to be failing: his great memory was not what it had been, and he had some symptoms of intermittent fever; but on 19th September, 1808, he was seized in the street with a fit of apoplexy, and after partially recovering sank on the 25th of that month at the comparatively early age of forty-nine. He was buried in Trinity College, close to the statue of Newton, at the opposite end of the chapel to where rest the remains of Bentley.

His library was divided into two parts, one of which was sold by auction; the other, containing the transcript of the Gale Photius, his books with MS. notes, and some letters from foreign scholars, was bought by Trinity College for 1000 guineas [$5,103]. His note-books were found to contain, in the words of Bishop Blomfield, "a rich treasure of criticism in every branch of classical literature—everything carefully and correctly written and sometimes rewritten—quite fit to meet the public eye, without any diminution or addition." They have been carefully rearranged of late years, and illustrate among other things his extraordinary penmanship and power of minute and accurate writing. Much still remains unpublished, though much has been given to the world. Monk, his successor as Greek professor, and Blomfield (both afterwards bishops) edited the *Adversaria*, consisting of the notes on Athenæus and the Greek poets, and his prelection on Euripides; Dobree, afterwards Greek professor, the notes on Aristophanes and the lexicon of Photius. Besides these, from other sources, Professor Gaisford edited his notes on Pausanias and Suidas, and Mr. Kidd collected his scattered reviews. And, when Bishop Burgess attacked his literary character on the score of his *Letters to Travis*, Professor Turton (afterwards Bishop of Ely) came forward with a vindication.

In claiming for Porson the very high place he has always occupied among Greek scholars, it is with those who went before him that he must be compared, if we would judge fairly of the advances he made in the knowledge of the language. In learning he was superior to Valckenaer, in accuracy to Bentley. It must be remembered that in his day the science of comparative philology had scarcely any existence; even the comparative value of MSS. was scarcely considered in editing an ancient author. With many editors MSS. were treated as of pretty much the same value, whether they were really from the hand of a trustworthy scribe, or what Bentley calls "scrub manuscripts" or "scoundrel copies." Thus, if we are to find fault with Porson's way of editing, it is that he does not make sufficient difference between the MSS. he uses, or point out the relative value of the early copies whether in MS. or print. Thus he collates very minutely Lascaris's edition of the *Medea*, mentioning even misprints in the texts, rather from its rarity and costliness than from its intrinsic value. And his wonderful quickness at emendation has sometimes led him into error, which greater investigation into MSS. would have avoided; thus, in his note on Eur., *Phœn.*, 1373, an error, perhaps a misprint (κε for με), in the first edition of the scholastic on Sophocles has led him into an emendation of v. 339 of the *Trachiniæ* which clearly will not stand. But his most brilliant emendations, such as some of those on Athenæus, on the *Supplices* of Æschylus, or, to take one single instance, that on Eur., *Helen.*, 751 (οὐδ᾽ Ἕλενος for οὐδὲν γε; see Maltby's *Thesaurus*, p. 299), are such as convince the reader of their absolute certainty; and this power was possessed by Porson to a degree no one else has ever attained. No doubt his mathematical training had something to do with this; frequently the process may be seen by which the truth has been reached.

A few words are called for on his general character. No one ever more loved truth for its own sake; few have sacrificed more rather than violate their consciences, and this at a time when a high standard in this respect was not common. In spite of his failings, few have had warmer friends; no one more willingly communicated his knowledge and gave help to others; scarcely a book appeared in his time or for some years after his death on the subjects to which he devoted his life without acknowledging assistance from him. And, if it be remembered that his life was a continued struggle against poverty and slight and ill-health, rather than complain that he did little, we should wonder how he accomplished so much.

The chief sources for Porson's life will be found in the memoirs in the *Gentlemen's Magazine* for September and October 1808, and other periodicals of the time (mostly reprinted in Barker's *Porsoniana*, London, 1852); Dr. Young's memoir in former editions of the *Encyclopædia Britannica* (reprinted *ibid.* and in his works); Weston's (utterly worthless) *Short Account of the late Mr. Richard Porson*, London, 1808, reissued with a new preface and title-page in 1814; Dr. Clarke's narrative of his last illness and death, London. 1808 (reprinted in the *Classical Journal*); Kidd's "Imperfect outline of the life of R. P.," prefixed to his collection of the *Tracts and Criticisms;* Beloe's *Sexagenarian* (not trustworthy), vol. i., London, 1817; Barker's *Parriana*, vol. ii., London, 1829; Maltby's "Porsoniana," published by Dyce in the volume of *Recollections of the Table-Talk of Samuel Rogers*, London, 1856; a life in the *Cambridge Essays* for 1857 by H. R. Luard; and a lengthy life by J. S. Watson, London, 1861.

The dates of Porson's published works are as follows: *Notæ in Xenophontis Anabasin*, 1786; Appendix to Toup, 1790; *Letters to Travis*, 1790; *Æschylus*, 1795, 1806; *Euripides*, 1797–1802; collation of the Harleian MS. of the *Odyssey*, 1801; *Adversaria* (Monk and Blomfield), 1812; *Tracts and Criticisms* (Kidd), 1815; *Aristophanica* (Dobree), 1820); *Notæ in Pausaniam* (Gaisford), 1820; *Photii Lexicon* (Dobree), 1822; *Notæ in Suidam* (Gaisford), 1834; *Correspondence* (Luard, edited for the Cambridge Antiquarian Society), 1867. Dr. Turton's vindication appeared in 1827. (H. R. L.)

PORTA, BACCIO DELLA. See BACCIO DELLA PORTA.

PORTA, GIAMBATTISTA DELLA (*c.* 1543–1615), natural philosopher, was born of a noble and ancient family at Naples about the year 1543. In early youth he travelled extensively not only in Italy but also in France and Spain, and he had scarcely emerged from boyhood when he published *Magiæ naturalis, sive de miraculis rerum naturalium lib. IV.* (1558), the first draft of his *Magia naturalis*, in twenty books, published in 1569. At an early age he founded in Naples the Academia Secretorum Naturæ, otherwise known as the Accademia dei Oziosi, of which the history has been briefly sketched elsewhere (see ACADEMY, vol. i. p. 68); and in 1610 he became a member of the Accademia dei Lincei at Rome. He died at Naples on 4th February, 1615.

The following is a chronological list of the principal writings of this prolific author: *De miraculis rerum naturalium*, in four books (1558); *De furtivis litterarum notis*, in five books (1563, and frequently afterwards, entitling him to high rank among the early writers on cryptography); *Magia naturalis* (1569, and often reprinted, also translated into English in 1658, into French, Spanish, and other languages); *Phytognomonica* (1583, a bulky treatise on the physiology of plants as then understood); *De humana physiognomonia*, in six books (1591); *Villa*, in twelve books (1592; an interesting practical treatise on farming, gardening, and arboriculture, based upon his own observations at his country seat near Naples); *De refractione, optices parte*, in nine books (1593); *Pneumatica*, in three books (1601); *De cœlesti physiognomonia*, in six books (1601); *Elementa curvilinea* (1601); *De distillatione*, in nine books (1604); *De munitione*, in three books (1608); and *De aeris transmutationibus*, in four books (1609). Porta also wrote several Italian comedies (*Olimpia*, 1589; *La Fantesca*, 1592; *La Trappolaria*, 1597; *I Due Fratelli Rivali*, 1601; *La Sorella*, 1607; *La Chiappinaria*, 1609; *La Carbonaria*, 1628; *La Cintia*, 1628). Among all the above-mentioned works the chief interest attaches to the *Magia naturalis*, in which a strange medley of subjects is discussed, including the reproduction of animals, the transmutation of metals, pyrotechny, domestic economy, statics, hunting, the preparation of perfumes; in book xvii. he describes a number of optical experiments. They include a description of the camera obscura. If, says he, a small aperture is made in the shutter of a dark room, distinct images of all external objects will be depicted on the opposite wall in their true colors; and he further adds that, if a convex lens be fixed in the opening so that the images are received on a surface at the distance of its focal length, the pictures will be rendered so much more distinct that the features of a person standing on the outside of the window may be readily recognized in his inverted image. He applied this instrument to a sort of magic lantern, the representation of eclipses of the sun, and of hunting and other scenes, battles, and other events produced by movable pictures and drawings. He considered the eye as a camera obscura, the pupil as the hole in the window contracting and dilating with different lights, and the crystalline lens as the principal organ of vision, though he seems to have regarded it not as his convex lens but as the tablet on which the images of external objects were formed, the cornea being, no doubt, in his estimation, the part of the eye which formed the picture. After speaking of spectacles and the like, he professed to know a combination of lenses by which "we may contrive to recognize our friends at the distance of several miles, and those of weak sight may read the most minute letters from a distance. It is an invention of great utility, and grounded on optical principles, nor is it at all difficult of execution; but it must be so divulged as not to be understood by the vulgar, and yet be clear to the sharp-sighted." The obscure description which follows does not, however, make it at all probable that he had really anticipated Galileo.

In his *De refractione* Porta treats of binocular vision. He repeats the propositions of Euclid on the dissimilar pictures of a sphere when seen with each eye and when seen with both; and he quotes from Galen on the dissimilarity of the three pictures thus seen. But, maintaining as he does that we can see only with one eye at a time, he denies the accuracy of Euclid's theorem; and, while he admits that the observations of Galen are correct, he endeavors to explain them on other principles. In illustrating Galen's views on the dissimilarity of the three pictures he gives a diagram in which can be recognized not only the principle but the construction of the stereoscope. It contains a view, represented by a circle, of the picture of a solid as seen by the right eye, of the picture of the same solid as seen by the left, and of the combination of these two pictures as seen by both eyes, placed between the first two pictures. These results, as exhibited in three circles, are then explained by copying the passage from Galen, and he requests the observer to repeat the experiments so as to see the three dissimilar pictures when looking at a solid column.

PORT ADELAIDE, South Australia. See vol. i. p. 138.

PORTADOWN, a market-town of Armagh, Ireland, is situated on the river Bann, and on the Great Northern Railway, 25 miles west-southwest of Belfast and 10 north-northeast of Armagh. The Bann, which is connected with the Newry Canal and falls into Lough Neagh about 5 miles north of the town, is navigable for vessels of 90 tons burden. It is crossed at Portadown by a stone bridge of seven arches, originally built in 1764, but since then re-erected. The town consists of a principal street, containing a number of good shops and houses, and with several streets inhabited by the working-classes branching from it at various points. The only public building of importance is the court-house and news-room. The manufacture of linen and cotton is carried on, and there is a considerable trade in pork, grain, and farm produce. The manor in the reign of Charles I. was bestowed on John Obyns, who erected a mansion and a few houses, which were the beginning of the town. A grain-market was established in 1780. The population in 1871 was 6735, and in 1881 it was 7850.

PORTALIS, Jean Étienne Marie (1745–1807), French jurist and the principal author of the *Code Civil*, which as the *Code Napoléon* has been declared the greatest monument of the reign of the emperor, came of a bourgeois family, and was born at Bausset in Provence on 1st April, 1745. He was educated by the Oratorians at their schools in Toulon and Marseilles, and then went to the university of Aix; while a student there he published his first two works, *Observations sur Émile* in 1763 and *Des Préjugés* in 1764. In 1765 he became an avocat at the parlement of Aix, and soon obtained so great a reputation that he was instructed by Choiseul in 1770 to draw up the decree authorizing the marriage of Protestants. From 1778 to 1781 he was one of the four assessors or administrators of Provence, and in 1783 he brought about the countess of Mirabeau's separation from her husband in spite of the impassioned pleading of the great Mirabeau himself. In 1788 he protested on behalf of the avocats of Aix against Loménie de Brienne's May edicts, but in the following year, probably owing to Mirabeau's influence, he was not elected to the States-General. He entirely disapproved of the great changes brought about by the Constituent Assembly; and, after refusing to be one of the royal commission for splitting up Provence into departments, he retired, first to his country house and then to Lyons, and took no further part in politics. In November, 1793, after the republic had been proclaimed, he came to Paris, and was thrown into prison, being the brother-in-law of Siméon, who was the leader of the federalists in Provence. He was soon removed through the influence of Barère to a maison de santé, where he remained undisturbed till the fall of Robespierre. On being released he practiced as a lawyer in Paris; and in 1795 he was elected by the capital to the Council of Ancients, at once becoming a leader of the moderate party oppsed to the directory. His reports, however, were chiefly on questions of law reform, and he commenced the labors which have made his name famous. As a leader of the moderates he was proscribed at the coup d'état of Fructidor, but, unlike Pichegru and Barbé-Marbois, he managed to escape to Switzerland, and did not return till Bonaparte became First Consul. Bonaparte knew his value, and made him a conseiller d'état in 1800, and then charged him, with Tronchet, Bigot de Préameneu, and Jacques de Maleville, to draw up the *Code Civil*. Of this commission he was the most industrious member, and many of the most important titles, notably those on marriage and heirship, are his work. In 1801 he was placed in charge of the department of cultes, or public worship, and in that capacity had the chief share in drawing up the provisions of the Concordat. In 1803 he became a member of the Institute, in 1804 minister of public worship, and in 1805 a knight grand cross of the Legion of Honor. He soon after became totally blind; and after undergoing an unsuccessful operation he died at Paris on 23d August, 1807.

The work of Portalis appears in the *Code Napoléon*, but see also Frederick Portalis's *Documents, rapports, et travaux inédits sur le Code Civil*, 1844, and *Sur le Concordat*, 1845; for his life, see the biography in the edition of his *Œuvres* by F. Portalis, 1823, and René Lavollée, *Portalis, sa vie et ses œuvres*, Paris, 1869.

PORT AU PRINCE (originally L'Hôpital, and for brief periods Port Henri and Port Républicain), the capital of the republic of Hayti (western portion of the island of Hayti, *q.v.*), lies in 18° 34′ N. lat. and 72° 20′ W. long, at the apex of the vast triangular bay which strikes inland for about 100 miles between the two great peninsulas of the west coast, and has its upper recesses protected by the beautiful island of Gonaives (30 miles long by 2 broad). The city (an archbishopric since the concordat of 1860) is admirably situated on ground that soon begins to rise rapidly towards the hills; and it was originally laid out by the French on a regular plan with streets of good width running north and south and intersected by others at right angles. Everything has been allowed to fall into disorder and disrepair, and to this its public buildings —a state-house, a national bank, a hospital, a lyceum, a custom-house, etc.—form no exception. The national palace remains as the flames of revolution left it in 1869, and the president lives in an ordinary house. The principal church is an "overgrown wooden shed." Every few years whole quarters of the town are burned down, but the people go on building the same slight wooden houses, with only here and there a more substantial warehouse in brick. The state of the streets is deplorable in the extreme; and, in spite of the old French aqueduct, the water-supply is defective; while the harbor is rapidly being filled by fetid deposits. From June to September the heat is excessive, reaching 95° to 99° in the shade. According to Ad. Ackerman, the average rainfall for the four years 1864–67 was 61.35 inches, distributed over an average of 152 days. The population, mostly negroes and mulattoes, is estimated at 20,000. Port au Prince was first laid out by M. de la Cuza in 1749. In 1751 and again in 1770 it was destroyed by earthquakes.

See Edgar La Selve (professor in the Port au Prince lyceum), in *Tour du Monde*, 1879, and Spenser St. John, *Hayti, or the Black Republic*, 1884.

PORT ELIZABETH, a seaport town of Cape Colony, at the head of an electoral division of the southeastern province, lies in 33° 55′ S. lat. on Algoa Bay, about 7 miles south of the mouth of the Zwartkop river. Built along the base and up the rocky slopes of the hills that rise for a height of 200 feet above the bay, it has rather a bare appearance as seen from the water, but on landing the stranger finds himself in the midst of a prosperous European town with substantial buildings and fine streets. A small and somewhat muddy stream, Baker's River, divides it into two parts, that to the east being mainly occupied by Malay fishermen. The whole length of the place is about 2 miles, and its breadth varies from a quarter to 1 mile. The main street runs up from the harbor, with its large wool and other warehouses, to the market-place, which is adorned with a handsome granite obelisk. Port Elizabeth owes its prosperity to the fact that it has become the great emporium for the whole interior of the country to the south of the Zambesi, being the terminus of the Eastern and Midland Railways which run inland to Graaf Reinet, Cradock (182 miles, since 1880), and Grahamstown (since 1879). The two great hindrances to development have been want of drinking-water and want of protection and convenient landing-places in the harbor. The former has been fully met by an aqueduct (28 miles) from Van Staanden's River (1878; see J. G. Gamble's *Report* to Inst. Civ. Eng., 1883), and the harbor was improved in 1881 by extending the old landing-pier to a total length of 900 feet and constructing a similar pier 800 feet long. The value of the imports has increased from £376,638 [$1,830,460.68] in 1855 to £4,001,658 [$19,448,057.88] in 1881 and £2,364,891 [$11,493,370.26] in 1883; that of the exports from £584,447 [$2,840,412.42] in 1855 to £2,583,737 [$12,556,961.82] in 1881 and £2,341,123 [$11,377,857.78] in 1883. The exports are mainly wool (£1,508,280 [$7,330,240.80] in 1881), ostrich feathers (£131,279 [$630,015.94]), and Angora goats' hair (£257,596 [$1,251,916.56]), as well as ivory, hides, diamonds. The population, which was not much above 4000 in 1855, reached 13,049 in 1875. The town dates from 1820.

PORTER, JANE (1776–1850), a novelist whose life and reputation are closely linked with those of her sister ANNA MARIA PORTER (1780–1832) and her brother Sir ROBERT KER PORTER (1775–1842). Their father, an officer in the English army, having died shortly after the birth in 1780 of the younger sister, the mother removed from Durham, their birthplace, to Edinburgh, where the inherited passion for the romance of war which gave character to the works of each appears to have been stimulated by their association with Flora Macdonald and the young Walter Scott. To develop the artistic ability displayed by the brother, the family moved in 1790 to London, and the sisters subsequently resided at Thames Ditton and at Esher with their mother until her death in 1831. The ability of Anna Maria Porter was the first to manifest itself in the premature publication of her *Artless Tales* (1793–95), these being followed by a long series of works, of which the more noteworthy are *Walsh Colville* (1797), *Octavia* (1798), *The Lake of Killarney* (1804), *A Sailor's Friendship and a Soldier's Love* (1805), *The Hungarian Brothers* (1807), *Don Sebastian* (1809), *Ballads, Romances, and other Poems* (1811), *The Recluse of Norway* (1814), *The Knight of St. John* (1817), *The Fast of St. Magdalen* (1818), *The Village of Mariendorpt* (1821), *Roche Blanche* (1822), *Honor O'Hara* (1826), and *Barony* (1830). Jane Porter, whose intellectual power, though slower in development and in expression, was of a stronger nature than that of her sister, had in the meantime gained an immediate and wide popularity by her first work, *Thaddeus of Warsaw* (1803), which was translated into several languages and procured her election as canoness of the Teutonic order of St. Joachim. Seven years latter her *Scottish Chiefs* anticipated in some measure the works of Sir Walter Scott in the field of national romance, though it is wanting in the higher qualities of the historic novel. Her chief subsequent works were *The Pastor's Fireside* (1815), *Duke Christian of Lüneburg* (1824), *Coming Out* (1828), and *The Field of Forty Footsteps* (1828). In conjunction with her sister she published in 1826 the *Tales round a Winter Hearth*, and the intervals between her larger works were filled up with frequent contributions to current periodical literature. *Sir Edward Seaward's Diary* (1831)—a work displaying considerable skill in the realistic reproduction of the style and mode of thought of an earlier period—has been persistently, though erroneously, attributed to her. The claim of her eldest brother, Dr. William Ogilvie Porter, to its authorship has been fully established, her share in its publication having been solely that of editor. In 1832 Anna Maria died, and for the next ten years Jane became "a wanderer" amongst her relations and friends.

While his sisters had been winning esteem in literature, Robert Ker Porter had in his own way been scarcely less successful. After two years of study at the Royal Academy he had gained reputation as a painter of altar-pieces and battle-scenes of imposing magnitude. He went to Russia as historical painter to the emperor in 1804, accompanied Sir John Moore's expedition in 1808, married the princess Mary de Sherbatoff in 1811, was created knight commander of the order of Hanover in 1832, and became British consul at Venezuela. Accounts of his wanderings are to be found in his *Travelling Sketches in Russia and Sweden* (1808), *Letters from Portugal and Spain* (1809), *Narrative of the late Campaign in Russia* (1813), and *Travels in Georgia, Persia, Armenia, Ancient Babylonia, etc., during the years* 1817–20 (1821–22). After leaving Venezuela he again visited St. Petersburg, but died there suddenly on 4th May, 1842. Jane Porter, who had joined him in Russia, then returned to England and took up her residence with her eldest brother at Bristol, where she died, 24th May, 1850.

PORT GLASGOW, a seaport, market-town, burgh of barony, and parliamentary burgh of Renfrewshire, Scotland, is situated on the south side of the Clyde, 2½ miles east of Greenock and 20 west of Glasgow. The elevated ridges to the back of the town are clothed with trees, their lower slopes being occupied with villas. The streets are wide, regular, and well-paved. The principal buildings are the court-house in the Grecian style, the town-hall, and the custom-house. On the adjoining slopes to the east are the picturesque ruins of Newark Castle, the ancient seat of the Maxwells. There are large and commodious harbors, a wet dock, and a graving dock. The port carries on an extensive trade with British North America, the United States, the Indies, and the Levant, the principal exports being iron, steel, machinery, and textile manufactures. The trade, though checked for a time by the rapid progress of Greenock, has been for some years on the increase. The shipbuilding-yards give employment to a large number of persons both in the town and the neighboring burgh of Greenock. Connected with the shipbuilding industry there are manufactures of sail-cloth, ropes, anchors, and chain cables, also engineering and riveting works, and iron and brass foundries. The population of the police burgh in 1851 was 6986, which in 1871 had increased to 10,823, and in 1881 to 13,224. The population of the parliamentary burgh in 1881 was 10,802.

Originally the district formed part of the adjoining parish of Kilmalcolm, the nucleus of the town being the small village of Newark attached to the barony of that name. In 1688 it was purchased from Sir Patrick Maxwell of Newark by the magistrates of Glasgow, to provide a convenient harbor for vessels belonging to the city. In 1695 it was disjoined from Kilmalcolm and erected into a separate parish under the name of New Port Glasgow, afterwards Port Glasgow. In 1710 it was made the chief custom-house port for the Clyde, but is now under the control of the Greenock office; and in 1775 it was created a burgh of barony. Under the Municipal Act of 1883 the town is governed by a provost, two bailies, and six councillors. Since the first Reform Act it has been included in the Kilmarnock parliamentary district of burghs.

PORT HOPE, a town and port of entry of Canada, in Durham county, Ontario, on the north shore of Lake Ontario, lies 63 miles northeast of Toronto by the Grand Trunk Railway (which is there met by the midland branch of the Grand Trunk Railway), and is connected with Charlotte, the port of Rochester, New York, by a daily steamboat service. The town is picturesquely situated on the side and at the foot of hills overlooking the lake; and Smith's Creek, by which it is traversed, supplies abundant water-power. Flour, plaster, woollen goods, leather, beer, carriages, agricultural implements, and steam-engines and boilers are among the objects of the local industries, and trade is carried on in lumber, grain, and flour. The value of the exports was $1,326,706 in the year ending 30th June, 1884, and that of the imports $221,830. The population in 1881 was 5585.

PORT HURON, a city and port of entry of the United States, county seat of St. Clair county, Michigan, lies 58 miles by rail northeast of Detroit, at the southern extremity of Lake Huron and on the west bank of the St. Clair river, which is there joined by the Black river. Port Huron is a point of great importance in the railway system, being the terminus of the Chicago and Grand Trunk and the Port Huron and Northwestern Railways (lines to East Saginaw, Sand Beach, Almont, and Port Austin), and connected by ferry to Sarnia with the Great Western of Canada and the Grand Trunk Railways. It is also the terminus and a stopping-place of several lines of lake steamers. It has a large lumber trade, ship-yards, dry-docks, saw-mills, flour-mills, planing-mills. The population was 5973 in 1870, 8883 in 1880, and 10,396 in 1884. Commenced in 1819, Port Huron was incorporated as a village in 1835, and as a city in 1857.

PORTICI, a town of Italy, 5 miles south of Naples, on the shores of the bay and at the foot of Vesuvius, a little to the north of the site of Herculaneum. It is traversed by the high road and the railway from Naples (only 5 miles distant) to Salerno. The palace, erected in 1737, once contained the Herculanean antiquities, now removed to Naples, and since 1882 it has been a school of agriculture. There is a small harbor. The population (9963 in the town in 1881, and 12,709 in the commune, which includes Addolorata) is partly engaged in the fisheries, silk-growing, and silk-weaving.

PORT JERVIS, a large village of the United States, in Deerpark township, Orange county, New York, situated at the intersection of the boundaries of New Jersey, New York, and Pennsylvania, at the junction of the Neversink with the Delaware. It is the terminus of the eastern division of the New York, Lake Erie, and Western Railroad, and of the Port Jervis and Monticello Railroad, and it has extensive repair-shops. The beauty of the surrounding scenery attracts summer visitors. Port Jervis was named after John B. Jervis, engineer of the Delaware and Hudson Canal, which connects the Pennsylvania coal-fields with the tidal waters of the Hudson. In 1875 the Erie Railway bridge, the Barrett bridge, and many buildings were carried away by an ice-gorge. The population of the village was 6377 in 1870 and 8678 in 1880 (township 11,420).

PORTLAND, a city and port of entry of the United States, capital of Cumberland county, Maine, lies on Casco Bay, in 43° 39′ N. lat. and 70° 13′ W. long. By rail it is 108 miles north-northeast of Boston, and 297 southeast of Montreal. The peninsula on which it is mainly built runs out for about 3 miles, has a breadth of about ¾ mile and rises in the west to 175 feet in Bramhall's Hill and in the east to 161 in Munjoy's Hill, which is crowned by an observatory. As seen from the harbor, the whole city has a pleasant and picturesque appearance, and the streets are in many parts so umbrageous with trees that Portland has obtained the sobriquet of the "Forest City." A large number of the houses are built of brick. Congress street, the principal thoroughfare, runs along, the whole ridge of the peninsula, from the western promenade, which looks down over the suburbs from Bramhall's Hill to the eastern promenade which commands the bay; it passes Lincoln Park (2½ acres) and the Eastern cemetery, which contains the graves of Commodore Preble and Captains Burrows[1] and Blythe, of Revolutionary fame. On Bramhall's Hill is the reservoir (12,000,000 gallons) of the water company, which was established in 1867 to supply the city from Lake Sebago, whose beautiful expanse (14 miles long by 11 wide) was the favorite haunt of Nathaniel Hawthorne's boyhood. The more conspicuous buildings of Portland are the city hall (1859), with a front in olive-colored freestone, 150 feet long; the post-office (1872), constructed of Vermont white marble in the mediæval Italian style; the custom-house (1872), in granite, with rich marble ornamentation in the interior; the marine hospital (1855), a large brick erection; the Maine general hospital, 1868; the Roman Catholic cathedral; the Roman Catholic episcopal palace; and several fine churches. The Portland Society of Natural History, established in 1843 and incorporated in 1850, though it has twice lost its property by fire (1854 and 1866), has again acquired very valuable collections. The Portland institute and public library, dating from 1867, had 30,000 volumes in 1884. A medical school was founded in 1858. Portland is in the main a commercial city, with an extensive transit trade, drawing largely from Canada and the Far West. Connected with Boston by rail in 1842, and with Montreal in 1853, it has now become a terminus of six different railroads; and, since the gauge of the Grand Trunk Railroad was altered, it can import direct from San Francisco. As the harbor, (which lies along the south side of the city) is seldom closed by ice, it has been long used as the winter port for the great ocean steamers between Great Britain (Liverpool and Glasgow) and Canada, which in summer ascend the St. Lawrence to Montreal and Quebec. At low water vessels drawing 22 feet and at high water vessels drawing 30 feet can come up to the wharves with safety in any season; and there is secure anchorage within a mile of the shore. The dry dock is one of the deepest in the United States. The following figures show the extent of the foreign trade:

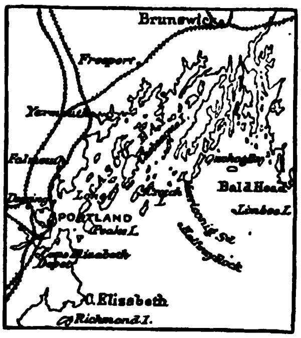

FIG. 1.—Environs of Portland.

	Imports.	Exports.
Average 1876–80	$9,368,044	$11,044,389
1881	11,078,612	12,476,389
1882	11,748,183	11,955,787
1883	10,235,991	13,847,574

Among the staple imports are wood, coal, potatoes (from Europe), salt, sugar and molasses, fish, earthenware, and textile manufactures; and among the staple exports to foreign countries fresh and preserved provisions of all kinds, grain, hay, cattle, wood, copper ore, tallow, shoes, potash, cotton, lumber (mainly to South America), and ice. In 1870 the total receipts of grain amounted to 1,516,875 bushels, in 1875 to 2,152,829, in 1878 to 4,492,952, and in 1883 to 4,964,158 bushels, or adding flour, 7,543,873 bushels. The number of entrances from foreign ports in 1883 was 338 (164,711 tons), clearances for foreign ports 501 (226,420 tons); entrances in the coasting trade 479 (403,166 tons), and clearances 389 (394,500 tons). In the same year the Portland-owned vessels numbered 368 (105,642 tons); and 116 were employed in the mackerel and cod fisheries. Fish-curing (cod, mackerel, and sardines), preserving meat, Indian corn, and other kinds of provisions, boot and shoe-making, furniture-making, carriage-building, machinery-making, engine-building, and sugar-refining are all prosecuted on a considerable scale for the size of the town; and a large number of minor industries are also represented. In 1884 there were six national banks, with an aggregate capital of $3,250,000, and two savings banks, with deposits of $8,966,879. In 1880 the capital invested in manufacturing was $4,659,375, the value of the annual production $9,569,523, and the amount of wages paid $1,547,375. Portland is divided into seven wards, and is governed by a mayor, a board of aldermen and a common council. It is the seat of the sessions of the United States courts for the district of Maine. The assessed value of property was $30,723-936 in 1874, and $33,030,020 in 1883. The population was 3704 in 1800, 20,815 in 1850, 31,413 in 1870, and 33,810 in 1880. If the adjoining villages be included, the total is raised to between 45,000 and 50,000.

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[1] [Distinguished in the war of 1812-14.—AM. ED.]

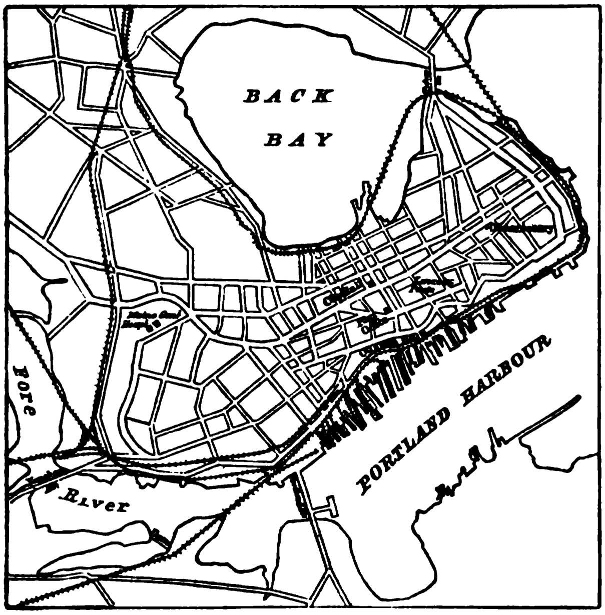


FIG. 2.—Plan of Portland, Me.

The name of Portland as applied to this city dates only from 1786; the Indians knew the place as Machigonne. The first European settlers (1632) called it Casco Neck, and after it passed to Massachusetts in 1658 it was denominated Falmouth. During the rest of the 17th century and the early years of the 18th, hostilities on the part of the French and the Indians prevented the growth of the town, which by 1764, however, had increased to about 2000 inhabitants. In 1775 it was bombarded by four British vessels under Captain Mowatt, but it was rebuilt in 1783, and formally incorporated in 1786. A city charter was obtained in 1832. The great fire of 1866 swept over a third of the city and caused a loss of from $6,000,000 to $10,000,000. Portland is the birthplace of Henry W. Longfellow, N. P. Willis, Sara P. Parton ("Fanny Fern"), Erastus and James Brooks, Commodore Preble, John Neal, and Neal Dow.

PORTLAND, the largest city of Oregon, in the United States, the capitol of Multnomah county and the seat of the United States courts for Oregon, is situated at the head of ship navigation (river craft ascend 126 miles farther) on the west bank of the Willamette, 12 miles above its junction with the Columbia river and about 120 from the ocean. It is a well-built and rapidly-growing city, laid out on a piece of level ground gradually rising from the river bank, and enclosed on the west by a semi-circle of fir-clad hills. Except in the business parts, the streets, which are remarkably well-kept, are planted with maple trees; and a park about 200 feet broad runs through nearly the whole length of the city from north to south. Besides the schools, several of which are especially noteworthy, the public buildings comprise a court-house, a United States custom-house and post-office, three public halls, three theatres, and spacious markets. In 1883 no less than $4,039,100 were expended on building enterprises, $2,000,000 of this sum being for business and manufacturing establishments. Portland is the natural centre of the rapidly developing railway system of Oregon and the neighboring Territories (see OREGON, vol. xvii. p. 848.) It is the terminus of the Oregon Railway and Navigation Company's system, which forms the connecting link with tide water of the Northern Pacific and Union Pacific Railroads, thus making Portland virtually the Pacific coast terminus of these two transcontinental lines. Vessels drawing from 19 to 21 feet of water can load at its wharves, and, though it is still dependent on San Francisco for a large portion of its foreign supplies, it trades directly with Great Britain, China, the Sandwich Islands, the South-American republics, etc. Wheat, flour, tinned salmon, and lumber are the principal articles of export. In 1883 the value of the exports amounted to $10,984,963 and that of the imports to $27,668,787. The manufacturing establishments—foundries, saw-mills, breweries, soap-works, boot and shoe factories, etc.—had in 1883 an aggregate production valued at $11,423,000, or an increase on the production in 1880 of $8,521,000. The valuation of property for the purposes of taxation was $9,622,750 in 1877 and $19,397,750 in 1883. The population, which was only 2874 in 1860 and 8293 in 1870, had increased by 1880 to 17,577, or, including the suburban city of East Portland, 20,511; and it is estimated that the present (1884) total is about 40,000. A separate district is inhabited by the Chinese, who number several hundreds.

Portland was laid out in 1845, and became a city in 1851. In December, 1872, it was visited by a destructive fire, and it had hardly recovered when, on 2d August, 1873, a more disastrous conflagration destroyed about twenty blocks in one of the most crowded parts of the city, and caused a total loss of $1,345,400.

PORTLAND, ISLE OF, a small island or peninsula of England, in the English Channel, 4½ miles south of Weymouth, Dorsetshire, connected with the mainland by a long narrow ridge of shingle called the Chesil Bank. There is communication with Weymouth both by rail and steamer. The island is 4½ miles long by 1¾ broad, the area being 2890 acres. The coast-line is wild and precipitous, and Portland is inaccessible from the sea on all sides except the south. The highest elevation is 490 feet. Numerous caverns have been excavated by the action of the waves, and off Portland Bill, the southern extremity of the island, is a bank called the Shambles, between which and the land there flows a dangerous current called the Race of Portland. The substratum of the island is Kimmeridge clay, above which rest beds of sand and strata of Oolitic limestone, widely famed as a building stone. The extensive quarries have supplied the materials for St. Paul's Cathedral and many other important public buildings in London and elsewhere, about 70,000 tons of stone being now exported annually. In the "dirt-bed" resting upon the Oolitic strata numerous specimens of petrified wood are found, some of them of great size. The soil, though shallow, is fertile, and mutton fed on the grass has a peculiarly rich flavor. Agriculture, fishing, and especially quarrying give employment to the inhabitants, who are tall and handsome, and retain some singular customs, among which may be mentioned that of conveying land by "church gift" (see REAL ESTATE). By the construction of a breakwater 2¼ miles in length, the building of which occupied twenty-three years, from 1849 to 1872, a harbor of refuge 2100 acres in extent has been formed, affording a safe and convenient anchorage for a very large fleet of vessels. It is defended by two forts of great strength, mounted with heavy ordnance. A convict prison, erected on Portland in 1848, has cells for 1500 prisoners.

Portland Castle, built by Henry VIII. in 1520 is generally occupied by the commander of the engineers or of the regiment stationed on the island. On the east side of the island are the remains of a more ancient fortress, ascribed to William Rufus. The Isle of Portland is not mentioned in the time of the Romans. In 837 it was the scene of an action against the Danes, and in 1052 it was plundered by

Earl Godwine. In 1643 the Parliamentary party made themselves masters of the island and castle, but shortly afterwards these were regained by the Royalists through a clever stratagem, and not recovered again by the forces of the Parliament till 1646. The island is under the government of a local board of health. The population in 1871 was 9,907, and in 1881 it was 10,061, including 550 on board vessels, 861 in Verne Citadel Barracks, and 1620 in the convict prison.

PORTLAND, WILLIAM BENTINCK, FIRST EARL OF (d. 1709), was descended from an ancient and noble family of Guelderland, and became a page of honor to William, prince of Orange, from which he was advanced to be gentleman of the bedchamber. In this capacity he accompanied the prince to England in 1670, and along with him was created doctor of civil law by the university of Oxford. Afterwards he became a colonel in a Dutch regiment of guards. When the prince of Orange was attacked with smallpox he, in accordance with a suggestion of the physicians volunteered to lie in bed with him, that the heat of his body might check and expel the disease. This remarkable act of self-sacrifice secured him throughout life the special friendship of the prince, and by his prudence and ability, no less than by his devotedness, he fully justified the confidence that was placed in him. In 1677 he was sent by the prince to England to solicit the hand of the princess Mary, eldest daughter of James, then duke of York. At the Revolution he was the chief medium of communication between the prince and the English nobility, and in the delicate negotiations his practical shrewdness greatly facilitated the arrival at a proper understanding. After superintending the arrangements in connection with the prince's expedition, he accompanied him to England, and was made groom of the stole, privy purse, first gentleman of the royal bedchamber, and first commissioner on the list of privy councillors. On 9th April, 1689, he was created Baron Cirencester, Viscount Woodstock, and earl of Portland. With the rank of lieutenant-general he distinguished himself in command of the Dutch cavalry at the battle of the Boyne in 1690, and he was also present at the battle of Landen in 1693, and at the siege of Namur in 1695. Along with marshal de Bouflers he prepared the terms of the peace of Ryswick in 1697, and shortly afterwards was appointed ambassador-extraordinary to Paris. Notwithstanding his diplomatic skill, his grave and cold manner rendered him unpopular with the English nobility, and his brusque honesty caused him to be sometimes wanting in outward respect to the king. Gradually his influence at the court was supplanted by that of the earl of Albemarle, who was more skilled in the arts of popularity; and in 1700, notwithstanding the efforts of the king to soothe his wounded vanity, he resigned his offices and retired to his seat at Bulstrode, Bucks, where he occupied his leisure in gardening and in works of charity. For receiving grants of land in Ireland, and for his share in the partition treaty, he was impeached by parliament, but the prosecution did not succeed. He died 23d November, 1709, and was buried in Westminster Abbey.

PORTLAND, WILLIAM HENRY CAVENDISH BENTINCK, THIRD DUKE OF (1738–1809), prime minister of England, was the grandson of Henry, second earl and first duke of Portland, who was son of William, first earl. He was born 14th April, 1738, and was educated at Oxford university, where he graduated M.A. in 1757. In 1761 he was elected to represent the borough of Weobly (Hereford) in parliament, but in May of the following year he was called to the Upper House on the death of his father. Under the marquis of Rockingham he was, from July, 1765 to July, 1766, lord chamberlain, and on the return of the marquis of Rockingham to power in 1782 he was made lord-lieutenant of Ireland. After the short ministry of Shelburne, succeeding the death of Rockingham, the duke of Portland was selected by Fox and North as a "convenient cipher" to become the head of the coalition ministry, to the formation of which the king was with great reluctance compelled to give his assent. The duke held the premiership from 5th April, 1783, until the defeat of the Bill for "the just and efficient government of British India" caused his dismissal from office on 17th December. In 1792 he succeeded the earl of Guildford as chancellor of the university of Oxford. Under Pitt he was, from 1794 to 1801, secretary of state for the home department, after which he was, from 1801 to 1805, president of the council. In 1807 he was appointed a second time first lord of the treasury. Ill-health caused him to resign in September, 1809, and he died 30th October following. He owed his political influence chiefly to his rank, his mild disposition, and his personal integrity, for his talents were in no sense brilliant, and he was deficient in practical energy as well as in intellectual grasp.

PORTLAND CEMENT. See BUILDING, vol. iv. p. 411, and CEMENTS, vol. v. p. 285.

PORTLAND VASE. See GLASS, vol. x. p. 579.

PORT LOUIS. See MAURITIUS, vol. xv. p. 647.

PORT LYTTELTON, a municipal borough of New Zealand, formerly called Port Cooper and Port Victoria, lies on the northwest side of Banks Peninsula, on the east coast of South Island. The town situated in 43° 36′ S. lat. and 172° 44′ E. long., stands on the north shore of a small bay 4 miles southwest from the heads. A fixed white light, visible 30 miles in clear weather is placed on Godley Head on the northwest side of the entrance to the bay. Harbor works, costing over £300,000 [$1,458,000], have made Port Lyttleton a first-rate commercial port. Protecting breakwaters have created a fine, accessible wet dock of about 110 acres in extent and contiguous to the town; there is ample wharf accommodation for large vessels and every appliance for loading, discharging, and storing cargo. A graving-dock, closed by a caisson, is 450 feet long, 82 feet broad between the copings and 46 feet on the floor, and has a depth of 23 feet of water on the sill. The shipping, excluding coasters, entered inwards at Port Lyttleton during 1883 amounted to 124 vessels of 83,117 tons, and 140 of 120,328 tons cleared outwards. Imports have increased in value from £629,457 [$3,059,161.02] during 1872 to £1,400,106 [$6,804,515.16] during 1883, and exports from £829,260 [$4,030,203.60] to £1,944,035 [$9,448,010.10]. Port Lyttelton is surrounded by steep hills, and is connected by rail with Christchurch, 7 miles inland. There is steam communication twice a week with the chief ports of New Zealand, and weekly with Melbourne. The population in the census of 1881 was 4127. The town which is supplied with water and gas, and with electric light lamps on the wharves and the railway bridge, has post and telegraph offices, a time observatory, a jail for long-service prisoners, a state school, a sailors' home, and an orphanage.

PORT MAHON, or MAHON, a city and seaport in the Mediterranean, on the east coast of the Spanish island of Minorca (see BALEARIC ISLANDS), lies on a height near the head of an inlet of the sea 3½ miles long by from 400 to 1200 yards wide, which, though of less importance than formerly, is still an admirable harbor of refuge. The city presents a fine appearance from the sea, and is solidly built of excellent stone, but contains few features of interest. Many of the houses bear the stamp of the English occupation, which has also left curious traces in the life of the people. Shoemaking is the principal trade, and shoes and the building stone already mentioned are the only important exports. The population was 21,976 in 1860, and 15,842 in 1877. At Cala Figuera (a cove to the southeast of the town) is a cotton-factory; the King's Island (I. del Rey, so called as the landing-place of Alphonso III. of Aragon in 1287) contains a hospital built by the admiral of the English squadron in 1722; farther southeast on the shore lies the village of Villa Carlos or George Town

(1746 inhabitants in 1877), with ruins of extensive English barracks; and at the mouth of the port, on the same side, are the remains of Fort San Felipe, which was originally erected by Charles V. and twice became the scene of the capitulation of British troops. Opposite San Felipe is the easily-defended peninsula of La Mola (256 feet high), which is occupied by extensive Spanish fortifications now in course of completion. Mahon is one of the principal quarantine stations of Spain; the hospital, erected between 1798 and 1803, stands on a long tongue of land, separated from La Mola by Cala Taulera.

Mahon is the ancient Portus Magonis, which under the Romans was a municipium (*Mun. Flavium Magontanum*), probably including under its authority the whole island. As the name suggests, it had previously been a Carthaginian settlement. The Moors had for some time been in possession when they were expelled by Don Jayme of Aragon in 1232. Barbarossa of Algiers besieged and captured the city in 1535; and in 1558 it was sacked by a corsair called Piali. The English, who under James Stanhope, afterwards Earl Stanhope, seized the island in 1708, made Mahon a flourishing city, and in 1718 declared it a free port. In the year 1756 it fell into the hands of the French, through the failure of the unfortunate Admiral Byng to relieve the garrison of St. Philip's (San Felipe). Restored to the English in 1762, it was in 1782 heroically but unsuccessfully defended by General Murray. In 1802 it was finally ceded to Spain by the treaty of Amiens.

PORTO ALEGRE, a city and seaport of Brazil, the capital of the province of Rio Grande do Sul, lies in 30° 2′ S. lat. and 51° 12′ W. long., at the northern extremity of the Lagõa dos Patos (Duck Lagoon), where it receives the waters of the Jacuhi, Sino, Cahi, and Gravatahi, whose confluence opposite the city is sometimes distinguished by the name of Lagõa Viamão. Like the other towns on this lagoon, Rio Grande do Sul and Pelotas, Porto Alegre is the seat of a very considerable trade, but it is impossible to sav precisely what share belongs to each of the three. (See Rio Grande do Sul.) Its harbor is accessible to vessels drawing 10 to 12 feet; it is the terminus of a railway running by São Leopoldo to Neuhamburg; and it serves as a centre for the various German colonies in the province. A cathedral, a seminary, a lyceum, a provincial library, government offices, a theatre, a large hospital, and a market-house are among the public buildings. The population is about 25,000.

Porto Alegre was founded in 1743 by immigrants from the Azores, and was at first known as Porto dos Cazaes. In 1770 it was chosen by José Marcellino de Figuereido as his residence and obtained its present name. Three years later it had 5000 inhabitants. The title of "town" with the full name São José de Porto Alegre was bestowed in 1808, and in 1812 São José became the governor's residence for the comarca, which till 1821 comprised both Rio Grande do Sul and Santa Catharina. In 1822 it was raised to the rank of a city, and in 1841, as a reward for its loyalty, was distinguished with the epithets "leal y valorosa."

PORTO BELLO (Span., *Puerto Bello*), a town in the republic of Colombia and state of Panamá, situated on the coast of the Caribbean Sea, about 23 miles east of Colon in 9° 32′ N. lat. and 78° 38′ W. long. As the name (bestowed by Columbus in 1502) implies, it possesses a fine natural harbor, the bay between Drake's Point in the north and Buenaventura Island in the south being easy of entrance and having a depth of 8 to 16 fathoms. Founded in 1584, the city rapidly grew in importance becoming the great depôt for the gold and silver from Peru, which were brought across the isthmus from Panamá, and here conveyed on board the royal galleons. It is now best remembered through the unexpected success which attended Admiral Vernon's attack in 1739. "Within forty-eight hours after his appearance in the harbor" he was in possession of the place, and before he left he utterly destroyed the fortifications. At that time the city contained about 10,000 inhabitants; it now barely numbers 1000, including the Negroes, who live in the quarter known as Guinea. A few public buildings, such as the principal church and the treasury, remain as indications of former prosperity. The decline is due much less to Admiral Vernon than to the extreme unhealthiness of the situation, and the fact that trade has taken to quite other channels.

PORTOBELLO, a municipal burgh of Scotland, in the county of Midlothian, lies on slightly sloping ground on the south shore of the Firth of Forth, 3 miles by rail east of Edinburgh. At the west end are extensive brickfields, two potteries (working English clay), two bottle-works, and a paper-mill. Southwards and eastwards the houses are those of a residential suburb of Edinburgh and a summer watering-place. Among the more conspicuous edifices are the new municipal buildings (1878), the old town-hall (1863), a United Presbyterian church (1880), the Free church (1876–77), the Episcopal church (1826), and the School Board schools (1876). Portobello beach is a fine reach of firm clean sands, but these have been to some extent spoiled by the vicinity of manufacturing works and sewage outlets. A marine parade was constructed in 1860 and a promenade pier (1250 feet long) in 1871. The population was 5481 in 1871 and 6794 in 1881. What used to be the separate village of Joppa is now included in Portobello.

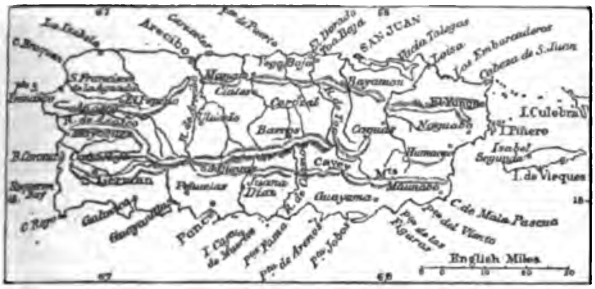
Portobello occupies part of a formerly desolate piece of ground known as the Figgate Whins. The first house was built by a sailor who had served under Admiral Vernon at the capture of Porto Bello in Central America in 1739; but the real beginning of the town dates from the discovery in 1765 of a bed of clay and the consequent erection of brick and tile works. It was made a burgh by the Reform Act of 1832–33.

PORT OF SPAIN. See Trinidad.

PORTO MAURIZIO, a city of Italy, chief town of a province and centre of a maritime district, lies on the coast of the Ligurian Sea, 46 miles by rail east of Nice and 70 miles west of Genoa, and consists of a picturesque old town situated on the heights and a modern town of villas on the lower slopes. The principal church, designed by Gaetano Cantone, is perhaps the most notable building of its class in the whole Riviera; the roof is divided into arches, domes, and semi-domes resting on massive piers. A few remains of the old city walls may still be seen. In 1881 the population of the city was 6309 and of the commune 6827. About 2 miles east of Porto Maurizio is the town of Oneglia, with a fine church, S. Giovanni Battista, designed by Gaetano Amoretti, a hospital (1785), and a national penitentiary on the cell-system. Its population in 1881 was 7286, that of the commune 7433. Both Porto Maurizio and Oneglia lie on the same bay, and schemes are under discussion for uniting their harbors into one great port. At Porto Maurizio an extension is being made (1884) in the western mole. The foreign traffic of the two ports was represented in 1883 by 154 sailing vessels and 27 steamers entering or clearing (the steamers all preferring Porto Maurizio), and the coasting trade by 627 vessels. Both towns are embowered amid olive groves, and the district is famous for the quality of its oil.

Porto Maurizio appears as *Portus Mauricii* in the Antonine Itinerary. After being subject to the marquises of Susa (11th century), of Savona (12th century), and of Clavesana, it was sold by Boniface of Clavesana in 1288 to Genoa for a yearly pension; in 1354 it became the seat of the Genoese vicar of the western Riviera, and remained in the possession of the republic till it was merged in the kingdom of Sardinia. Oneglia, formerly situated inland at the place called Castelvecchio (Old Castle), has occupied its present site from about 935. The bishops of Albenga sold it in 1298 to the Dorias of Genoa, who in their turn disposed of it in 1576 to Emanuel Philibert. In the various wars of the house of Savoy Oneglia often changed hands. In 1614 and 1649 the Spaniards and in 1623 and 1672 the Genoese obtained possession; in 1692 it had to repulse an attack by a French squadron; in 1744–45 it was again occupied by the Spaniards, and in 1792 bombarded and burned by the French. Pellegrino Amoretti, assistant secretary to Charles V., and Andrea Doria, the famous admiral, were natives of Oneglia.

PORTO RICO (Span., *Puerto Rico*), one of the Spanish West India Islands, lies 70 miles east of Hayti between 17° 50′ and 18° 30′ N. lat. and 65° 35′ and 67° 10′ W. long. It forms an irregular parallelogram, 108 miles long and 37 broad, and has an area of 3530 square miles, or rather less than that of Jamaica. From east to west it is traversed by a range of hills so situated that the streams flowing northward are much longer than those flowing south. The highest district, however, and the highest peak—El Yunque (3600 feet)—are situated in the Sierra de Loquillo near the northeast corner. As the hills intercept the northeast trade-winds with their rain-clouds there is sometimes almost a superabundance of moisture in the northern lowlands, while in the south severe droughts occur and the land demands artificial irrigation, as yet carried out with too little co-operation and system. The island is, however, exceptionally well watered, 1300 streams being enumerated, of which forty-seven are considerable rivers ; and its general appearance is very beautiful. Forests still cover all the higher parts of the hills, and differ from those of the other West Indian Islands mainly in the comparative absence of epiphytes. Among the noteworthy trees Baron Eggers (see *Nature*, 6th December, 1883) mentions the *Coccoloba macrophylla*, or "ortegon" of the natives, which forms extensive woods in some places, chiefly near the coast, and is conspicuous by its immense yard-long purple spikes ; a beautiful *Talauma*, with white odorous flowers, and yielding a timber called "sabino" ; an unknown tree with purple flowers like those of *Scævola Plumieri ;* a large *Heliconia ;* and several tree-ferns (*Cyathea Serra* and an *Alsophila*). Besides the two staples—sugar and coffee—tobacco, cotton, rice, maize, *Caladium esculentum*, yams, and plantains, as well as oranges, cocoa-nuts, and other tropical fruits, are commonly cultivated. The rice, which is the principal food of the laborers, is a mountain variety grown without flooding. On the lowland pastures, covered mainly with *Hymenachne striatum*, large herds of excellent cattle are reared to supply butcher-meat for St. Thomas, the French islands, etc. In general Porto Rico may be described as extremely fertile, and its exports more than double in value those of Jamacia. In 1883 the principal items were—sugar and molasses, 78,482 tons, valued at £1,036,595 [$5,037,851.70] ; coffee, 16,801 tons, at £955,948 [$4,594,107.28] ; honey, 30,378 tons, at £148,148 [$719,999.28] ; and tobacco, 1730 tons, at £114,614 [$557,024.04]. Of the tobacco a large proportion is sent to Havana to be manufactured into cigars. The total value of exports and imports has increased from £2,219,870 [$10,788,568.20] in 1850 to £5,118,712 [$24,876,940.32] in 1883. The great want of the island is still roads and bridges, though the Government has done good work in this department in recent years ; the journey across the hills can only be performed on horseback, and even along the coast-route wheeled traffic is at times interrupted. Gold, iron, copper, coal, and salt are all found in Porto Rico, but the last alone is worked.



Porto Rico.

The island, which was declared a province of Spain in 1870, is divided into the following seven departments: *Bayamon*, near the northeast end of the island (containing the capital, San Juan Bautista, and Toa-Alta, Toa-Baja, Naranjito, Vega-Alta, etc.), *Arecibo* (Arecibo, Hatillo, Camuy, Quebradillas, etc.), *Aguadilla* (Aguadilla, Moca, Aguada Lares or San Sebastian), *Mayaguez* (Mayaguez, Añaico, San German), *Ponce* (Ponce, Guayanilla, Peñuelas, Coamo), *Humacao* (Humacao, Naguabo, Luquillo), *Guayama* (Hato-Grande, Gurabo, etc.). And the island of Viequez (with the town of Isabel Segunda) is attached as an eighth department, and used as a military penal station. The total population of Porto Rico was not more than 319,000 in 1830; by 1860 it reached 583,308; and by 1880 754,313. At this last date 429,473 (219,418 males and 210,055 females) were white and 324,840 (162,352 males and 162,488 females) colored. There is still plenty of room for further expansion. Among the people of European origin are Spaniards, Germans, Swedes, Danes, Russians, Frenchmen, Chuetas or decendants of Moorish Jews from Majorca, and natives of the Canary Islands. There are also a number of Chinese. The Gibaros or small landholders and day-laborers of the country districts are a curious old Spanish stock largely modified by Indian blood. Till 1856 it was believed that no trace of the original inhabitants of the island remained ; archeological collections, however, have since been made and are now preserved in the Smithsonian Institution, the Ethnological Museum in Berlin, and elsewhere. They comprise stone axes, spear-heads, and knives, stone and clay images, and fragments of earthenware. At Gurabo, on the banks of the Rio Grande de Loiza, there is a curious rude stone monument, on the upper surface of which appear several strange designs (see L. Krug, "Ind. Alterth. in Porto Rico," in *Z. für Ethn.*, Berlin, 1876.)

Principal Towns.—San Juan Bautista or St. John's (24,000 inhabitants in town and district), the capital, lies in 18° 29′ N. and 66° 7′ W. on the north coast, on a small island (Morro) connected with the mainland by bridges. It is a place of some strength and contains a governor's palace in the old fort of Santa Catalina, a palace erected by Ponce de Leon, a cathedral, a town-house, a theatre, etc. The harbor is one of the best in the West Indies, having a comparatively unobstructed entrance, and along the wharves a depth at low water of 10 to 13 feet, and at high water 11½ to 14½. Ponce (38,000 inhabitants in town and district) lies about 3 miles inland from the south coast. Its public buildings are frequently of brick or stone, but the private houses are of wood. It contains a town-hall (situated, like the principal church, in the main square), a public hospital (1875), and an English Episcopal church, and it is lighted with gas by an English company. Mayaguez (27,000 inhabitants in town and district), on the west coast, is also situated several miles inland, and is separated from its port by a river. An iron bridge, however, was constructed about 1875–76. The town has military barracks, clubs, and gasworks. The harbor, accessible only to vessels drawing less than 16 feet, is silting up, as indeed is the case with almost all the harbors of Porto Rico. Other towns are Guayama on the south coast, with its harbor at Arroya, and San Carlos de Aguadilla on the west coast. The seaports are St. John's, Ponce, Mayaguez, Naguabo, Fajardo, Aguadilla, and Viequez.

History.—Porto Rico, the Borinquen of the aborigines, was discovered by Columbus in November, 1493. In 1510 Ponce de Leon founded the town of Caparra, soon after abandoned and now known as Puerto Viejo, and in 1511, with more success, the city of San Juan Bautista. The native inhabitants—probably not very numerous, though, with their usual exaggeration, old chroniclers rate them at 600,000—were soon subdued and swept away.[1] In 1595 the capital was sacked by Drake, and in 1598 by the duke of Cumberland. In 1615 Baldwin Heinrich, a Dutchman, lost his life in an attack on the Castello del Mono. The attempt of the English in 1678 was equally unsuccessful, and Abercromby in 1797 had to retire after a three days' siege. In 1820 a movement was made towards a declaration of independence on the part of the Porto Ricans, but Spanish supremacy was completely re-established by 1823. The last traces of slavery were abolished in 1873 by the abrogation of the system of forced labor.

See Antonio de Herrera, "Descripcion de la isla de Puerto Rico, 1582," in *Boletin de la Soc. Geogr. de Madrid*, 1876 ; Bello y Espinosa, "Geschichtl., geogr., und stat. Bemerk. über Puerto Rico," in *Zeitschr. für Ethnologie*, 1872 ; Inigo Abbad, *Historia . . . de la Isla de S. J. B. de Puerto Rico*, Madrid, 1788, republished by José Julian Acosta of Porto Rico.

PORT ROYAL, a town and naval station of Jamaica, occupies the outer end of a narrow strip of land called the "Palisades," which, projecting westward for about 9 miles, forms the natural breakwater of the noble bay on which Kingston, the present capital of the island, is built. As a town Port Royal (though in the 17th century it was reputed the finest in the West Indies) is now a wretched place of 1205 inhabitants (1881), with narrow and extremely dirty streets, and contains no buildings of note except a hospital (200 patients) and the spacious admiralty house, which is surrounded by beautiful gardens; but as a naval station it is still of very considerable importance, has well-equipped machine-shops, and is defended by a number of forts and batteries partly of quite modern erection.

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[1] A detailed account of their manners, translated from Abbad by Mr. Bidwell, will be found in the *Consular Reports*, 1880.

The first great blow struck at the prosperity of Port Royal was the earthquake of 1692, which swallowed up whole streets and forts and sunk a considerable part of the site into the sea, where remains of buildings are still visible under water in clear weather. In 1703 the whole town, except the royal forts and magazines, was reduced to ashes; on 22d August, 1722, most of the houses were swept into the sea by a hurricane; in 1815 another conflagration proved nearly as destructive as the first; and in 1880 another hurricane did grievous damage.

PORT ROYAL, a celebrated Cistercian abbey, occupied a low and marshy site in the thickly-wooded valley of the Yvette, at what is now known as Les Hameaux near Marly, about 8 miles to the southwest of Versailles. It was founded in 1204 by Mathilde de Garlande, wife of Matthieu de Montmorenci-Marli, during his absence on the fourth crusade, and in its early years it received a variety of papal privileges, including (1223) that of affording a retreat to lay persons who desired to withdraw from the world for a season without binding themselves by permanent vows. Apart from the famous reforms begun here in 1608 by Jacqueline Marie ARNAULD (*q.v.*), the Mère Angélique, the history of Port Royal presents little of general interest until about ten years after the establishment (1626) of the sister house of Paris, when the community fully came under the influence of Duvergier de Hauranne (see vol. vii. p. 489), abbé of St. Cyran, the friend of Jansen, and leader of the anti-Jesuit movement in France. The religious views of St. Cyran spread rapidly in Port Royal de Paris, and among the members and connections of the Arnauld family; and it was under his influence that in 1637 Antoine Le Maître (1608–1658), a nephew of the Mère Angélique, resolved to abandon his brilliant prospects as an advocate and seek a life of ascetic retirement. He found a lodging for himself at Port Royal des Champs (as the mother house came to be called for distinction's sake), which since the departure of the nuns in 1626 had been untenanted. In the following year he was joined in his religious retreat by his younger brothers Simon de Séricourt (1611–1658), who had served in the army, and Louis Isaac (1613–1684), better known in the world of letters by his assumed name of De Sacy. They were at various times joined by others until in 1646 the "solitaries of Port Royal," apart from merely occasional visitors, had risen to the number of twelve. From almost the beginning of his sojourn Le Maître, carrying out the ideas of his imprisoned master St. Cyran, devoted a considerable part of his time to teaching; the number of pupils and also of teachers gradually increased until in 1646 and following years the "Petites Écoles," as they were modestly called, around Port Royal les Champs and in Paris, although destined to be short-lived, attained a great and widespread success (compare vol. vii. p. 586). Of the regular teaching staff probably the most distinguished were Claude Lancelot (1615–1695)[1] and Pierre NICOLE (*q.v.*); of the pupils it is enough to mention TILLEMONT (*q.v.*) and RACINE (*q.v.*). In 1648 the Mère Angélique with some of the nuns returned from Paris to Port Royal des Champs, which in the interval had been considerably enlarged, while the neighborhood had been rendered more salubrious by the labors of the solitaries, who now removed to the farmhouse of Les Granges on the height above. In the same year Antoine ARNAULD (*q.v.*), the apologist of the *Augustinus*, came into residence, and thenceforward the "gentlemen of Port Royal" became closely identified in the public mind with the Jansenist cause. The open struggle, which began with the publication in 1653 of the bull of Pope Innocent X. condemning the five propositions (see JANSENISM), came to a disastrous crisis in 1656, when Arnauld was expelled the Sorbonne, and he, as well as Sacy, Fontaine, and Nicole, had to go into hiding. The publication of the *Provincial Letters* in the course of the same year did not tend to soothe the Jesuits, but the timely "miracle of the Holy Thorn" (24th May. 1656; see vol. xviii. p. 340) helped to postpone somewhat the evil days that were coming on the Port Royalists. But only for a time; for in 1661 the young and ardently orthodox Louis XIV. caused the Petites Écoles to be broken up and the postulants and novices of the two religious houses to be dispersed. For continued contumacy both houses were in 1664 laid under interdict, which was only removed when the "peace of the church" was established by Clement IX. in 1669. In the same year, however, Port Royal de Paris was separated from the parent house with a grant of one-third of the revenues, and placed under Jesuit management. The nuns of the abbey of Port Royal des Champs were allowed to take in children as pupils, but not to receive any accessions to their own number, and the Petites Écoles were not resumed. The "peace," such as it was, was again destroyed by the bull of Clement XI. in 1705, and in 1708, the nuns proving inflexible, a papal bull was granted for the final suppression of Port Royal des Champs and the transference of the whole property to Port Royal de Paris. The dispersion of the aged sisters took place in the following year; the buildings were levelled with the ground in 1710; and in 1711 the bodies (to the number, it is said, of nearly 3000) that lay buried within the desecrated precincts were disinterred and removed to other places. Port Royal de Paris continued to subsist in obscurity until 1790.

See Sainte-Beuve, *Port Royal* (3 vols., 1842–43; 4th ed., 6 vols., 1878), an exhaustive work, by which all the earlier histories have been superseded.

PORT SAID, a town and seaport of Lower Egypt, which owes its existence to the Suez Canal (1859-69), and was named after Sa'íd Pasha, patron of the enterprise. It lies on the west side of the canal, on the low narrow, treeless, and desolate strip of land which separates the Mediterranean from Lake Menzaleh (see plate XXXVI., vol. iv.); the supply of fresh water brought from the sweet-water canal at Ismailia by a conduit is barely sufficient for the wants of the town, which is regularly laid out and has some streets of substantial houses. The population rose from 12,332 in 1880 to 16,560 in 1882. Nearly half of this number reside in a miserable native suburb about 500 yards to the west of the town proper. The British subjects (405) are nearly all Maltese. Port Said, having no direct means of communication with the interior, is essentially a coaling station for steamers, and is entirely dependent on the canal trade. The steamers from Alexandria to the Syrian ports call here, and there is a daily steamboat to Ismailia. The outer harbor is formed by the terminal piers of the canal, and the inner harbor comprises three sheltered basins,—the commercial dock, the arsenal dock, and the Sherif dock. The third is flanked by buildings originally erected by Prince Henry of the Netherlands as a depôt for Dutch trade. Besides a Catholic and a Greek church, the town contains a hospital and five schools, one of which is maintained by the Capuchin friars, and another by the freemasons.

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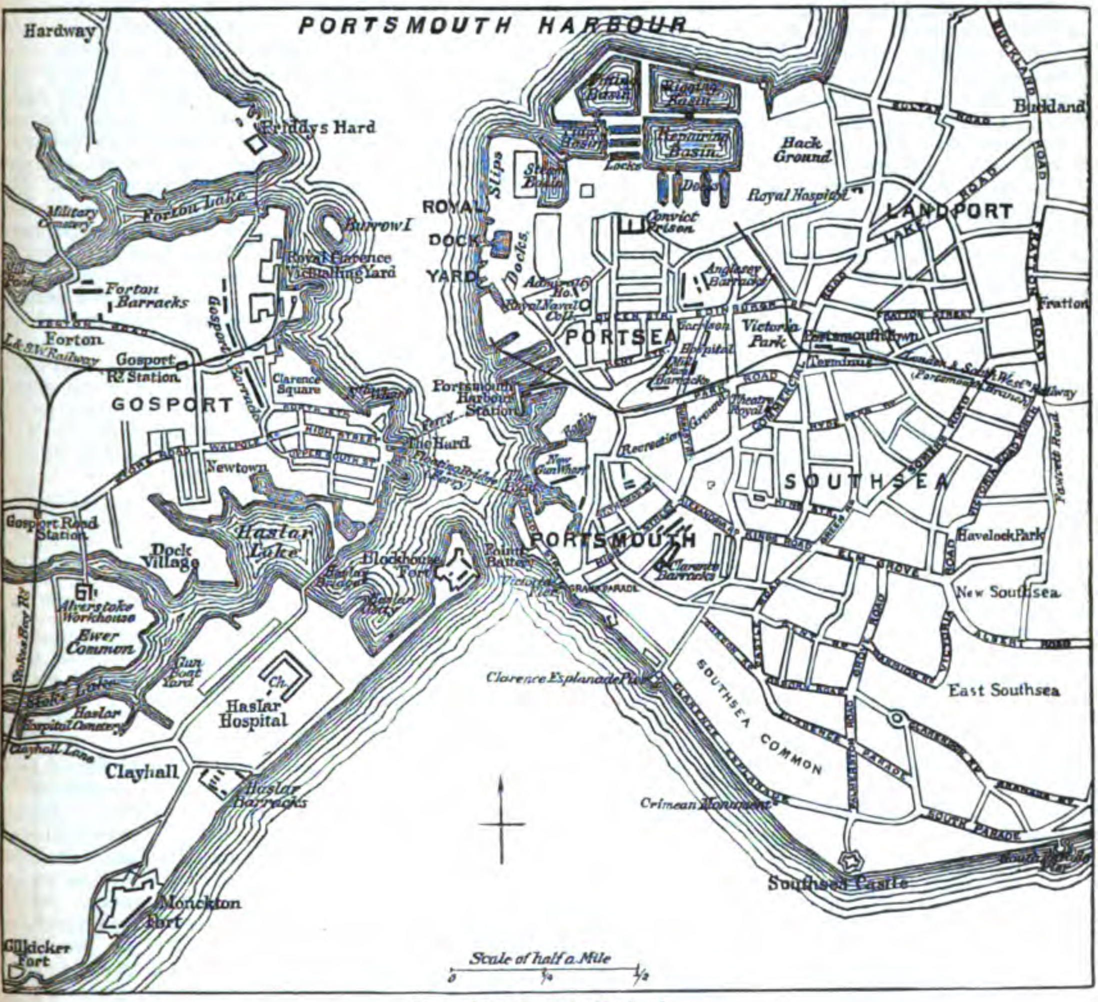
[1] Author of *Nouvelle Méthode pour apprendre la Langue Grecque* (1655), *Nouvelle Méthode pour apprendre la Langue Latine* (1656), *Grammaire générale et raisonnée* (1660), and other educational works.

PORT ST. MARY. See PUERTO DE SANTA MARIA.

PORTSMOUTH, a municipal and parliamentary borough, seaport, and naval station of Hampshire, England consists of an aggregate of towns situated in the southwestern corner of Portsea Island, opposite the Isle of Wight, 18 miles south by east of Southampton and 74 southwest of London by the London and Southwestern Railway. For the general position of Portsmouth, see plate VII. vol. xi. The original town is not now nearly so populous as the suburbs comprised in the general name of Portsea (including Portsea proper) on the north and west, Landport on the north, and Southsea on the east. Portsmouth proper is the barrack and garrison town; at Portsea is situated the great naval dockyard; Landport is occupied chiefly by the houses of artisans; and Southsea, as possessing facilities for bathing, is resided in by the wealthier classes. The old High Street of Portsmouth, which is now continuous with the Commercial Road from the Landport side, forms a spacious and busy central thoroughfare 2 miles in length, with numerous fine buildings, including the new and old post-office, the new offices of the Waterworks Company and Gas Company, the Central or Town Railway station, the new Government House with its pleasure-grounds, the quaint old building occupied by the new free library, and the grammar-school, which was founded in 1732, though the new building was opened in 1879. Since the demolition of the ancient ramparts and unwholesome moats a few years ago there have sprung up a handsome people's park and recreation grounds for the naval and military forces, and improvements are still being vigorously carried forward. Much of the Government work has been done by convict labor, notably at the northeast of Landport, where 1300 convicts have been engaged in the formation of a new island (Whale Island), on which gunnery experiments are carried out in connection with the training-ships of the gunnery school. The towns constitute one of the strongest fortresses of the kingdom, being protected by a chain of detached forts, the outer line of which on the land side north of the harbor extends along the Portstown Ridge, the inner line protecting the approach by Stokes Bay and Gosport on the west side, while eastwards are the Hilsea lines, within which are also the Royal Artillery and cavalry barracks of Hilsea and the powder-magazine of Tipner. On the south side the forts are built in the sea, each being provided with an Artesian well sunk into the sea bed, from which a plentiful supply of fresh water can at all times be obtained. The coast to the eastward is lined by the forts of "Cumberland" and "Southsea Castle," which complete the circle. There are 8 barracks—5 in Portsmouth, 1 in Southsea, and 2 in Portsea—and at Eastney are the extensive buildings which constitute the headquarters of the Royal Marine Artillery; on the Gosport side of the harbor are those of the Portsmouth division of the Royal



Plan of Portsmouth, England.

Marines. In the church of St. Thomas a Becket (12th cent.) the chancel and transepts form part of the original structure; the nave and tower were erected in 1698. The garrison chapel near the grand parade, in the Early English style, formed originally a portion of the hospital of St. Nicholas (1212), and was restored in 1866. Among more recent buildings may be mentioned the new jail and county lunatic asylum, both situated on the outskirts. In the centre of the town and adjoining the people's park are the new cathedral and buildings of the Roman Catholic schools, the new Presbyterian church, the seamen and marines orphan schools, the offices of the board of guardians and the borough overseers. At Portsea a new railway station has been built on piles driven into the harbor bed. Besides these, amongst other public buildings may be mentioned the town-hall, the county court, and the theatre. At Portsea is Aria College, opened in 1874 for the training of Jewish ministers. In the same town is situated the convict prison, which superseded the hulks in 1852. Landport has a freemasons' hall (1879–80), and a people's park of eight acres opened in 1878. Southsea, which is only of recent origin, possesses assembly-rooms and baths, a pier (1879), and a fine esplanade 2 miles in length. Southsea Castle, built by Henry VIII., was taken by the Parliamentary forces in 1642 and partly dismantled, but it has now been refortified. The creek which formerly separated Portsmouth and Portsea was filled up in 1876.

The port of Portsmouth extends eastward 9 miles to Emsworth, and westwards 5 miles to Hill Head at the entrance to Southampton Water. About 3 miles to the south of the harbor is the well-known anchorage of Spithead, protected by the Isle of Wight. The harbor, one of the best in the kingdom, stretches 4 miles inwards to the northwest of the town, with an entrance 220 yards in breadth, permitting access to vessels of the largest tonnage at low tide. There is an anchorage within the basin at low tide of 380 acres, and a portion of the harbor is permanently occupied by dismantled vessels and the reserved fleet of the navy. There is a graving-dock built by the corporation, with 18 feet of water on the blocks, and a patent slip. Extending along the eastern shore are the ordnance gun wharf between Portsmouth and Portsea and to the north of it the great naval Government dockyard, which has lately been much enlarged (see DOCKYARD, vol. vii. 272). At GOSPORT (*q.v.*) are the royal Clarence victualling yard and the Haslar hospital. Portsmouth has a considerable trade in coal, timber, fruits, and agricultural produce. In 1883 the total number of vessels that entered the port from British and foreign possessions and coastwise was 2094 of 210,210 tons burden, the number that cleared 2079 of 216,926 tons. The borough of Portsmouth is governed by a mayor, fourteen aldermen, and forty-two councillors. The area of the borough is 4320 acres, with a population in 1871 of 113,569, and in 1881 of 127,989. Of the latter number 120,022 were included in Portsea.

To the north of Portsmouth harbor is Porchester Castle, a ruined Norman fortress occupying the site of the *Portus Magnus* of the Romans. The *Saxon Chronicle* mentions the arrival of Port and his two sons on the coast in 501, but the derivation of the name Portsmouth is too evident to require a mythical invention to explain it. Portsmouth, though a small town soon after the Norman invasion, did not possess a church till 1140. It received its first charter from Richard I. In the beginning of the 13th century it had grown to be a naval station of some importance, and for the accommodation of the king's galleys the docks were enclosed by a strong wall. A large portion of the town was burned by the French in 1372. Great additions were made to the fortifications by Edward IV., and the works were continued by later sovereigns, especially Elizabeth and James II. Its importance as a naval dockyard commences about 1544. The English fleet assembled at Portsmouth in 1545 before the naval engagement with the French off Spithead. In 1628 Villiers, duke of Buckingham, when on the point of embarking at Portsmouth with the army for the relief of
Rochelle, was killed by Felton. The town was
Parliamentary forces in 1642. In 1662 the
Charles II. with Catherine of Braganza were
Portsmouth in the chapel of the garrison.
"Royal George," with Admiral Kempenfeld
having been careened to stop a leak, went
harbor. About 1792 Portsea began to be built on
to the north of the town. Among eminent
nected with the town mention may be mad
Dickens, Jonas Hanway, Sir Isambard Brunel, S

Allen, *History of Portsmouth*, 1817; Saunders, *A*
mouth, 1878.

PORTSMOUTH, a city and port of e
United States, one of the two shire-towns o
ham county, New Hampshire, and alter
Concord the seat of the sessions of the Un
courts for the district of New Hampshire
peninsula on the right bank of the Piscataq
from its mouth, in 43° 4′ N. lat. and 70° 4
By rail it is 57 miles north-northeast of Bost
and old-fashioned beyond most of the Ne
cities, with shaded streets and many quai
houses, survivals from colonial times, Ports
favorite summer resort. Notwithstanding
lence of its harbor—which is from 35 to 75
safe, free from ice at all seasons, and capa
taining 2000 vessels—it has very little for
There are cotton-mills (Kearsarge), brewerie
shoe factories, and some other industrial esta
in the city; and shipbuilding, which is th
industry, has long been extensively prosec
United States navy yard, though situate
tinental or Navy Island, on the north side o
in the township of Kittery (Maine), is gene
as Portsmouth yard. It contains a fine b
dock, 350 feet by 105. Among the more c
buildings in Portsmouth are the old church o
the athenæum (15,000 volumes), and the cus
There is a public library of 8000 volumes.
Harbor, 2 miles distant, is Governor W
mansion, dating from 1750. The entran
harbor is defended by earthworks at Jaffr
and Gerrish's Island. The population w
1850, 9211 in 1870, and 9690 in 1880.

Settled in 1623 under the Laconia Company,
Bank (as it was first called) was named Portsmo
and incorporated as a city in 1849. It was the c
colony and State of New Hampshire till 1807
rank was bestowed on Concord. The "Ranger,
commanded by Paul Jones, and the first ship
stars and stripes, was built at Portsmouth for t
Congress in 1777. The *New Hampshire Gazett*
Portsmouth in 1756, is the oldest of all the ex
papers of the United States, and the *Portsmo*
established in 1793, is also still published. T.
J. T. Fields, Eliza B. Lee, and B. P. Shillaber (
ington") are natives of the city.

PORTSMOUTH, a city of the United S
tal of Scioto county, Ohio, lies at the con
the Scioto with the Ohio, and is the souther
of the Ohio and Erie Canal, and of a bran
the Cincinnati, Washington, and Baltimor
(Hamden to Portsmouth, 56 miles), as well
portant station on the Scioto Valley Railwa
entrepôt for the rich mineral regions of sou
and northeastern Kentucky, and for the
valley of the Scioto. Portsmouth has a large a
trade both by rail and river; and it also co
furnaces, rolling-mills, foundries, saw-mill
mills, breweries, flour-mills, shoe-factories
spoke factories, etc. Among the public bu
an opera-house and a masonic temple. The
institutions include a hospital, a children's
a home for destitute aged women. The ci
two libraries, water-works, and tramways.
lation was 6268 in 1860, 10,592 in 1870, and
1880. Portsmouth was laid out in 1803,
charter of the city dates from 1814.

PORTSMOUTH, a city of the United S
tal of Norfolk county, Virginia, lies on the

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[1] [*The Maryland Gazette* is older. See Vol. XVII. p. 445.—AM. ED.]

ig-iron, and early vegetables. The
96 in 1860, 11,390 in 1880, and 14,870
outh was founded in 1752. On 20th
avy yard—then employing 1000 men
by fire, the loss being estimated at
llars.

TICS.

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reña which separates Algarves from
gal, forms various small ranges and
s, such as the Serra do Malhão
onte Figo, and then closes with the
ue (2963 feet) and runs into the sea
of Cape St. Vincent,

Rivers.

of Portugal is also merely a portion
Its three most important
o, the Tagus, and the
e in Spain and flow through that
y all enter the sea in Portugal,
s of the Douro and the Tagus are
ost important cities of the kingdom,
n. The chief Portuguese tributaries
he Tameja, the Tua, and the Sabor
the Agueda, the Coa, and the Paiva
he Tagus, the Ellja, the Ponsul, and
north, and the Niza, the Sorraya,
the south; while into the Guadiana,
ortuguese bank, flow the Caia, the
Vascão. The other important rivers
ich forms the boundary of Portugal
he lower part of its course, the
do, the Vouga, and the Mondego
e Tagus, and the Sado, the Mira,
d the Silves to the south of it.
the rivers of Portugal, it has no
y of mention, though it abounds in
dicinal springs, such as the Caldas
nd beautiful little mountain-lakes
the tops of the Serra da Es-

Climate.

Portugal is particularly equable and
salubrious qualities were
English doctors of the
o used to send many patients to
luding Fielding the novelist; and,
has been superseded as a winter
viera and Algiers, there are signs
become a European health-resort
rtance. To prove the temperate
ate it is not enough to state that the
mperature of Lisbon, Coimbra, and
61.1°, and 60.2° Fahr. respectively;
is it to mention that the mean
re for the month of January is only
mbra and Oporto, and for July only
or the same two cities, showing a
summer and winter of about 20°.
temperature is partly caused by the
ll which is precipitated on Portugal
t westerly kingdoms of Europe and
d to the Atlantic, and which has
s 16 feet in a year; but it is notice-
avy rainfall comes down in gradual
ver the whole year, and not in the
opics. This great humidity has its
ll as its advantages, for, though
rich, it produces also heavy fogs,
Portuguese coast exceedingly dan-
This charming climate and equability
re not, however, universal in Por-
be enjoyed mainly in the highlands
dura, and in the northern provinces,

of Elizabeth river, opposite Norfolk. It is the eastern terminus of the Seaboard and Roanoke Railroad (part of a great passenger route between Boston and New Orleans), has one of the best harbors on the Atlantic coast, is the seat of the United States Gosport navy yard (with a dry dock built of granite at a cost of $974,536, and a large naval hospital), and exports cotton, lumber, pig-iron, and early vegetables. The population was 9496 in 1860, 11,390 in 1880, and 14,870 in 1884. Portsmouth was founded in 1752. On 20th April, 1861, the navy yard—then employing 1000 men—was destroyed by fire, the loss being estimated at several million dollars.

PORTUGAL.

PART I.—GEOGRAPHY AND STATISTICS.

Plate IV. THE kingdom of Portugal, which is geographically a province of the Iberian Peninsula on its west coast, is bounded on the N. by the Spanish province of Galicia, on the E. by the Spanish provinces of Leon, Estremadura, and Andalusia, and on the S. and W. by the Atlantic Ocean. **Boundaries.** It lies between 36° 56′ and 42° 10′ N. lat. and 6° 15′ and 9° 30′ W. long. It is 362 miles in length by 140 in breadth, and contained by the latest (1878) computation[1] 34,419½ square miles. **Coasts.** Its coast-line is nearly 500 miles in length, and only one province, Tras-os-Montes, is not washed by the sea. On the extreme north the coast is low, but farther south it becomes rocky and steep for a few miles near Povoa de Varzim. From that town to Cape Carboeiro the coast of Beira is flat, sandy, and marshy, closely resembling the French Landes; after another stretch of dunes it again becomes steep and rugged from Cape Roca to Cape Espichel, and along the northern side of the Bay of Setubal, and then remains low throughout the rest of the coast-line of Estremadura (Portuguese). In Alemtejo the coast is low and in places rocky and full of shallows; and, although at Cape St. Vincent the cliffs are steep and inaccessible, the general coast-line of Algarves, the southernmost province of Portugal, is low and sandy. **Capes.** The chief capes, which form the only cliffs on the otherwise flat and sandy coast, are Cape Mondego, Cape Carboeiro, Cape Roca, Cape Espichel, Cape Sines, Cape St. Vincent, and Cape Santa Maria, and the chief bays are those of Figueria, Ericeira, Setubal, and Sines. **Islands.** The only islands off the coast are the dangerous Farilhões and the Berlengas off Cape Carboeiro, which would be uninhabited but for an old castle, now used as a prison, on the largest island of the latter group.

Mountains. The mountain-systems of Portugal can only be adequately treated under SPAIN (*q. v.*), as they are in every instance continuations to the west or southwest of the great Spanish ranges. Thus the mountains of the Cantabrian Pyrenees in Galicia spread themselves over the two northern provinces of Portugal, Entre Minho e Douro and Tras-os-Montes, in various short ranges, of which the most important are the Serra do Gerez (4815 feet) and the Serra de Marão (4665 feet), the latter extending down the left bank of the Tameja and sheltering the wine-districts of Tras-os-Montes from the east winds. In Beira the granite Serra da Estrella (6540 feet), the loftiest range in Portugal, forms part of the system of the Guadarramas and a continuation of the Sierra de Gata, and terminates in the Serra de Lousão (3940 feet), while the chalk mountains in the south of the province, such as the Monte Junto near Santarem (2185 feet) and the Serra de Cintra, which runs into the sea at Cape Roca, belong to a different geological period. The chalk mountains of the Serra de Arrabida (1537 feet) to the south of the Tagus correspond with the Serra de Cintra, and form Cape Espichel; but the other low ranges to the south of the river in Alemtejo, such as the Serra de San Mamede (3363 feet) and the Serra de Ossa (2130 feet), belong to the system of the mountains of Toledo. The continuation of the Sierra Moreña which separates Algarves from the rest of Portugal, forms various small ranges and isolated mountains, such as the Serra do Malhão (1886 feet) and Monte Figo, and then closes with the Serra de Monchique (2963 feet) and runs into the sea in the steep cliffs of Cape St. Vincent,

The river system of Portugal is also merely a portion of that of Spain. **Rivers.** Its three most important rivers, the Douro, the Tagus, and the Guadiana, all rise in Spain and flow through that country; but they all enter the sea in Portugal, and at the mouths of the Douro and the Tagus are situated the two most important cities of the kingdom, Oporto and Lisbon. The chief Portuguese tributaries of the Douro are the Tameja, the Tua, and the Sabor on the north, and the Agueda, the Coa, and the Paiva on the south; of the Tagus, the Ellja, the Ponsul, and the Zezere on the north, and the Niza, the Sorraya, and the Canha on the south; while into the Guadiana, on its right or Portuguese bank, flow the Caia, the Oeiras, and the Vascão. The other important rivers are the Minho, which forms the boundary of Portugal and Galicia in the lower part of its course, the Limia, the Cavado, the Vouga, and the Mondego to the north of the Tagus, and the Sado, the Mira, the Odelouca, and the Silves to the south of it. Important as are the rivers of Portugal, it has no inland lakes worthy of mention, though it abounds in hot and other medicinal springs, such as the Caldas de Monchique; and beautiful little mountain-lakes are numerous on the tops of the Serra da Estrella.

Climate. The climate of Portugal is particularly equable and temperate, and its salubrious qualities were recognized by the English doctors of the 18th century, who used to send many patients to winter there, including Fielding the novelist; and, though Portugal has been superseded as a winter resort by the Riviera and Algiers, there are signs that it may again become a European health-resort of the first importance. To prove the temperate nature of the climate it is not enough to state that the average mean temperature of Lisbon, Coimbra, and Oporto are 61.3°, 61.1°, and 60.2° Fahr. respectively; more instructive is it to mention that the mean average temperature for the month of January is only 50.2° at both Coimbra and Oporto, and for July only 69.4° and 70.3° for the same two cities, showing a difference between summer and winter of about 20°. This equability of temperature is partly caused by the very heavy rainfall which is precipitated on Portugal as one of the most westerly kingdoms of Europe and one most exposed to the Atlantic, and which has reached as much as 16 feet in a year; but it is noticeable that this heavy rainfall comes down in gradual showers spread over the whole year, and not in the torrents of the tropics. This great humidity has its drawbacks as well as its advantages, for, though it makes the soil rich, it produces also heavy fogs, which render the Portuguese coast exceedingly dangerous to ships. This charming climate and equability of temperature are not, however, universal in Portugal; they are to be enjoyed mainly in the highlands of Beira, Estremadura, and in the northern provinces, especially at Cintra and Coimbra. In the deep valleys, even of those favored provinces where the mountains keep off the cool winds, it is excessively hot in summer; while on the summits of the mountains snow lies for many months, and it is often extraordinarily cold. Even in Lisbon itself the temperature, though its mean is only the same as that of Coimbra, varies from 38.1° in January to 90.6° Fahr. in July, a difference of more than 50°. In Alemtejo the climate is very unfavorable, and, though the heat is not so great as in Algarves, the country presents a far more deserted and African appearance, while in winter, when heavy rains swell the Tagus and make it overflow its banks, damp unhealthy swamps are left, which breed malaria. Notwithstanding that Algarves is hotter than Alemtejo, and the climate there very sultry owing to the sea-breezes being intercepted by the Serra de Monchique and other mountains, a profuse vegetation takes away much of the tropical effect so that it is a far shadier and more agreeable province than Alemtejo. Although such a rainy country, Portugal is very rarely visited by thunderstorms; but, on the other hand, shocks of earthquake are frequently felt, and recall the great earthquake of Lisbon in 1755.

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[1] Strelbitsky *Superficie de l'Europe*, 1882.

The geology, flora, and fauna of Portugal are essentially the same as those of Spain, and will be studied under SPAIN (*q.v*).

Population.

Population.—The population of Portugal, according to the census of 1st January, 1878, was 4,160,315, and in 1881 it was calculated to be 4,306,554, or 125 persons to the square mile. The following is a table of the populations of the different provinces and districts according to the census of 1878 and the official estimate of 1881:

Districts.		Population. 1878.	Population. 1881.	Provinces.	Population. 1878.	Population. 1881.
Vianna do Castello		201,390	211,539	Entre Minho e Douro	982,735	1,014,768
Braga		319,464	336,248			
Porto		461,881	466,981			
Villa Real		224,628	225,090	Tras-os-Montes	393,279	396,676
Braganza		168,651	171,586			
Aveiro	Alta Beira	257,049	270,266	Beira	1,323,134	1,377,432
Viseu		371,571	387,208			
Coimbra		292,037	307,426			
Guardo	Baixa Beira	228,494	234,368			
Castello Branco		173,983	178,164			
Leiria		192,982	199,645	Estremadura	911,922	946,472
Santarem		220,881	227,943			
Lisbon		498,059	518,884			
Port Alegre		101,126	105,247	Alemtejo	350,103	367,169
Evora		106,858	112,735			
Beja		142,119	149,187			
Faro		199,142	204,037	Algarves	199,142	204,037
				Portugal	4,160,315	4,306,554
				Azores[1]	259,800	269,401
				Madeira	130,584	132,223
				Total	4,550,699	4,708,178

According to the census of 1878 the following towns had a population of more than 10,000 each: Lisbon, 246,343; Oporto, 105,838; Braga, 19.755; Setubal, 14,798; Loulé, 14,448; Coimbra, 13,369; Evora, 13,046; Tavira, 11,459; Covilhã, 10,809; Elvas, 10,471; Povõa de Varzim, 10,365; Ovar, 10,022.

The ethnological composition of the population is most mixed: in the two northern provinces the population is essentially Galician, but farther south the mixture becomes obvious; not only did the conquering Portuguese largely intermarry with the Arabs, but in the places where they exterminated them they replaced them by colonies of crusaders of all nations, chiefly French, English, Dutch and Frisian, who have left their mark on the features and character of the nation, and they also largely intermarried with the Jews. No Jews were so wealthy or so cultivated as those of Portugal, who, though for many centuries keeping strictly apart from the Christians, yet after their forced conversion or expulsion by King Emmanuel largely intermarried, especially with the people of Lisbon. Farther south an African physiognomy appears, derived from the thousands of negro slaves imported to till Alemtejo and Algarves, from the days of Dom Henry till the decline of the Portuguese power.

Emigration is thinning the population, or rather keeping it from rapidly increasing; and the following are the results of the statistics published by the Royal Geographical Society of Lisbon for 1872-81. There emigrated in the ten years between 1871 and 1881 from Entre Minho e Douro 51,531 persons, from Tras-os-Montes 7799, from Beira 31,437, from Estremadura 12,769, from Alemtejo 42, from Algarves 225, from the Azores 22,794, from Madeira 6410, making a grand total of 133,007. Of these emigrants 129,549 were bound for America, the whole number in all probability for the Brazils, 3348 for the Portuguese colonies in Africa, and 95 for Asia. It will be noticed that the majority of these emigrants come from the wealthy northern provinces and the sober population of Entre Minho e Douro, while the number from the fever-stricken Alemtejo is practically nil.

Colonies.

Colonies.—See AZORES, CAPE VERD ISLANDS, GOA, MACAO, MADEIRA, MOZAMBIQUE and COLONY (vol. vi. p. 145).

Commerce.

Commerce.—The commerce of Portugal has not rapidly, though it has steadily, increased during the last thirty years; the chief countries with which it trades are, in order of value, England and her colonies, Brazil, the United States, France and Spain; but it is hardly fair to mention commerce with Spain, because the large amount of smuggling which takes place makes it impossible to estimate the real amount of trade between the two countries. The following table of exports and imports in nineteen classes, compiled by Mr. George Brackenbury, British consul at Lisbon, dated 24th April, 1884, is published in the *Consular Reports* for 1884, and contains the latest information on Portuguese trade and commerce. It will be noticed that the chief imports are breadstuffs, metals, cottons, and minerals, and the chief exports fermented liquors, live stock (which is nearly all sent to England) and timber.

Tariff Classes.	Imports. 1882.	Imports. 1883.	Exports. 1882.	Exports. 1883.
1. Live animals	£228,329[2]	£221,908	£605,916	£640,950
2. Animal products	423,204	392,101	138,397	105,796
3. Fisheries	345,432	325,304	141,160	152,104
4. Wood and hair	495,441	514,166	59,058	58,544
5. Silk	202,551	212,818	18,638	6,554
6. Cotton	850,863	870,001	19,743	15,498
7. Flax and similar materials	169,986	169,944	5,654	5,940
8. Timber	230,514	236,093	602,116	585,272
9. Bread-stuffs	1,694,163	1,272,540	98,466	74,452
10. Colonial produce (so-called)	752,145	684.921	30,393	20,511
11. Divers vegetable substances	166,183	171,956	401,222	336,704
12. Metals	1,057.334	1,359,768	616,189	148,569
13. Minerals	493,736	525,770	348,823	341,072
14. Fermented liquors	44,031	27,848	2,217,511	2,479,218
15. Glass and ceramic ware	81,016	64,728	4,353	3,854
16. Paper, and manufactures in which it is used	102,120	103,496	16,473	11,551
17. Chemical products	76,125	73,658	89,445	98,029
18. Produce and compositions of various kinds	133,844	117,699	7,693	7,852
19. Manufactures of various materials	537,234	468,459	89,762	70,114
Total	£8,083,751	£7,813,178	£5,501,012	£5,162,586

Agriculture.

Agriculture.—The state of agriculture in Portugal is still deplorable; the wealth and energy of the country have been thrown into the wine trade, and the production and cultivation of cereals have been so much neglected that, in spite of its being eminently adapted for such cultivation, nearly all its cereals are imported from the United States, to the value in 1883 of over £1,000,000. The wine production, on which Portugal has so long depended, was the work of the Methuen treaty of 1703, for it was not until after that treaty that the barren rocks of the Alto Douro were covered with vines. But now, though the returns show slight alteration, there must soon be a great change. The phylloxera has utterly destroyed thousands of vineyards in Entre Minho e Douro and in Beira. The labors of the phylloxera commission seem unable to check its ravages;[1] the commissioners themselves are hindered by the people—an inspector having been even shot at in the district of Riguengo.[2] The reason why no great alteration is to be perceived in the returns is that the great Oporto shippers have such vast stocks that it may be years before the want comes to be felt. To remedy the failure, which can be only a matter of time, tobacco-growing has been proposed (see Consul Crawfurd's *Report*), and will probably be tried in place of vine-culture. Portugal has lately become a great exporter of live stock to England, as also of large quantities of fruits and early vegetables, including oranges (especially from Condeixa), lemons, limes, peaches (from Amarante), and the celebrated Elvas plums. The difference in the character of the inhabitants of different provinces is well shown by the fact that in the north the peasant not only tends his vines but in many instances rears silkworms and even possesses olive trees, while in Alemtejo he is content to live upon chestnuts and to take care of his pigs and goats.

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[1] The Azores and Madeira are regarded as colonies and as an integral part of the country.

[2] In the *Consular Reports* 1 milrei is taken to be equivalent to 4s. 5½d.

Manufactures.

Manufactures.—Nothing proves more decidedly the agricultural character of the Portuguese than the repeated failures to establish manufactures among them. This has often been ascribed to the provision respecting the importation of English goods in the Methuen treaty; but not all the efforts of Pombal or of the modern protectionist cabinets have been able to establish any important manufactures. The following table, extracted from Consul Brackenbury's *Report*, gives a list of the chief establishments—for manufactories they can hardly be called—in Portugal, with the number of workmen and the value of the products.

	Number of Factories.	Operatives.	Daily Wages.	Value of Products.
Carpentering	83	5,109	£256	£165,006
Wax products	21	89	2	12,584
Ceramic ware	43	2,045	97	72,079
Building	51	6,748	459	63,584
Cork-works	22	1,612	92	224,672
Tanneries	93	823	44	323,489
Distilleries	79	364	31	101,924
Food products	57	2,367	116	517,392
Metallurgy	171	5,215	325	439,669
Flour, etc., mills	62	3,182	12	125,467
Paper factories	31	1,364	69	93,293
Firewood-making	18	206	7	6,977
Soap-works	13	83	6	74,204
Tobacco-works	22	4,021	252	1,249,236
Cotton, linen, etc., weaving	97	39,597	330	1,152,752
Woollen-weaving	161	8,964	736	864,518
Silk-weaving	24	854	58	51,393
Typographical establishments	66	591	42	32,444
Clothing	134	5,328	150	348,073
Glass-works	5	903	28	37,417
Various industries	97	1,503	22	117,485
Total	1150	90,918	£3129	£6,073,658

Some of these establishments ought to be more successful, for the glass-works of Leiria, the lace-works of Vianna and Peniche, and the potteries of Aveiro had an immense reputation in the 18th century, which they have now lost, as the table clearly shows. Portugal possesses plenty of mineral wealth, though not so much as Spain, but from want of capital and enterprise such resources as exist are neglected. A very few of the chief mines may be noted—the lead-mines of Coimbra, one of antimony near Oporto, and above all the very important copper-mines of San Domingos near Beja, worked by an English company, which contributed thirteen-sixteenths of the total exports of minerals in the six months between January and June, 1883. Of greater importance are the fisheries,—the fishermen both of Beira and Algarves being famous for their courage; and large quantities of sardines and preserved tunny fish are exported to Italy and France, and an even larger quantity of oysters to England.

Finance.

Finance.—The revenue of Portugal has for many years ceased to balance its expediture, and the deficit has had to be met by borrowing, but it is only fair to remark that vigorous attempts have been made to reduce the expenditure of recent years. The estimated revenue for 1883–84 and 1884–85 was classified under six heads.

	1883-1884.	1884-1885.
Direct taxes	£1,387,790	£1,395,753
Stamps	763,777	721,778
Indirect taxes	3,643,811	3,587,136
Additional 6 per cent. (since 27th April, 1882)	240,889	234,889
Domains and sundries	655,573	801,449
Repayments	238,069	244,788
Total ordinary revenue	£6,929,909 [$33,679,357.74]	£6,985,793 [$33,950,953.98]

A few of the sub-heads which help to swell these various classes of revenue are worth detailing.

	1883-1884.	1884-1885.
Direct taxes—		
Land taxes.	£700,444	£700,444
Industrial tax	243,222	250,000
Income tax	88,322	89,044
Inhabited house tax	83,778	86,556
Dividends tax	66,889	67,667
Bank tax	35,489	36,791
Titles and concessions tax	40,667	41,222
Servants and carriage tax	23,333	23,111
Indirect taxes—		
Import duties	1,637,555	1,647,112
Tobacco duties	703,555	718,467
Breadstuffs	302,667	287,222
Octroi at Lisbon	297,778	311,333
"Real de agua"	220,000	214,222
Additional customs	128,444	145,496
Salt tax	60,000	25,778
Exports	52,844	48,089
Special 2 per cent. on export of wine	48,889	46,222
Domains and Sundries—		
Railways	274,678	281,756
Post-office and telegraphs	151,671	177,778
Military exemption tax	64,444	60,000
Suppressed religious establishments	31,111	33,333
Repayments—		
Interest on stock held by the treasury	197,978	197,978

The last item deserves particular notice, as it proves the confused manner in which Portuguese financiers keep their accounts; they prefer to pay into their treasury interest on bonds held by it, instead of extinguishing that amount of the national debt.

Against this revenue must be set the expenditure (which always exceeds it), causing a deficit of £194,141 [$943,525.26] on the ordinary balance sheet, and of £1,558,142 [$7,572,570.12] when the extraordinary expenditure is taken into account, in 1880–84. The chief items in the estimates for that year compared with the estimates for 1883–84 are—

	1883-1884.	1884-1885.
Public debt (of which interest on debt took up £2,882,769 in 1883-84, and £2,882,784 in 1884-85)	£2,901,850	£2,909,712
Ministry of finance	1,329,208	1,463,955
Ministry of the interior	482,565	491,787
Ministry of justice	142,455	149,283
Ministry of war	1,019,821	1,079,683
Ministry of the marine and colonies	379,120	372,528
Ministry of foreign affairs	70,065	78,327
Ministry of public works	618,405	639,709
Total	£6,943,489 [$33,745,356.54]	£7,179,934 [$34,894,479.24]

Under the head of the "ministry of finance" there was an estimated sum of £600,367 [$2,760,321.02] in 1883–84 and of £672,202 [$3,266,901.72] in 1884–85 for interest of debt, which in any other system of finance would have been put down to the head of "public debt." The extraordinary expenditure was estimated to amount to £1,364,000 [$6,629,040] in 1884–85, the chief items of which were for the ministry of public works, chiefly spent on the fortifications of Lisbon, and for the minister of the colonies, for in only two colonies—Cape Verd Islands and Macao—do the colonial revenues meet their expenditure, the mother-country having to afford substantial help to her African colonies every year. The estimated balance-sheet for 1884-85 was—

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[1] See Consul Crawfurd's *Report*, Oporto, 1884.
[2] Mr. Baring's *Report*.

Ordinary expenditure	£7,179,934
Revenue	6,985,793
Deficit	£194,141

It is very difficult to give any exact estimate of the extent of the public debt of Portugal owing to the financial confusions noted above, but on 30th June, 1883, it was estimated at £96,175,692, namely—

Internal debt, new 3 per cents	£52,369,291
External debt	43,372,530
Old debt, to be converted	433,871
Total	£96,175,692

but of this amount the treasury holds about £8,000,000.

Government.

Government.—The government of Portugal is an hereditary and constitutional monarchy, exercised under the charter of 1826, as modified in 1852 and 1878, under which the king is charged with the executive and shares the power of making laws with two chambers. His civil list amounts to £144,000 [$699,840] a year, and he is advised in all matters of administration and assisted in nominating peers by a council of state appointed for life, but depends for advice in legislative and executive matters on a cabinet of seven members selected from the chambers by a premier, summoned by the king. The House of Peers consists of 150 members nominated by the king for life, and contains many of the most eminent professors and authors, as well as men of wealth, and additions may be made to its number by the king on the advice of the premier, with the consent of the council of state. All the members of the House of Peers do not possess titles, nor do all titled persons belong to the House of Peers; legislation and the titular and hereditary aristocracy are kept quite apart. The House of Deputies consists of 173 members, elected directly by all male citizens of twenty-five years of age, either paying in direct taxes 4s. 6d. [$1.09] a year, or deriving an annual income of 22s. [$5.35] from real estate, while all graduates, priests, officers, and certified teachers have votes without further qualification. The president of the chamber is selected by the king out of five elected candidates, and the deputies are paid. The Azores and Madeira elect members to the House at Lisbon. For administrative purposes Portugal is divided into seventeen districts, for judicial purposes into twenty-six districts or "comarcas," with appeal courts at Lisbon and Oporto, and a supreme court at Lisbon, and for military purposes into four divisions. The Roman Catholic is the state religion, but others are tolerated, and the power of the priests has been greatly checked by the wholesale suppression of monasteries in 1834. The church in Portugal is governed by a patriarch at Lisbon, two archbishops at Braga and Evora, and fourteen bishops, of whom the most important is the bishop of Oporto. For purposes of local government the districts are under the rule of civil governors, who have much the same powers as prefects in France, while in the 292 "concelhos," or administrative councils, there are elected councillors, and in the 3960 "freguezias" or parishes the villagers elect a magistrate, who has the same powers as an English justice of the peace.

Army and navy.

Army and Navy.—Under a decree dated 19th May, 1884, the Portuguese army has been reorganized. The effective war strength is to be maintained at 120,000 men. The term of service is for 12 years, of which 3 are to be with the colors, 5 in the first reserve, and 4 in the second reserve. The force is divided into 36 regiments of infantry, 10 regiments of cavalry, 4 regiments, 1 brigade, and 4 companies of artillery, and 1 regiment of engineers. In 1883, under the old regulations, the army contained 41 general officers; its effective strength in time of peace was 33,231 men with 1643 officers, and on a war footing 75,336 men with 2688 officers. For colonial service there is one regiment of 1143 soldiers and 50 officers divided into 3 battalions, of which one is always stationed at Goa and another at Macao. The officers are trained in the military academy at Lisbon, and there is an asylum for the sons of soldiers. The navy is no longer the power it used to be, but, though small, it is equipped in modern fashion and furnished by the naval arsenal at Lisbon. It consisted in 1884 of 30 steam-ships, of which one was an armored corvette mounting 7 guns, and 5 others corvettes mounting 46 guns, and of 14 sailing ships, of which one was a frigate mounting 19 guns. Its personnel consisted of 283 officers and 3235 sailors.

Education.

Public Instruction.—The public instruction of Portugal is regulated by the law of 1884, which enacted that all children should be bound to attend a primary school, if there was one within a mile, from the age of seven to fifteen, under penalty to the parents of a fine and deprivation of civil rights. Under this law there were in Portugal, in 1874, 2649 primary schools with 122,004 pupils of both sexes. Secondary education is not neglected, and under the same law of 1844 17 lycées have been established in the seventeen continental districts, and from them it is possible for a pupil to enter either the university of Coimbra, which during the present century has recovered some of its ancient lustre, or the special schools. These special schools are very ably conducted, and modern Portuguese policy gives, as we have seen, a higher status to teachers and professors of all grades than they obtain in most other countries. The most important of these schools are the polytechnic school at Lisbon, the polytechnic academy at Oporto, the medical schools and industrial institutes in both these cities, the institute general of agriculture, the royal and marine observatories and the academy of fine arts—all four at Lisbon. The valuable public libraries of Lisbon, Evora, Villa Real, and Braga, supported by the state, and in addition the free library at Oporto, ought also to be mentioned, as well as the archives at the Torre del Tombo, with which a school of palæography and diplomacy has lately been connected.

Public Works.

Public Works.—On 1st January, 1884, there were 1245 miles of railway open (944) and in course of construction (301), also 50 miles of tramways were open, and 2900 miles of telegraph were in operation; and every recent loan has been raised for the purpose of extending these important public works. The chief lines of railway open are those from Lisbon to Valencia de Alcantara, and thence by Talavera to Madrid, and from Lisbon to Oporto, Tua, Nine and Braga, while the line to Faro, which is to connect Algarves with the capital, has been already extended beyond Beja as far as Casevel. There is also an alternative line to Madrid open through Elvas and Badajoz, which connects Lisbon with the Andalusian system and gives a short route to Seville, Cadiz, and Malaga. As to smaller lines opening up Beira, the line from Figueira da Foz to Villar Formosa through Celorico and Guarda is completed, and one is projected parallel to the Lisbon-Oporto line from Villar Formosa to Alcantara on the south, which is to be connected with Oporto through Tua towards the west. The telegraph system is already very complete, and the last touch has been put to it by laying down a submarine cable from Lisbon to Rio de Janeiro, binding the mother-country still more closely with what was once her greatest colony.

(H. M. S.)

PART II.—HISTORY.

It has been stated that geographically the kingdom of Portugal is an integral part of the Iberian Peninsula; the only reason why it has retained its independence, while the other mediæval states of that peninsula have merged into the kingdom of Spain, is to be found in its history. When Philip II. of Spain annexed Portugal it was a century too late for it to coalesce with Spain. It had then produced Vasco de Gama and Affonso de Albuquerque, and its language had been developed from a Romance dialect into a literary language by Camoens and Sá de Miranda. Conscious of its national history, it broke away again from Spain in 1640, and under the close alliance of England maintained its separate and national existence during the 18th century. A union with Spain might have been possible, however, during the first half of the present century had not a generation of historians and poets arisen, who, by recalling the great days of the Portuguese monarchy, have made it impossible for Portugal ever again to lose the consciousness of her national existence.

The history of Portugal really begins with the gift of the fief of the Terra Portucalensis or the county of Porto Cale to Count Henry of Burgundy in 1094; for

Early history.

any attempt to identify the kingdom of Portugal and the Portuguese people with Lusitania and the Lusitanians is utterly without foundation. With the rest of the Iberian Peninsula, Portugal was colonized by the Phœnicians and conquered by the Carthaginians; and the Roman province of Lusitania, whether according to the division of Iberia into three provinces under Augustus or into five under Hadrian, in no way coincided with the historical limits of the kingdom of Portugal. In common with the rest of the Peninsula, it was overrun by the Vandals, Alans, and Visigoths, and eventually conquered by the Arabs in the 8th century. It was not until the 15th century that an attempt was made by Garcia de Menezes to identify Lusitania with Portugal. Under the influence of the Renaissance, Bernardo de Brito insisted on the identity, and claimed Viriathus as a Portuguese hero. Other writers of the same epoch delighted in calling Portugal by the classical name of "Lusitania," and Camoens, by the very title of his great epic, *Os Lusiadas*, has immortalized the appellation.

For two centuries Portugal remained subject to the Omayyad caliphs, and under their wise rule the old Roman coloniæ and municipia, such as Lisbon, Lamego, Viseu, and Oporto, maintained their Roman self-government and increased in wealth and importance. Towards the close of the 10th century, as the Omayyad caliphate grew weaker, the Christian princes of Visigothic descent who dwelt in the mountains of the Asturias began to grow more audacious in their attacks on the declining power, and in 997 Bermudo II., king of Galicia, won back the first portion of modern Portugal from the Mohammedans by seizing Oporto and occupying the province now known as Entre Minho e Douro. In the beginning of the 11th century the Omayyad caliphate finally broke up, and independent emirs established themselves in every large city, against whom the Christian princes waged incessant and successful war. In 1055 Ferdinand the Great, king of Leon, Castile, and Galicia, invaded Beira; in 1057 he took Lamego and Viseu, and in 1064 Coimbra; and his son Garcia, who succeeded him as king of Galicia in 1065, maintained Nuno Mendes, count of Oporto, and Sesnando, a renegade Arab wazír, count of Coimbra, as feudal vassals of his court. In 1073 Alphonso VI., the second son of Ferdinand the Great, united once more his father's three kingdoms, and for a time rivalled his father's successes, until a fresh outburst of Mohammedan fanaticism ended in the rise of the Almoravide dynasty, and the defeat of the Christian king at Zalaca in 1086 by Yúsuf ibn Teshufín. To resist this revival of the Mohammedan power, Alphonso VI. summoned the chivalry of Christendom to his aid, and among the knights who came to his assistance were Counts Raymond and Henry of Burgundy. In the days of his success Alphonso had compelled Motawakkil of Badajoz to cede to him both Lisbon and Santarem, but the fortune of war had changed, and Sír, the general of the Almoravide caliph Yúsuf, retook both cities. Alphonso felt the need of a valiant warrior on his Galician frontier, and in 1094 he combined the fiefs of Coimbra and Oporto into one great country and conferred it upon Henry of Burgundy with the hand of his illegitimate daughter Theresa, while to Raymond he gave Galicia and his legitimate daughter and heiress Urraca.

Henry of Burgundy.

Count Henry of Burgundy, the first count of Portugal, was the second son of Henry, third son of Robert, first duke of Burgundy, and was in every way a typical knight of his century, a brave restless warrior, and a crusader; but when once firmly established in his country he thought much more about his chances of succeeding his father-in-law as king than of trying to carve a kingdom for himself out of the dominions of the Mohammedan caliphs. When, therefore, Alphonso VI. died in 1109 and left his thrones to his daughter Urraca, and nothing to Henry, the Burgundian at once invaded Leon. For five years the Christian princes, Henry of Burgundy, Alphonso Raimundes (the son of Count Raymond), Alphonso of Aragon, and Queen Urraca, fought together, while Sír was consolidating the Almoravide power, until Count Henry died suddenly at Astorga in 1112, leaving his wife Theresa to rule the county of Portugal during the minority of his infant son, Affonso Henriques.

Theresa, who ruled at Guimarães during her son's minority, was a beautiful and accomplished woman, who devoted all her energies to building up Affonso's dominions into an independent state, and under her rule, while the Christian states of Spain were torn by civil wars, the Portuguese nobles were prevented from interfering, and began to recognize Portugal as their country, and to cease from calling themselves Galicians. Her regency was a stormy one in spite of all her efforts to maintain peace: in 1116 she was persuaded by Gelmires, bishop of Santiago, to try and extend her frontier towards the north, and seized Tuy and Orense; in 1117 she was besieged by the Mohammedans in Coimbra; and in 1121 her sister Urraca took her prisoner, but, through the interposition of Bishop Gelmires and Mauricio Burdino, archbishop of Braga, peace was quickly made between them. For the next few years a curious parallelism appears between the careers of the two sisters: Urraca showered favors on her lover, Pedro de Lara, until her young son Alphonso Raimundes, or Alphonso VII. of Leon and Castile, with the help of Bishop Gelmires, revolted against her; and with equal blindness Theresa favored her lover, Fernando Peres de Trava, whom she made governor of the cities of Oporto and Coimbra, until she was detested by the boy Affonso Henriques, and Paio, archbishop of Braga. They did not, however, break out into open revolt until after a successful invasion by Alphonso VII. of Leon and Castile, who forced Theresa to recognize his supremacy in 1127. Her son refused to ratify her submission, and rose in rebellion with Archbishop Paio, Sueiro Mendes, Sancho Nunes, and others; and at the battle of San Mamede on 14th June, 1128, Theresa was taken prisoner, and then wandered about in Galicia with her lover until her death in 1130.

Affonso Henriques.

Affonso Henriques, who at the age of seventeen assumed the government, was one of the heroes of the Middle Ages; he succeeded to the rule of the county of Portugal when it was still regarded as a fief of Galicia, and after nearly sixty years' incessant fighting he bequeathed to his son a powerful little kingdom, whose independence was unquestioned, and whose fame was spread abroad throughout Christendom by the reports of the victories of its first king over the Mohammedans. The four wars of independence which Affonso Henriques waged against Alphonso VII. lasted more than twelve years, and were fought out on the Galician frontier with varying success, until the question of Portuguese independence was peaceably established and confirmed by the valor of the Portuguese knights, who overcame those of Castile in the famous tournament of Valdevez, and Affonso Henriques assumed the title of the king of Portugal. The independence of Portugal from Galicia being thus finally achieved, Affonso Henriques abandoned the idea of extending his dominions towards the north, and devoted the next twenty-five years of his life to one long crusade against the Mohammedans, and to extending his frontier towards the south. The state of the Mohammedan power in Spain was particularly favorable to his enterprise. The wave of Moslem fanaticism which had created the Almoravide dynasty had exhausted itself, and independent chiefs had established themselves again in the different provinces, while in Africa 'Abd al-Mumem, the successor of the Almohade madhi, was destroying the power of the Almoravides by means of yet another wave of fanati-

Portugal a kingdom.

cism. As early as 1135 Affonso had built the castle of Leiria to protect his capital, Coimbra, but for some years he left the task of attacking the Mohammedans to the Knights Templars and Knights Hospitallers, who made incessant incursions from their headquarters at Soure and Thomar. But the castle of Leiria had soon fallen; and in 1139, after the flower of Mohammedan Spain had crossed over to Africa under Teshufín, the last Almoravide caliph, to fight the Almohades, and when Alphonso VII. was making his second incursion into the heart of Andalusia, Affonso Henriques collected his whole army and invaded the province of the Ḳaṣr ibn Abí Dánes. Advancing to the south of Beja, he met the united forces of all the neighboring cities under a wáli named Ismar, and completely routed him at Orik or Ourique on 25th July. This battle has been surrounded with a mass of legends; it was solemnly asserted two hundred years afterwards that five kings and 200,000 Mohammedans were utterly defeated, and that after the battle Affonso was proclaimed king by his soldiers. Such legends hardly need contradiction; the victory was a great one, but it was obtained over provincial emirs; and it was not by victories over Mohammedans but by struggles with his Christian cousin Alphonso VII. that independence was to be won. Of still later invention was the fiction of the cortes of Lamego, and the passing of the fundamental laws of the monarchy, on which Vertot and other writers have expended so much eloquence. Of great significance with regard to the legendary splendor of the victory is the fact that in the very next year Ismar or Omar, the emir who was defeated at Ourique, was able to take the field again, when he once more seized the castle of Leiria, and destroyed it. In 1143 a regular peace was concluded between Alphonso VII. and Affonso Henriques at Zamora through the mediation of the cardinal Guy de Vico, when Affonso Henriques was finally recognized as king, and promised to be a vassal of the pope, and to pay him four ounces of gold annually. For many subsequent years the history of Portugal is merely a narration of wars against the Mohammedans. Abú Zakaría, wazír of Santarem and Mohammedan leader in the Belatha (a district including the banks of the Tagus and the cities of Lisbon, Santarem, and Cintra), defeated the Templars at Soure in 1144, but in 1147 Santarem itself was surprised and taken on 15th March. Of still more importance was the capture of Lisbon in the same year. A number of German crusaders from the Rhine and Flanders under Count Arnold of Aerschot and Christian Ghistell, and of English crusaders under their constables, Hervey Glanvill, Simon of Dover, Andrew of London, and Saher d'Arcellis, put in at Oporto on their way to Palestine, and were persuaded by the bishop to commence their holy work by assisting in the siege of Lisbon. With their help the ancient city, which claimed to have been founded by Ulysses, and which had three times—in 792, in 851, and in 1093—been taken by the Christians and held for a short time, was finally captured on 24th October by Affonso Henriques, who also persuaded many of the crusaders to settle and form colonies in Portugal. The series of conquests continued: Cintra, Palmella, and Almada quickly surrendered, and at last, after a failure in 1152, the great city of Alcácer do Sal was taken in 1158. In 1161 Affonso Henriques met with his first important check. The Almohade caliphs, having at last triumphed in Africa, determined to extend their power to Spain, and on the arrival of their troops the Portuguese king was defeated. Then the character of the war changed. A disputed succession weakened the Almohade caliphate, and independent bands of "salteadors," who were little better than brigands or free-lances, began to establish themselves in the cities of Alemtejo; such was Giraldo Sempavor, who took Evora in 1166.

Affonso Henriques became ambitious to win the great city of Badajoz, although by a treaty signed at Cella Nova with Alphonso VII. he had undertaken to confine his conquests to the right bank of the Guadiana. No doubt it was owing to the death of his cousin and the separation of the kingdoms of Castile and Leon that he believed he could effect his purpose. But his son-in-law, Ferdinand of Leon, would not allow such a breach of treaty, and determined to oppose it; and Affonso Henriques made the fatal mistake of again mixing himself up in Spanish affairs by invading Galicia in 1167. At last, in 1169, he formed the siege of Badajoz; Ferdinand at once invested the besieger in his camp, and the Portuguese hero was severely wounded and taken prisoner. To gain his freedom he was compelled to surrender his conquests in Galicia, and Ferdinand nobly inflicted no harsher terms; nevertheless the old king never recovered from the effect of his wound, and the remaining exploits of his reign were the work of his son Dom Sancho. By 1169 the internal dissensions of the Mohammedans were over, and the new Almohade caliph, Yúsuf Abú Ya'kúb, crossed over to Spain with a large army. He speedily reconquered all the Portuguese acquisitions in Alemtejo, and in 1171, after a vain attempt to take Santarem, made a truce for seven years with Affonso Henriques, who in the following year admitted his son Sancho as king with himself, and left him all the duties of war. Dom Sancho proved himself the worthy son of his father, and for twelve years Alemtejo was one great battle-ground. The greatest struggle was in 1184, when Yúsuf brought over fresh forces from Africa, and again besieged Santarem; but pestilence defended the city, and on 4th July Sancho utterly defeated the fever-stricken army of the besiegers, Yúsuf himself being mortally wounded in the battle. This triumph worthily closed the reign of the great crusader king, Affonso Henriques, who died on 6th December, 1185.

Sancho I.

The fame of Dom Sancho I., "the Povoador," or "City builder," rests more on his internal administration than on his early exploits as a soldier. But before he had time to obey his inclinations he had to continue a war of life and death with the Mohammedans. In 1189 he conquered Algarves and took Silves, the capital of the province, with the help of some English, Dutch, Danish, and Frisian crusaders; but the conquest was not final, for in 1192 Yúsuf Abú Ya'kúb reconquered not only Algarves but the whole province of Alemtejo, including Alcácer do Sal, failing only before Santarem. Finding the Mohammedans under their great Almohade caliph too dangerous to attack again, Dom Sancho made peace with them, and for some years, until 1200, concerned himself with the affairs of Spain, waging continuous war against Alphonso IX. of Leon without any particular result. His internal administration was far more important. During his father's reign there had been nothing but fighting, and, except in Lisbon and Oporto, where a large trade for that period had arisen, and in the northern provinces of Entre Minho e Douro and Tras-os-Montes, where agriculture survived, the scanty population lived chiefly on the spoils taken in their yearly incursions on the Mohammedans. Sancho therefore both encouraged the growth of towns and fostered agriculture. The Portuguese towns had almost without exception preserved their old Roman local self-government, which had been taken advantage of by the Mohammedans; and Sancho wisely followed their example, while he encouraged the increase of population by wise laws, and furthered immigration, especially from the crusaders of England, France, and the north of Europe. The country districts he treated on a different principle. He granted large tracts of land to noblemen and cities and the military orders, on condition that they should be cultivated and occupied. The later years of Sancho's reign were filled with disputes with Pope Innocent III. This struggle bears a curious resemblance to the quarrels of Henry II. with the pope, which had raged a few years earlier in England. Dom Sancho had insisted on priests accompanying their flocks to battle, and also on making them amenable to the secular courts. This seemed monstrous to Innocent, who sent legate after legate to demand Sancho's submission and the payment of the tribute to the Holy See. But the King had in his chancellor Julião the first Portuguese student who studied the revival of Roman law at Bologna, and who had imbibed broad views there as to the papal power, and he in Sancho's name asserted the king's full right even to dispose of the estates of the church in his kingdom if he liked. This general quarrel was complicated by the behavior of Martinho Rodrigues, bishop of Oporto, who was hated alike by his chapter, the king, and the people of his city, and who, after being besieged in his palace for five months, escaped to Rome, and claimed the pope's protection in 1209. Sancho was now in weak health and in no mood to continue the struggle, so in 1210 he yielded to all the demands of the pope and the bishops; then, after giving large estates to his sons and daughters, he retired to the convent of Alcobaça, where he died in 1211, leaving a reputation as a warrior and a statesman only second to that of his father.

Affonso II.

The reign of Affonso II. "the Fat" is chiefly important in the constitutional history of Portugal, and for one memorable feat of arms, the recapture of Alcácer do Sal. On his father's death, Affonso, probably by the advice of the chancellor Julião, summoned a cortes or parliament, consisting of the bishops, "fidalgoes," and "ricos homens" of the realm, which is the first on record, as that at Lamego in 1143 is apocryphal. The king assented to the final compact which his father had made with the church, and propounded a law of mortmain, probably drawn up by Julião, by which the church could receive no more legacies of land, because it could not perform military service. Affonso himself proved to be no warrior, but he was very tenacious of the wealth and power of the crown, and refused to hand over to his brothers the large legacies which Dom Sancho had left to them; and it was not until after a long civil war, in which Alphonso IX. of Leon joined, that he gave his sisters their legacies, at the same time taking care that they all became nuns, while his brothers went into exile, and never obtained their lands at all. Though Affonso himself was no soldier, the Portuguese infantry showed how free men could fight at the battle of Navas de Tolosa in 1212; and his ministers, bishops, and captains took advantage of the weakness of the Almohades after this great defeat to reconquer Alemtejo, and in 1217 they retook Alcácer do Sal, and defeated the wális of Andalusia with the help of a body of crusaders. In this expedition the king took no part; he was more bent upon filling his treasury, which soon brought him again into conflict with the church. His chancellor, Gonçalo Mendes, inherited the policy of Julião, and encouraged him to lay hands on the lands of the archbishop of Braga, Estevão Soares, whereupon Pope Honorius III. excommunicated the king, and laid an interdict upon the kingdom until Affonso should make compensation and should expel his chancellor from court. This Affonso refused to do, and he was still under the interdict of the church when he died in 1223.

Sancho II.

Sancho II. was only thirteen when he succeeded his father, and, as might have been expected during a minority, the turbulent nobility and intriguing bishops tried to undo the late king's labors to consolidate the royal power. The old statesmen of Affonso II.—Gonçalo Mendes, the chancellor, Pedro Annes, the "mordomo mor" or lord steward, and Vicente, dean of Lisbon—saw that it was necessary to get the interdict removed if there was to be peace during the king's minority, and so they prudently retired into the background. Estevão Soares, the archbishop of Braga, then became the most powerful man in the kingdom, and, with Abril Peres, the new mordomo mor, he agreed with Alphonso IX. of Leon that the Portuguese should attack Elvas at the same time that the Spaniards laid siege to Badajoz. The siege of Elvas was completely successful; the young king greatly distinguished himself, and in the following year, 1227, felt strong enough to reinstate his father's old friends in office, making Vicente chancellor, Pedro Annes once more mordomo mor, and Martim Annes "alferes mor" (standard-bearer). This change of power greatly disconcerted the bishops and clergy, who began to intrigue for the overthrow of the young king, but he wisely continued to occupy himself with fighting the Mohammedans, knowing well that the pope would not dare to attack a crusading monarch. He endeavored to imitate closely his cousin St. Louis, of France, and his wise policy secured him the protection of the pope, who in 1228 sent John of Abbeville as legate, with full powers to rebuke the Portuguese bishops. The legate made the chancellor, Vicente, bishop of Guarda, and highly commended the favor shown by the king to the friars, who had been introduced into Portugal by his aunts, and to the military orders. But in 1237 Dom Sancho II. had another serious quarrel with the church, and an interdict was laid on the kingdom; but prompt submission to Pope Gregory IX. secured immediate pardon. Meantime his old and wise councillors had mostly died, and his court was thronged with gay young knights and troubadours. He again attacked the Mohammedans, and invaded Algarves; and in 1239 he took Mertola and Ayamonte, in 1240 Cacello, and in 1244 Tavira. Unfortunately in the interval between 1240 and 1244 the king fell in love with a Castilian lady, Donna Mencia Lopes de Haro, the widow of Alvares Peres de Castro, whom he probably married. This union was most distasteful to the Portuguese people, and furnished the bishops with a pretext for forming a party and overthrowing him, provided they could find a leader and obtain the assistance of the pope. In 1245 the king's brother, Affonso, who had settled at the court of his aunt, Blanche of Castile, queen-dowager of France and mother of Louis IX., and who had there married the heiress of Boulogne, offered himself as a leader to the Portuguese malcontents. The pope at once issued a bull, deposing Sancho, and João Egas, archbishop of Braga, Tiburcio, bishop of Coimbra, and Pedro Salvadores, bishop of Oporto, went to Paris and offered Affonso of Boulogne the crown of Portugal on certain conditions, which he accepted and swore to obey. In 1246 Affonso arrived at Lisbon, and solemnly declared himself the defender of the kingdom; and for two years a civil war raged, which ended in Dom Sancho's retiring to Toledo, where he died on 8th January, 1248.

Affonso III.

With such a commencement it might have been expected that the reign of Affonso III. would have been a period of civil war and internal dissension, or at least of complete submission to the church and the feudal nobility, but, on the contrary, it was from a constitutional point of view the most important of all the early reigns, and also that in which Portugal concluded its warfare with the Mohammedans and attained to its European limits. In short, Affonso III. was essentially a politic king, if not a high-principled man. On his brother's death he exchanged his title of "visitador" or "curador" of the kingdom for that of king, and at once prepared to complete the conquest of Algarves. Aided by his uncle Dom Pedro and the Knights Hospitallers under Gonçalo Peres Magro, he speedily reduced the remainder of the province. This rapid extension of the Portuguese territory was by no means agreeable to Alphonso X. "the Wise," king of Leon and Castile; but, after a short war, Affonso III. consented to marry Alphonso's illegitimate daughter, Donna Beatrice de Gusman, and to hold Algarves in usufruct only. He then turned his attention to his own position in Portugal, and determined to bridle the power of the bishops, in spite of his oath at Paris. Perceiving that this could only be done with the help of the mass of the people, he summoned a cortes at Leiria in 1254, to which representatives of the cities were elected and sat with the nobles and higher clergy. With the help of this cortes—one of great importance in the constitutional history of Portugal—he dared the interdict laid upon the kingdom for having married again (the daughter of Alphonso the Wise) whilst his first wife (Matilda, countess of Boulogne) was alive. Finally, however, on the petition of the archbishops and bishops of Portugal, Pope Urban IV. legalized the disputed marriage in 1262 and legitimated his elder son, Dom Diniz, while in 1263 Alphonso X. made over to him the full sovereignty of Algarves. On the other hand, the people made use of their power, and in a full cortes at Coimbra in 1261 the representatives of the cities boldly denounced Affonso's tampering with the coinage, and compelled recognition of the fact that taxes were not levied by the inherent right of the king but by the free consent of the people. After a prosperous and successful reign Nemesis came upon Affonso in the rebellion of his eldest son Diniz in 1277, which continued until 1279, in which year the king died.

Diniz.

The period of war and of territorial extension in the Peninsula was now over, and the period of civilization was to dawn. Territorially and constitutionally Portugal was now an established kingdom; it remained for it to become civilized and thoroughly homogeneous before the great heroic period of exploration and Asiatic conquest should begin. No better man for such work than the new king, Dom Diniz, could have been found: he was himself a poet and loved letters; he was a great administrator and loved justice; above all he saw the need of agriculture and the arts of peace to take the place of incessant wars, and nobly earned the title of the "Ré Lavrador," or "Denis the Laborer." From all these points of view his reign is of vast importance in the history of Portugal, though, like all reigns of peaceful progress, it is not signalized by many striking events. It began with a civil war between Diniz and his brother Affonso, who disputed his legitimacy, which ended in a compromise; and in 1281 Diniz married Isabel, daughter of Pedro III., of Aragon, who for her pure and unselfish life was canonized in the 16th century. His reign is only marked by one war with Sancho IV. and his successor, Ferdinand IV., of Castile and Leon, which was terminated in 1297 by a treaty of alliance, according to the terms of which Ferdinand IV. married Constance, daughter of Diniz, while Affonso, the heir to the throne of Portugal, married Beatrice, of Castile, sister of Ferdinand. Still more interesting are the king's relations with Edward I., of England, with whom he exchanged many letters, and with whom he made a commercial treaty in 1294. He corresponded also often with Edward II., of England, and agreed with him in 1311 that the Knights Templars had been greatly maligned; and on their suppression by Clement V., recollecting the great services which the military orders had rendered to Portugal and their great power, Dom Diniz founded the Order of Christ, and invested it with the lands of the Templars, thus at once obeying the pope and avoiding a serious disturbance at home. The king showed his love of agriculture by the foundation of agricultural schools and homes for farmers' orphans, as well as by encouraging improved farming, and by establishing the pine forest of Leiria, his love of justice by wise laws, checking, though not abolishing, the feudal courts, and by the appointment of royal corregidors in every town of which the crown possessed the franchise, and his love for commerce by his commercial treaty with England, and by the foundation of a royal navy, of which a Genoese, named Emmanuel Pessanha, was the first admiral. But his real affection was for literature: he encouraged a school of Portuguese poets at his court, and established a university at Lisbon, which, after many changes, found a permanent home at Coimbra. At the end of this reign war broke out between the king and the heir-apparent, and a pitched battle was only prevented in 1323 by St. Isabel riding between the armies and making a peace between her husband and her son, which lasted until the death of the great peace-monarch, the Ré Lavrador, in 1325.

Affonso IV.

Affonso IV. pursued his father's policy of making family alliances with the kings of Aragon and Castile, and in 1328 married his daughter, Donna Maria, to Alfonzo XI. of Castile, who neglected her, and for her sake Affonzo IV. declared war against Castile. Peace was made through the intervention of St. Isabel in 1340, when Dom Pedro, son of Affonso, married Constance Manuel, daughter of the duke of Penafiel, and Affonso IV. himself promised to bring a strong Portuguese army to the help of Alphonso XI. against the emir of Morocco, Abú Hamem, who had crossed the straits to assist the sultan of Granada. The united Christian armies won a decisive victory at the river Salado, in which Affonso especially distinguished himself, and earned the title of "the Brave"; from that time he remained at peace with Castile, and further strengthened his position in Spain in 1347 by marrying his daughter, Donna Leonora, to Pedro IV. of Aragon. The later years of the reign of Affonso IV. were stained by the tragedy of Donna Ines de Castro. (See vol. v. p. 176.)

Pedro I.

The first act of Dom Pedro on ascending the throne in 1357 was to punish the murderers of Ines; and further, to show his love for her, he had her dead body disinterred and crowned, and afterwards solemnly buried with the kings and queens of Portugal in the convent of Alcobaça. The spirit of stern, revengeful justice which had marked the commencement of his reign continued to show itself in all matters of administration; he punished priest and noble with equal severity, and the people gave him the title of "Pedro the Severe." Like his grandfather, he greatly valued the friendship of England, and was on intimate terms with Edward III., who in 1352 had ordered his subjects by proclamation never to do any harm to the Portuguese. A curious sequel to the commercial treaty of 1294 was executed in 1353, when Affonso Martins Alho, on behalf of the maritime cities of Portugal, signed a treaty with the merchants of London guaranteeing mutual good faith in all matters of trade and commerce. This is the most interesting feature of Dom Pedro's short reign.

Ferdinand.

The accession in 1367 of Ferdinand, the only son of Pedro by Constance, marks a crisis in the history of the Portuguese monarchy. As a natural result of the long peace which had succeeded the final conquest of Algarves, the people of Portugal had grown richer, more cultivated, and more conscious of their nationality, while the court had grown more and more dissolute and more out of consonance with the feelings of the people. If the Portuguese monarchy was to continue to exist, it was obvious that it must become again a truly national monarchy, as it had been in the days of Affonso Henriques, and that the kings must remember their duties and not think only of their pleasures. The life and reign of Dom Ferdinand are marked, like those of his father, by a romantic amour, which, if not so tragic as the story of Ines de Castro, had far greater political importance. Ferdinand was a weak and frivolous but ambitious king, who, after binding himself to marry Leonora, daughter of the king of Aragon, suddenly claimed the thrones of Castile and Leon in 1369 on the death of Pedro the Cruel, through his grandmother, Beatrice of Castile, and was favorably received at Ciudad Rodrigo and Zamora. But the majority of the Castilian nobles did not wish to see a Portuguese monarch on their throne, and welcomed the illegitimate Henry of Trastamare as Henry II. of Castile. The contest ended in 1371 through the intervention of Pope Gregory XI., Ferdinand agreeing to surrender his claims on Castile and to marry Leonora, daughter of Henry II. However, in spite of the pope, this treaty was never carried out; Ferdinand had seen and fallen passionately in love with Donna Leonora Telles de Menezes, daughter of a nobleman in Tras-os-Montes and wife of João Lourenço da Cunha, lord of Pombeiro. For love of this lady, whom he eventually married, he refused to fulfil his treaty with Castile; but Henry II. strongly resented this insult, and taking up arms invaded Portugal and laid siege to Lisbon. Ferdinand entered into negotiations with John of Gaunt, who also claimed Castile through his wife Constance (daughter of Pedro the Cruel), and he signed a treaty of alliance through his ambassador, João Fernandes Andeiro, with Edward III. of England. Donna Leonora, however, did not approve of the English alliance, and in 1374 Ferdinand made peace with Castile through the mediation of Cardinal Guy of Boulogne. The queen was now supreme, and terrible in her tyranny. She had not even the merit of constancy, for she fell in love with Andeiro, the late ambassador to England, and induced the king to make him count of Ourem. Ferdinand himself continued to aspire to the throne of Castile; and in 1380, after the death of Henry II., he again sent Andeiro to England to procure assistance for a new war against Henry's successor, John I. Richard II. of England received the ambassador graciously, and in 1381 the earl of Cambridge, brother of John of Gaunt, arrived with a powerful force, and his son Edward was betrothed to Donna Beatrice, Ferdinand's only child, who had been recognized as heiress to the throne by a cortes at Leiria in 1376. But the Portuguese king, as usual, failed to keep faith, and in 1383, under the influence of the queen, he deserted the English, who then ravaged Portugal and made peace with John I. of Castile at Salvaterra. By this treaty John I. engaged to marry Donna Beatrice, and it was arranged that Queen Leonora should be regent of Portugal until Beatrice's eldest son came of age. Six months afterwards, on 22d October, King Ferdinand died, and Donna Leonora assumed the regency.

Regency of Leonora.

But she did not hold it long. The whole Portuguese people detested her, and their feeling of nationality was outraged by the contemplated union of their crown with that of Castile. Dom John, grandmaster of the Knights of St. Bennett of Aviz, and an illegitimate son of Pedro the Severe, shared both the personal hatred for the queen and the political desire for independence, and on 6th December he headed an insurrection at Lisbon and slew the queen's lover, Andeiro, in the precincts of the palace. Leonora fled to Santarem and summoned John I. of Castile to her help, while Dom John was proclaimed defender of Portugal, João das Regras being appointed chancellor and Nuno Alvares Pereira constable. Dom John sent to England for assistance, which was promised him, and put the capital in a state of defence. In 1384 John of Castile entered Portugal and formed the siege of Lisbon. The resistance was worthy of the cause; the archbishop of Braga fought like a knight; but a pestilence in the besiegers' camp did them more mischief than even the bravery of the besieged, and John I. had to retire defeated. Before doing so he discovered that Donna Leonora had plotted to poison him, so he seized her and imprisoned her in the convent of Tordesillas, where she died in 1386. But it availed little to have repulsed one Castilian army; the relative sizes of Portugal and Castile made it obvious that the struggle would be a severe one; the independence of Portugal was at stake, and the Portuguese fought as men fight for their existence as a nation. The heroic constable, who won the surname of the "Holy Constable," defeated the Castilians at Atoleiro and Trancoso. On 6th April, 1385, a cortes assembled at Coimbra, and declared the crown of Portugal to be elective, choosing, at the instance of the chancellor, Dom John to be king of Portugal. King John then called all his chivalry together, with the freemen of his cities, and, with the help of 500 English archers, utterly defeated a superior Castilian army at Aljubarrota on 14th August, and in the following October the Holy Constable destroyed another army at Valverde. These blows greatly weakened the prestige of Castile and increased that of Portugal, and when John of Gaunt arrived the following year with 2000 lances and 3000 archers the king of Castile sued for peace. King John of Portugal perceived the advantage of the friendship and alliance of England, and on 9th May, 1386, was signed the treaty of Windsor, by which the two countries were to be allies forever in every transaction. He drew the alliance still closer in 1387 by marrying Philippa of Lancaster, a daughter of John of Gaunt by his second marriage; and a truce was made between Portugal and Castile, and renewed at intervals until a final peace was signed in 1411. The only attempt made to disturb King John I. was an incursion by the eldest son of Ines de Castro, Dom Diniz, in 1398, assisted by Henry III. of Castile, but the legitimate claims of the prince carried no weight against the conqueror of Aljubarrota, and he retired discomfited. The long reign of John I. was, like that of King Diniz, a reign of peaceful development: Diniz had settled and united the country after the Moorish wars; John did the same after the obstinate war with Castile, and at the end of his reign saw Portugal beginning to expand beyond the sea. The keynotes of his foreign policy were friendship with England and peace with Castile. Henry IV., Henry V., and Henry VI. of England all successively ratified the treaty of Windsor; Richard II. sent troops to help King John against Dom Diniz in 1398; Henry IV. made him a knight of the Garter in 1400; and Henry V. sent him help in the expedition to Ceuta in 1415. John's internal government was not so happy, for, though personally a clever administrator, he had had, in order to maintain himself when he claimed the crown, to grant vast privileges and estates to the nobles who became more and more powerful, and, by their exercise of full feudal rights, almost independent. It was at the earnest request of his three elder sons, Dom Duarte or Edward, Dom Pedro, and Dom Henry, that he consented to invade Africa in 1415. The young princes desired to win their knightly spurs; there were no enemies at home; and what could be more proper than to attack the old hereditary foes of Portugal, the Moors, in Morocco itself? The queen from her death-bed sent her blessing; the princes proved themselves worthy sons of their father; and by the occupation of Ceuta the Portuguese made their first conquest beyond the limits of their country. The expedition over, the elder princes each followed his own bent; Dom Edward assisted his father in the labors of government; Dom Pedro, who was made duke of Coimbra, traveiled throughout Europe, and showed himself everywhere a learned and accomplished as well as brave knight; and Dom Henry, who was master of the Order of Christ, governor of Algarves, and duke of Viseu, established himself at Sagres, and devoted his life to the encouragement of maritime exploration, for an account of which see vol. x. p. 161. Portuguese discoveries thus made illustrious the closing years of the reign of King John, who died in 1433.

John I.

Edward.

Contrary to expectation, the reign of King Edward (so called after Edward III. of England) proved, in spite of his own great qualities, but short, and was marked by one signal disaster. On ascending the throne he summoned a full cortes at Evora and secured the passing of the Lei Mental, or the provision which was supposed to be in the mind of King John when he gave his extensive grants to the nobility, namely, that they could only descend in the direct male line and on failure should revert to the crown. By this means Edward hoped to check the excessive power of the nobles, many of whom fled to Castile. He supported his father's policy, married a princess of Aragon, and, after confirming the treaty of Windsor, was made a knight of the Garter in his father's room. He also encouraged the explorations of Dom Henry; but the king's life was shortened and Dom Henry's explorations were checked for a time by the fatal expedition to Tangiers in 1436. At the earnest request of his youngest brother Dom Ferdinand and of Dom Henry himself, and in spite of the remonstrances of the pope and Dom Pedro, the king sent a fleet to attack Tangiers; the army was cut off, and it was only by sacrificing Dom Ferdinand as a hostage that the troops were allowed to retire to their ships. The imprisonment of his brother preyed on King Edward's mind, and he died in 1438, while Dom Ferdinand, after a long and cruel captivity at Fez, borne with such exemplary piety as to win him the title of "the Constant Prince," died from ill-treatment in 1443.

Affonso V.

The new king, Affonso V. was a minor, and his reign began with a struggle for the regency between his mother, Donna Leonora, and his uncle, Dom Pedro, duke of Coimbra. The people of Lisbon supported the latter, who was recognized as regent; and his conduct justified the choice. He pursued his brother's policy of curbing the pretensions of the nobles, and encouraged Dom Henry's work of discovery which advanced every year. Dom Pedro's power was seemingly at its height in 1447 when Affonso V. was declared of age and at the same time married his cousin Leonora, daughter of Dom Pedro; but the duke of Braganza poisoned the king's mind against his uncle, and schemed his dismissal from court. Then, not satisfied with this, he marched against him with a royal army, largely recruited by the nobility, who hated the duke of Coimbra. The two forces met at Alfarrobeira on 20th May, 1449, when the regent was slain, to the great regret of the Portuguese people. The young king fell more and more under the influence of the duke of Braganza and his sons, who humored his desire for knightly fame and his dream of sitting on the throne of Castile, and who secured to themselves vast grants of royal property. This knightly idea appears in Affonso's three expeditions to Africa, which won him the surname of "the African:" in 1458 he took Alcácer Seguier; in 1461 he failed; and in 1471 he took Arzilla and Tangiers. Meanwhile maritime exploration went on apace; but in 1460 Dom Henry the Navigator, the heart and soul of these maritime enterprises, died. The "Ré Cavalleiro" or knightly king was now bent on the old chimerical scheme of winning Castile; for that purpose he married in 1475 his own niece, the infanta Joanna, only daughter of Henry IV. of Castile, and claimed the kingdom; but the Castilians preferred the infanta Isabella, who had married Ferdinand, king of Aragon. The rival parties took up arms; and the king of Portugal was utterly defeated at Toro in 1476, which sent him hurriedly to France to beg help from Louis XI.; but his mission was in vain, and he saw no alternative save signing the treaty of Alcantara (1478), by which his newly-won wife was sent to a convent. He remained inconsolable at his loss, and alternately abdicated and returned until his death in 1481.

John II.

His successor, John II., was a monarch of a very different type; though he had proved himself a brave and valiant soldier at the battle of Toro, he pursued the old policy of the house of Aviz, that of peace and family alliances with Castile and of commercial intimacy with England. But he was also a typical king of this period, and followed the example of Louis XI. in France and Henry VII. in England in breaking the power of the nobles, with the hearty acquiescence of the people. Besides political reasons for this policy, he remembered that he was the grandson of the great duke of Coimbra, and bound to revenge his murder at Alfarrobeira. The first act of his reign was to summon a full cortes at Evora, at which it was decreed that the royal corregidors should have full right to administer justice in all the feudal dominions of the nobility. This act brought him of course into direct conflict with the nobility, who were headed by Ferdinand, duke of Braganza, to the king's great delight, for, as he said, the wanton liberality of his father had left him only the high roads of Portugal for his inheritance. Hence the duke of Braganza was naturally the first object of the king's attack. He was the wealthiest nobleman not only in Portugal but in the whole Peninsula; his brothers held the high offices of constable and chancellor of the kingdom, and they too had all assisted in the overthrow of the duke of Coimbra. He believed himself to be safe because he and the king had married sisters, but he was promptly arrested for high treason, and after a very short trial was executed at Evora on 22d June, 1483. His own and the king's brother-in-law, Ferdinand, duke of Viseu, a grandson of King Edward, succeeded to the leadership of the nobles; but John II., imitating Louis XI.'s policy of not sparing his own family, stabbed him with his own hand at Setubal on 23d August, 1484, and afterwards executed some eighty of the leading nobles, breaking the feudal power of the class forever. This terrible struggle over, he occupied himself which such success in administration that he won the surname of "the Perfect King." But he did not intend to keep the Portuguese in idleness. He was surrounded by the gallant knights who had been trained by his father, and who, though now frightened out of treason, yet needed some occupation, and at his court were the famous navigators trained by Dom Henry. In 1484 he built a fort at La Mina or Elmina to cover the increasing trade with the Gold Coast, and in 1486 Bartholomeu Dias rounded the Cape of Good Hope and reached Algoa Bay. The king was full of plans for reaching India and discovering Prester John; besides despatching a special expedition for this purpose in 1487, he sent Pedro de Evora and Gonçalo Annes to Timbuctoo, and Martim Lopes to Nova Zembla to find a northeast road to Cathay. With all his perspicacity, he made the great mistake of dismissing Columbus in 1493 as a visionary; but he was occupied to the very last day of his life in getting ready the fleet with which Vasco de Gama was to find out the passage to India by the Cape of Good Hope (see vol. x. p. 161 *sq.*). It was in his reign, in 1494, that the pope issued his famous bull dividing the undiscovered parts of the world between Spaniards and Portuguese. A great sorrow darkened the later years of John II. in the death of his only son, Affonso, who in 1490 had married Isabella, eldest daughter of Ferdinand and Isabella of Spain; and he himself died in the flower of his age in 1495.

Emmanuel.

The reign of Emmanuel, "the Fortunate," brother of the murdered duke of Viseu, is the heroic period of Portuguese history. The great men and brave knights of the reigns of Affonso V and John II. were still living, and Vasco de Gama, Francisco de Almeida and Affonso de Albuquerque were to make their king's reign forever glorious. Yet Emmanuel personally contributed but little to this glory; his one idea was to sit on the throne of Castile. To gain this end he proposed to marry Isabella, eldest daughter of Ferdinand and Isabella and widow of Dom Affonso, and to win her hand he consented to expel the Jews from Portugal, although they were the richest and most useful class of people in the kingdom, and had been faithfully protected ever since the days of Affonso Henriques. He married Isabella in 1497, and was on a progress through Spain in the following year for the purpose of being recognized as heir to the throne, when she died suddenly at Toledo, and with her disappeared his great hopes. Even then he did not despair, but in 1500 married his deceased wife's sister, Maria, though her elder sister Joanna was also married, and had a son who was afterwards the emperor Charles V. While the king was thus occupied great things were being done in Asia by his subjects.

n 1497 Vasco de Gama had crossed the Indian Ocean and reached Calicut; in 1500 Pedro Alvares Cabral discovered Brazil on his way to India; in 1502 Vasco de Gama paid his second visit to the Malabar coast; in 503 Duarte Pacheco defended Cochin and with 900 Portuguese defeated an army of 50,000 natives; and in 505 Francisco de Almeida was appointed first viceroy of India. This is not the place to dilate on the great deeds of **ALBUQUERQUE** (*q.v.*) and of the Portuguese n India; it is enough here to mark the dates of a few f the most important discoveries and feats of arms which illustrate the reign of Emmanuel. In 1501 João da Nova discovered the Island of Ascension and Amerigo Vespucci the Rio Plata and Paraguay; in 1509 Diogo Lopes de Sequieira occupied Malacca; in 1510 Affonso de Albuquerque occupied Goa; in 1512 Francisco Senão discovered the Moluccas; in 1515 Lopes Soares built a fort at Colombo in the island of Ceylon; in 1517 Fernando Peres Andrada established himself at Canton, and made his way to Peking in 1521; and in 520 Magalhães (Magellan), a Portuguese sailor, though n the Spanish service, passed through the straits which bear his name.

John III. The reign of John III., who succeeded Emmanuel in 1521, is one of rapid decline. The destruction of the feudal power of the nobility by John II. had not been an unmixed good: it had fatally weakened the class of leaders of the people; the nobility lost all sense of patriotism and intrigued for "moradias," or court posts; and, in short, their position was much the same as that of the French nobility before the Revolution of 1789. The overthrow of their power had also made the king absolute; having now no feudal nobility to combat, he had no need of the support of the people, and the newly created Indian trade brought him an income greater than that of any prince in Europe, so that he had no need of taxes. There was, however, a more serious cause of the declining power of Portugal than the absolutism of the government, and that was the rapid depopulation of the country. Alemtejo and Algarves had never been thoroughly peopled; the devastation produced by constant war could not be easily repaired; and, though the exertions of Diniz the Laborer had made Beira the garden of Europe, the southern part of the kingdom was chiefly in the hands of the military orders, who did not sufficiently encourage immigration. The great discoveries of the 15th century quickened the depopulation of Portugal. Not only did the bulk of the young men gladly volunteer as soldiers and sailors to go in search of wealth and honor, but whole families emigrated to Madeira and the Brazils. Also the Portuguese who did continue to live in their native country flocked to Lisbon, which trebled in population in less than eighty years, owing to the large fortunes which could be made there in trade. The king, the nobles, and the military orders were quite unconcerned at this extensive emigration, for their large estates were cultivated much more cheaply by African slaves, who were imported from the time of the first voyages of Dom Henry in such numbers that Algarves was entirely cultivated by them, and even in Lisbon itself they outnumbered the freemen by the middle of the 16th century. In this respect the condition of Portugal resembled that of Italy at the time of the decline of the Roman empire, as the wealth of Lisbon resembled that of imperial Rome, while in another respect the utter corruption of the officials in the factories and Indian settlements too far resembled the peculation and corruption of the Roman proconsuls. While the Portuguese nation was exhibiting these signs of a rapid decline, another factor was added by the religious zeal of John III. This king inherited his father's bigotry and fanaticism, and was anxious to introduce the Jesuits and the Inquisition into Portugal. The Church of Rome was not likely to hinder his pious desire, but for several years the "neo-Christians"—the name given to the half-hearted converts made from the Jews as the condition of their remaining in Portugal—managed to ward off the blow. But the king's earnest wish was gratified at last, and in 1536 the tribunal of the Holy Office was established in Portugal with the bishop of Ceuta as first grand inquisitor, who was soon succeeded by the king's brother, the cardinal Henry. The Inquisition quickly destroyed all that was left of the old Portuguese spirit, and so effectually stamped out the Portuguese revival of literature that, while towards the close of the 16th century all Europe was becoming civilized under the influence of the Renaissance, Portugal fell back and her literature became dumb. The king had his reward for his piety; he was permitted to unite the masterships of the orders of Christ, Santiago, and Aviz with the crown, and to found new bishoprics at Leiria, Miranda, and Porto Alegre; but it was left to St. Francis Xavier to show the real beauty of Christianity in his mission to the Indies.

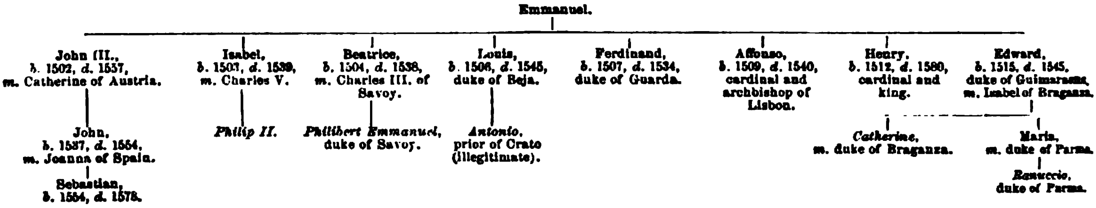
It was in India that the decline of the Portuguese was most perceptible. Nuno da Cunha, son of the discoverer Tristan da Cunha, governed the Indian settlements worthily till 1536, and then corruption undermined all prosperity until the arrival of Dom João de Castro in 1545. He was a Portuguese hero of the noblest type; and for three years the friend of St. Francis Xavier revived the glories of Albuquerque by winning the battle of Diu, and then died in the missionary's arms. Everything went afterwards from bad to worse, till even observers like the Dutchman Cleynaerts saw that, in spite of all its wealth and seeming prosperity, the kingdom of Portugal was rotten at the core and could not last. King John III., satisfied with peace and the establishment of the Inquisition in his kingdom, did nothing to check the decline; and he endeavored to secure his aims by the marriage of his only surviving son John to his niece Joanna, a daughter of Charles V., but he had the misfortune to outlive his son, who died in 1554. When he himself died in 1557 he left the crown to his grandson, a child of three years old, the ill-fated Dom Sebastian.

Sebastian. Nothing could be more disastrous for Portugal than the succession of a minor at this juncture. Under the will of John III. the regency was assumed by Queen Catherine and the cardinal Henry, his widow and his brother, but all power was exercised by the brothers Luis and Martim Gonçalves Camara, of whom the former was the young king's tutor and confessor and the latter prime minister. In 1568 Dom Sebastian was declared of age by the Camaras, who thus excluded the cardinal from even a semblance of power. As the king came to take more interest in affairs, the mixture of imperiousness, fanaticism, and warlike ambition which made up his character began to make its mark upon his reign. He tried to check the luxury of his people by a sumptuary edict that no one might have more than two dishes for dinner; he encouraged the Inquisition; and he dreamt of a new crusade in Africa for the conquest and conversion of the Moors. His crusading ardor was most objectionable to his people, who had highly approved of John III.'s surrender of all ports in Africa except Ceuta, Tangiers, Arzilla, and Mazagan, but the Jesuits and young courtiers about his person encouraged him in his wild ideas. In 1574 he paid a short visit to Ceuta and Tangiers, and in 1576, to his great delight, Mouley Ahmed ibn 'Abdallâh, after being disappointed in his application to Philip II. for help against Mouley 'Abd al-Melik, sultan of Morocco, applied to Sebastian. The king proceeded to raise money by harsh taxes on the converted Jews and by partial bankruptcy, and set sail for Africa on 24th June, 1578, with 15,000 infantry, 2400 cavalry, and 36 guns; of this army only some 10,000 were Portuguese, the rest consisting of Spanish and German volunteers and mercenaries, and 900 Italians, under Sir Thomas Stukeley, whom, when on his way to deliver Ireland from Elizabeth, Sebastian had stopped. On reaching

Africa the Portuguese king was joined by Mouley Ahmed with 800 Mohammedans. He at first amused himself with hunting, and then, just as Dom Ferdinand had done in 1436, he foolishly left his base of operations, his fleet, and the sea, and began to march over the desert to attack Larash (El-Araish). Mouley 'Abd al-Melik, who had previously endeavored to dissuade the young king from his purpose, collected an army of 40,000 cavalry, 15,000 infantry, and 40 guns, and, feeling that he was himself on the point of death from a mortal disease, ordered an instant attack upon the Portuguese at Alcácer Quibir, or Al-ḳaṣr al-Kebír, on 4th August, 1578. Dom Sebastian behaved like a brave knight, though he had not been a prudent commander, and when all was lost he was determined to lose his own life also. According to the most trustworthy account, Christovão de Tavora, his equerry, had shown a flag of truce, and had offered to surrender with the fifty horsemen who still remained about the king, when Sebastian suddenly dashed on the Moorish cavalry, who, irritated by this breach of faith, instantly slew him and the brave equerry who had followed his master. The slaughter was terrible; Mouley 'Abd al-Melik died during the action; Mouley Ahmed was drowned; Sir Thomas Stukeley was killed, with many of the chief Portuguese nobles and prelates, including Don Jayme de Braganza (brother of the sixth duke of Braganza), the duke of Aveiro (who had commanded the cavalry), and the bishops of Coimbra and Oporto, while among the prisoners were the duke of Barcellos and Duarte de Menezes. The sad news was brought to Lisbon by the admiral of the fleet, Dom Diogo de Sousa, and the cardinal Henry was proclaimed king of Portugal as King Henry I.

Henry I.

Hardly had the new king been crowned when intrigues began about his successor. He could not live long; but he determined not to examine the question himself, and so summoned a cortes at Lisbon at once to decide it. Of the seven candidates only five need be seriously considered, for Pope Gregory XIII., who claimed as heir-general to a cardinal, and Catherine de' Medici, who claimed through Affonso III. and his first wife, the countess of Boulogne, require no further notice; the relationship of the other five to Emmanuel can be best perceived from the following table:



It clearly appears that the heiress to the throne was Catherine, duchess of Braganza, and failing her heirs the duke of Parma, and that the claims of Philip II. and of the duke of Savoy were only valid in case of the extinction of the line of Dom Edward. Yet, though the university of Coimbra declared in favor of the duchess of Braganza, Philip II. set to work to win over the majority of the cortes. Money and lavish promises assisted the eloquence of his two chief supporters, Christovão de Moura and Antonio Pinheiro, bishop of Leiria; and when the cardinal-king died on 31st January, 1580, the cortes was quite ready to recognize Philip, although the people, or rather that small portion of the inhabitants who were really Portuguese, felt their old disinclination towards the union of Spain and Portugal. Philip prevented any movement on the part of the duke of Braganza by promising him Brazil with the title of king, and a marriage between the prince of the Asturias and his daughter, which, as the duke hated war and loved ease, were readily accepted; but to Philip's surprise a competitor whom he had taken no account of, Antonio, the prior of Crato, declared himself king at Santarem, and then entered Lisbon and struck money. Portugal, however, enervated by wealth, oppressed by the Inquisition, and reduced in free population, felt no inclination to make a powerful stand against Philip, who had all the prestige of being the son of Charles V., while the hotheaded but incapable prior of Crato could not be compared to the great John I.; and the cortes, which had in 1385, under the honeyed words of João das Regras, enthusiastically fought for Portugal, in 1580 listened to the promises of Christovão de Moura and rejected the prior of Crato. The duke of Alva entered Portugal at the head of a Spanish army and easily defeated Dom Antonio at Alcantara, after which Philip was declared king of Portugal.

Philip II. of Spain.

The other candidates were obliged to acquiesce in Philip's success; the duke of Braganza, though greatly disappointed at receiving only the office of constable and the order of the Golden Fleece instead of the whole of Brazil, was, like the majority of his countrymen, too apathetic to strike a blow. Philip pledged himself to recognize the individuality of Portugal in a cortes held at Thomar in 1581, when he promised that he would maintain the rights and liberties of the people, that the cortes should be assembled frequently, that all the offices in the realm should be given to Portuguese alone, and that no lands or jurisdiction in Portugal should be given to foreigners, and that there should be a Portuguese council, which should accompany the king everywhere and have entire charge of all Portuguese affairs. But the lower classes refused to believe that Dom Sebastian was dead,—a belief encouraged by the stratagem of a wounded noble on the evening of the battle of Al-ḳaṣr al-Kebír to gain admission into the city of Tangiers by asserting that he was the king; and four successive impostors arose, who assumed the name of the dead monarch. The first two, who were mockingly called the "king of Pennamacor" and the "king of Ericeira," were Portuguese of low birth, who were recognized by a few people in the vicinity of their native villages, and easily captured in 1584 and 1585; the third, Gabriel Espinosa, was given out as Dom Sebastian by a Portuguese Jesuit, and introduced as such to Donna Anna, a natural daughter of Don John of Austria, who believed in him, but he was executed in 1594; while the fourth, a poor Calabrian named Marco Tullio, who could not speak a word of Portuguese, asserted his pretensions at Venice as late as 1603, twenty-five years after Dom Sebastian's death, and, after obtaining some success in Italy, was also captured, sent to the galleys, and afterwards executed. Of more importance were the renewed attempts of the prior of Crato to assert his claims with the assistance of foreign allies. In 1582 he proceeded to the Azores with a strong French fleet under Philip Strozzi, but his ill-fortune followed him: Strozzi was defeated and killed in a battle with the Spanish admiral Don Alvaro de Bacam, and Don Antonio fled to England. There Elizabeth received him kindly, and in 1589 she sent a strong fleet under Drake and Norris to help him win back his "kingdom"; but Drake and Norris quarrelled, Portugal showed no willingness to receive him, nothing was done, and the English retired. The unfortunate prior, finding that Elizabeth would do nothing more for him, again returned to Paris, where he died in poverty in 1594.

Domination of Spain.

"The sixty years' captivity," as the domination of Spain over Portugal from 1580 to 1640 is called, was a time of disaster for the country: not only did the English sack Faro in 1595, but Dutch, English, and French all preyed upon its great colonial possessions; the Dutch in particular, after beating the Portuguese in India, took from them the greater part of the lucrative Indian trade. This they did with the more ease since, with the true commercial spirit, they not only imported merchandise from the East to Holland but also distributed it through Dutch merchants to every country of Europe, whereas the Portuguese in the days of their commercial monopoly were satisfied with bringing over the commodities to Lisbon, and letting foreign nations come to fetch them. The Dutch incursion into the Indies was directly caused by Philip's closing the port of Lisbon to them in 1594; and in 1595 Cornelius Houtman, a Dutchman, who had been employed by the Portuguese as an Indian pilot and then imprisoned by the Inquisition, offered to lead a Dutch fleet to the Indies, and in 1597 they erected a factory in Java. They speedily extended their sphere of operations by occupying the Moluccas and Sumatra, and in 1619 they built Batavia as a rival commercial capital in the East to Goa. The English quickly followed their example; in the reign of Elizabeth the English captains had been content to ravage Pernambuco in 1594–95, Fort Arguin in 1595, and the Azores in 1596, and in the reign of James I. the East India Company was established in the Indies at Surat. The French also settled themselves in Brazil and opened a flourishing trade with South America and the west coast of Africa; and even the Danes struck a blow against the monopoly of the Portuguese by building a factory at Tranquebar. To make up for these losses, what had Portugal received from Spain? The promises made to the cortes at Thomar were all broken; the cortes was only summoned once in 1619 to recognize Philip, the eldest son of King Philip III., as the heir to the throne on the occasion of his only visit to Lisbon; Lerma and Olivares, the all powerful ministers of Philip III. and Philip IV., appropriated to themselves large territories within the realm of Portugal; and, whenever it was possible, Spaniards were installed in Portuguese bishoprics and civil offices.

At last a blow was struck against this supremacy of Spain in the revolution of 1640 and the elevation of the house of Braganza to the throne of Portugal. Things had been tending towards a revolution for a long time, but the final impulse came from the energy of certain noblemen, conjoined with the weakness of Spain and the hope of assistance from France.

Revolt of Portuguese.

The general discontent was shown by risings in Lisbon in 1634 and in Evora in 1637, where for a short time the mob ruled the city; and, when Spain was hampered by the Catalan revolt and the French war, the opportunity seemed favorable for the Portuguese. The difficulty was to find a leader; the eighth duke of Braganza, grandson of the infanta Catherine, daughter of Dom Edward, was a pleasure-loving, easy-tempered man, fond of music and hunting, quite happy in his palace at Villa Viçosa; but the energy of his wife, Luiza de Guzman, Castilian though she was, secured his passive co-operation, and his confidential adviser, João Pinto Ribeiro, soon formed a powerful band of conspirators among the Portuguese noblemen, when the news arrived in 1640 that the arrière-ban of Portugal was summoned to fight against the Catalans. Portugal was at that time under the nominal government of Margaret of Savoy, duchess of Mantua, who was surrounded with Spaniards and Italians; but the real government was in the hands of the tyrannical secretary of State, Miguel de Vasconcellos de Brito. Ribeiro had no difficulty in collecting together many daring and discontented noblemen, of whom the chief were Miguel de Almeida, Pedro de Mendonça Furtado, Antonio and Luis de Almada, Estevão and Luis da Cunha, Rodrigo and Emmanuel de Sá, and Jorge de Mello; and the archbishop of Lisbon himself, Rodrigo da Cunha, if not actually a conspirator, certainly must have had a knowledge of what was going on through his relatives the Almadas and Da Cunhas. The plot was carefully elaborated, parts being assigned to the leading conspirators; and the day fixed was the 1st of December. The plot was completely successful; the archbishop of Lisbon was appointed lieutenant-general of the kingdom, with Almeida, Mendonça, and A. de Almada for councillors, and expresses were sent off to the duke of Braganza to inform him of all that had passed and to offer him the crown. He was at first unwilling to accept the honor thrust upon him, but the duchess, on whom a prophecy that she should be a queen had had a great effect, persuaded him to go to Lisbon, where he was crowned as King John IV. on 13th December, 1640. The whole of Portugal at once rose and expelled the Spaniards, and on 19th January a full cortes met at Lisbon, which recognized King John as king of Portugal, and his son Theodosius as heir-apparent.

John IV.

The Portuguese knew well that, in spite of the Catalan rebellion and the terrible wars in which Spain was engaged, they were not strong enough to maintain their independence without foreign help, and at once sent ambassadors to France, Holland, and England. Richelieu was charmed with the success of the revolution, hoping to make Portugal a thorn in the side of Spain, such as Scotland had been to England in former days, and he at once sent a fleet under De Brezé to the Tagus; the Dutch also sent a fleet under Gylfels; but Charles I. of England was too much occupied with his quarrels with his parliament to do more than merely recognize the new king.

The Portuguese were at first successful, owing to the many wars in which Spain was involved, and, after the defeat which Mathias de Albuquerque inflicted on the baron of Molingen at Montijo on 26th May, 1644, felt at their ease in spite of the serious plot of the duke of Caminha and the archbishop of Braga, until it became obvious that Mazarin would desert them without compunction if it suited his purpose. The old Portuguese colonies at once declared for their fatherland, and this brought about a colonial war with Holland, in which indeed the Portuguese generals won many successes, but which deprived them of the assistance of the Dutch in Europe. Mazarin's refusal to insist on their independence at the congress at Münster, though he protected their envoys against the Spaniards, made them despondent; and a very curious letter of Mazarin's (4th October, 1647), offering the crown of Portugal to the duke of Longueville, exhibits at once the feeble character of John IV., the despair of the Portuguese, and their dependence on France. Mazarin's desertion did not at first do great harm, for the war between France and Spain continued, though peace was made with the empire. In the midst of this universal war John IV. died in 1656.

Affonso VI.

As the prince of Brazil, Dom Theodosio, the eldest son of the late king, had predeceased him, his second son Affonso, a boy of thirteen, succeeded to the throne as Affonso VI. under the regency of his mother. The queen-regent, who had always been more energetic than her husband, determined to pursue the war with Spain with more vigor, and summoned Marshal Schomberg to organize her armies. The result of Schomberg's presence soon appeared, and on 14th January, 1659, Dom Antonio Luis de Menezes, count of Cantanhede, won a victory over Don Luiz de Haro at Elvas. This victory in one way injured the Portuguese cause, for it so incensed Don Luiz de Haro that, during the famous conferences at the Island of Pheasants with Mazarin which led to the signature of the treaty of the Pyrenees in 1659, he not only would not hear of any intercession for the Portuguese but insisted on the insertion of a secret article in the treaty to the effect that France would promise to entirely abandon them. Neither Mazarin nor Louis XIV. intended to keep this secret article and give up the advantage of having such a useful ally in the Peninsula, and they accordingly looked about for some means to evade it. England offered the opportunity; Charles II. was seeking a wife and gladly accepted the suggestion that he should marry Catherine of Braganza, sister of the king of Portugal, both because Portugal had sheltered his cousins Prince Rupert and Prince Maurice in 1650, and because the colonial sessions which the queen-regent offered as her daughter's dowry would be very popular in England. The marriage was accordingly agreed upon in 1661, and in 1662 the earl of Sandwich came to bring the bride from Lisbon, while the English occupied Tangiers, Bombay, and Galle as her dowry, and promised to send troops to Portugal, and to make peace between the Dutch and the Portuguese. Before, however, the English soldiers arrived and the final struggle with Spain began, a family revolution had taken place in Portugal. The young king, a feeble vicious youth, was very wroth that his mother had exiled a favorite valet to the Brazils; and by the advice of two noblemen about his person suddenly declared himself of age in 1662 and transferred the government to the able hands of Luis de Sousa e Vasconcellos, count of Castel Melhor. The queen retired to a convent chagrined, but Castel Melhor continued her policy, and formed the English soldiers, who had arrived under the earl of Inchiquin, some French and German volunteers and mercenaries, and the newly-organized Portuguese levies into a powerful army, of which Schomberg was the real, though not the ostensible, commander. With this army a series of victories were won, which caused Affonso VI. to be surnamed "Affonso the Victorious," though his own successes, such as they were, were confined to the streets of Lisbon. On 8th June, 1663, the count of Villa Flor with Schomberg by his side utterly defeated Don John of Austria, and afterwards retook Evora; on 7th July, 1664, Pedro Jacques de Magalhães defeated the duke of Ossuna at Ciudad Rodrigo; on 17th June, 1665, the marquis of Marialva destroyed a Spanish army under the marquis of Carracena at the battle of Montes Claros, and Christovão de Brito Pereira followed up this victory with one at Villa Viçosa. These successes entirely broke the power of Spain, and peace was only a matter of time, when Castel Melhor decided to increase both his own power and that of Portugal by marrying the king to a French princess. Such an alliance was highly approved of by Louis XIV., and the bride selected was Marie Françoise Elizabeth, Mademoiselle d'Aumale, daughter of the duke of Savoy-Nemours and granddaughter of Henry IV. of France. The marriage was celebrated in 1666; but Castel Melhor found that, instead of increasing his power, it worked his ruin. The young queen detested her husband, and fell in love with his brother Dom Pedro; and after fourteen months of a hated union she left the palace and applied for a divorce on the ground of non-consummation to the chapter of the cathedral-church of Lisbon, while Dom Pedro shut up King Affonso in a portion of the palace and assumed the regency. He was recognized as regent by the cortes on 1st January, 1668, and at once signed a peace with Spain on 13th February, by which the independence of Portugal was recognized in return for the cession of Ceuta. This peace, signed at Lisbon, was chiefly negotiated by the earl of Sandwich and Sir Richard Southwell, the English ambassadors at Madrid and Lisbon. On 24th March the queen's divorce was pronounced and confirmed by the pope, and on 2d April she married the regent. His rule was gladly submitted to, for the people of Portugal recognized his sterling qualities, which compared favorably with those of the unfortunate Affonso VI. Castel Melhor fled to France, and the king—for Dom Pedro only called himself "regent"—was imprisoned, first in the island of Terceira and then at Cintra, till his death in 1683, the very same year in which the queen also died.

Pedro II.

As long as Affonso VI. lived Dom Pedro's power was not thoroughly established, but in 1683 he was proclaimed king as Pedro II. His reign was marked by good internal administration, the breaking out of the War of the Spanish Succession, and the Methuen treaty. His good administration kept him from being short of money, and enabled him to dispense with the cortes, which never met between 1697 and 1828; but the war of the succession almost emptied his treasury. He had in 1687, at the earnest request of the duke of Cadaval, his most intimate friend, consented to marry again in order to have an heir, and had selected Maria Sophia de Neuburg, daughter of the elector palatine, rather to the chagrin of Louis XIV., who, in the prospect of the death of Charles II. of Spain, had counted on the support of Pedro's first wife, a French princess, and who now sought to form a strong party at the court of Lisbon. He was so far successful that on the death of Charles II. King Pedro not only recognized Louis XIV.'s grandson as Philip V. of Spain but in 1701 protected a French fleet in the Tagus under the count of Chastenau against Sir George Rooke. The great Whig ministry of England was not likely to submit to this desertion on the part of England's ancient ally, and sent the Right Honorable John Methuen in 1703 to Lisbon with full powers to make a treaty, both political and commercial, with Portugal. On 27th December, 1703, he signed the famous Methuen treaty, by which Portuguese wines were to be imported into England at a lower duty than those from France or Germany, in return for a similar concession to English textile fabrics. The immediate result was that Pedro acknowledged the archduke Charles, and the ulterior that Englishmen drank port wine instead of claret or hock throughout the last century, while the Portuguese imported nearly everything they wanted from England and remained without manufactures. On 7th of March, 1704, Sir George Rooke arrived at Lisbon, convoying 10,000 English troops under Lord Galway and the archduke Charles himself. The English army at once advanced with a Portuguese auxiliary force and took Salvaterra and Valença. In the following year but little was done on the Portuguese frontier, because the archduke had sailed round to Barcelona, and Dom Pedro, who was slowly dying, handed over the regency to his sister Catherine, queen-dowager of England. Had he been conscious he might have learned of the great successes of the allied army under João de Sousa, marquis das Minas, and Lord Galway, who in rapid succession took Alcantara, Coria, Truxillo, Placencia, Ciudad Rodrigo, and Avila, and even for a short time occupied Madrid, and of their equally rapid retreat; he never recovered sufficiently, however, to know of these movements; he gradually sank, and died at Alcantara on 9th December, 1706.

John V.

The long reign of John V., who assumed the royal state at once from the regent Catherine, resembles the reign of John III. At its commencement he left the power in the hands of his father's friend, the duke of Cadaval, who continued Dom Pedro's policy and prosecuted the war against Philip V. Cadaval bound the king more surely to the Anglo-Austrian party by marrying him to the archduchess Marianna, daughter of the deceased emperor Leopold I., who was escorted to Lisbon by an English fleet under Admiral Byng in 1708. Yet the war itself did not go favorably for the allies in Spain, for the Spaniards had become enthusiastic partisans of Philip V.; and in 1709 a Portuguese army under the marquis of Fronteira was beaten at Caia, while in 1711 Duguay Trouin took and sacked Rio de Janeiro, afterwards the capital of Brazil. The war languished all over Europe after the accession of the archduke Charles to the empire, and on 6th February, 1715, nearly two years after the treaty of Utrecht, peace was signed between Portugal and Spain at Madrid by the secretary of state, Lopes Furtado de Mondonça, count of Côrte-Real. The king, as soon as he began to pay more attention to affairs, exhibited his attachment to the papacy, and in 1717 sent a fleet at the pope's bidding on a crusade against the Turks, which won a naval victory off Cape Matapan. The king declined to join the war against Alberoni, and disclosed a tendency to imitate Louis XIV., especially in building. The only indication of policy he showed was his determination to maintain peace by a close alliance with Spain. His daughter Maria Barbara was married to the infant Don Ferdinand, eldest son of Philip V., who succeeded to the throne of Spain as Ferdinand VI., while the Spanish infanta Marianna was married to the Portuguese heir-apparent, Dom Joseph. The enormous sums of money which John V. lent to the pope, to the real impoverishment of his country, brought him rewards which were of no real value, but which were such as he highly esteemed; namely, the archbishopric of Lisbon was erected into a patriarchate, and the title of "Fidelissimus" or "Most-Faithful" was conferred upon the kings of Portugal, to correspond with those of "Most Christian" and "Most Catholic" attributed to the kings of France and Spain respectively.

Joseph.

Joseph, who succeeded his father in 1750, had the merit of perceiving the pre-eminent powers of Sebastião de Carvalho, who governed Portugal throughout this reign, and who, under his title of the marquis of Pombal (see POMBAL), ranks among the very greatest of 18th-century statesmen. In everything—in his great internal and administrative reforms, in his financial reforms, in the reorganization of the army, in the abolition of slavery, and in the great struggle with the Jesuits—Joseph supported his minister. Pombal made the king more absolute than ever, and exalted the royal prerogative while using it for purposes of reform; and in return the king maintained Pombal in power in spite of the violent protests of the priests and the opposition of his wife. Circumstances greatly helped the minister to establish an ascendency over the king's mind: his conduct at the time of the great earthquake on 1st November, 1755, secured him his high position over the other two secretaries of state; the Tavora plot gave him the influence which enabled him to overthrow the Jesuits in 1759; and the second attempt on the king's life in 1769 strengthened his hands in his negotiations with Rome and ensured the suppression of the order in 1773. The only war in which Portugal was engaged during this reign was caused by the close alliance with England, for, when Choiseul made the Family Compact and Spain entered upon the Seven Years' War, a Spanish army under the marquis of Sarria invaded Portugal and took Braganza and Almeida in 1762. Pombal immediately applied to England for help, when the count of Lippe-Bückeburg came over with a body of English troops and set to work to organize the Portuguese army; and, mainly owing to the brilliant services of Brigadier-General Burgoyne, the Spaniards were defeated at Valencia de Alcantara and Villa Velha, and peace was made on 10th February, 1763. The close of the reign was disturbed by disputes with Spain as to the possession of Sacramento in South America, which were still unsettled when King Joseph died on 20th February, 1777, leaving four daughters, of whom the eldest, Donna Maria Francisca, had married the king's brother, Dom Pedro.

Maria I. and Pedro III.

The accession of Donna Maria was the signal for the overthrow of the great marquis and the reversal of his policy. The new queen was a weak woman, and her husband, Dom Pedro, who was proclaimed king, was a weak man; coins were struck in the names of Pedro III. and Maria I., but both sovereigns were ruled by the queen-dowager, who hated Pombal, and eventually sentenced him never to come within twenty leagues of the court. The incapacity of his successor soon became manifest, while the queen, who was completely under the sway of her confessor, Dom Ignacio de San Caetano, found her greatest happiness in raising and sending large sums of money to the Latin convent at Jerusalem. Such was the state of Portugal when the great crisis in the world's history caused by the French Revolution was at hand; and, when in 1792 it became evident that affairs could no longer go on in this haphazard fashion, it was also evident that the queen was no longer fit even for the slight fatigue she had to undergo. Her brain had given way in 1788, after the successive deaths of her husband, of her eldest son Dom Joseph, who had married his aunt, Donna Maria Benedicta, and of her confessor, and Dom John found it necessary to take the management of affairs into his own hands, though he was not actually declared regent until 1799.

About the time that Dom John became regent the wish to check the spread of the principles of the French Revolution, which were as much feared in Portugal as in all other Continental states, led to the great activity of Dom Diogo Ignacio de Pina Manique, the intendant-general of police. He eagerly hunted down all Portuguese gentlemen suspected of encouraging French principles or of being freemasons, expelled all Frenchmen from the kingdom, and kept a jealous eye on the American consul, Edward Church, and a merchant named Jacome Ratton, whom he declared to be at the head of a republican conspiracy. Moreover, the Portuguese ministers not only combated the dreaded French principles at home, they also believed it a holy duty to join in the general war against France, and therefore a corps of 5000 men was sent into the eastern Pyrenees to serve under General John Forbes Skelater, and four ships under the marquis of Niza joined the English fleet in the Mediterranean. The Portuguese force under Forbes Skelater served in all the actions in the eastern Pyrenees, shared in the successes of General Ricardos, and in the defeats of the count de la Union and General Urrutia; but nevertheless the Spanish Government, then under the influ- of Godoy, the Prince of the Peace, did not hesitate to desert Portugal and make a separate peace with the French republic at Basel in July, 1795. This naturally drove Portugal into a still closer alliance with England; and, when, after the treaty of San Ildefonso (1796), by which Spain declared war against England, and the secret convention between Pérignon and Godoy to divide Portugal between them, Spanish troops were massed on the Portuguese frontiers, an urgent supplication for help was sent to England. In response the House of Commons voted Portugal a subsidy of £200,000; a force of 6000 men was despatched under Major-General Sir Charles Stuart, which deterred the Spaniards from attempting an invasion; and the prince of Waldeck, like the count of Lippe in former days, was sent to reorganize the Portuguese army. Yet the English party was not strong enough to carry the day entirely; Sir Charles Stuart was soon withdrawn, and an effort made to secure peace with France through the mediation of Spain. But the concessions of the French party were of no avail; the First Consul was as violently opposed to Portugal, as being a province of England, as the Convention and Directory had been, and in 1800 Lucien Bonaparte was sent to Madrid with instructions from his brother to insist on the abandonment of the English alliance, on the opening of Portuguese ports to France and the closing of them to England, on the extension of French Guiana to the Amazons, on the cession of a portion of Portugal to Spain, until the recovery from England of Trinidad, Port Mahon, and Malta, and on the payment of a large sum of money, and he was authorized to offer to Spain a corps of 15,000 Frenchmen if these hard terms were rejected. The Portuguese ministers did reject them, and immediately Leclerc's corps entered Spain. The campaign lasted but a few days. Olivenza and Campo Mayor fell into the hands of the Spaniards, who also won bloodless victories at Arronches and Flor da Rosa. Peace was made at Badajoz with Spain, by which Portugal ceded Olivenza, and at Paris with France, by which it consented to the extension of French Guiana to the Amazons, and promised a large indemnity. Napoleon Bonaparte was anything but satisfied with the treaty of Badajoz, and received Lucien on his return with but little favor, for his aim was utterly to destroy Portugal as a nation; and it was with a full intention to excite her to war that he sent one of the roughest and least educated of his generals, Lannes, as ambassador to Lisbon. Lannes acted fully up to his chief's expectations: he ordered the dismissal of all the ministers who favored England, and was obeyed both from fear of France and from a dislike of England owing to her high-handed naval policy. Even this humble submission of the regent did not satisfy Napoleon, and in 1804 he replaced Lannes by Junot, whom he orded to insist upon Portugal's declaring war against England. Then for a time he desisted from executing his plans against the country owing to his great campaigns in Europe, and made a treaty of neutrality with the Portuguese Government. At length in 1807, having beaten Austria, Prussia, and Russia, Napoleon again turned his thoughts to his project for the annihilation of Portugal, which had become more than ever a thorn in his side, since it refused to co-operate in his Continental schemes for ruining England. He resolved at first to act with Spain and Godoy, as Pérignon had done in 1797, and on 29th October, 1807, signed the treaty of Fontainebleau, by which it was arranged that Portugal should be conquered and divided into three parts; the northern portion should be given to the king of Etruria in the place of his Italian kingdom, which Napoleon desired to annex, while the southern portion was to be formed into an independent kingdom for Godoy, and the central provinces were to be held by France until a general peace. The signature of the treaty was followed by immediate action: Junot moved with an army rapidly across Spain, and, together with a Spanish force under General Caraffa, entered Portugal from the centre, while General Taranco and General Solano with two other Spanish armies occupied the Minho and Alemtejo. With amazing rapidity Junot accomplished the march, and the Portuguese hardly knew that war was imminent until on 27th November Colonel Lecor rushed into Lisbon with the news that the French were in possession of Abrantes. This alarming intelligence unnerved the regent, who listened to the strongly-worded advice of Sir Sidney Smith, commander of the English ships in the Tagus, to abandon his kingdom for the Brazils, and leave the English to defend Portugal; and on 27th November Dom John, after naming a council of regency, went on board the English fleet with his whole family, including the queen Maria I. The English ships had hardly left the Tagus when a small force of wearied French soldiers, who were all that remained from the terrible fatigues of the march, entered Lisbon on 30th November.

The Peninsular War.

Nothing proves more certainly the widely-spread existence of what were called French principles—that is to say, democratic ideas—in Portugal than the hearty reception which Junot met with from the first. At Santarem a deputation of the freemasons of Portugal, who were there, as in other Continental countries, a secret society for the propagation of democratic principles, welcomed him; the marquis of Alorna with the army instantly submitted to him; and the council of regency, knowing the temper of the citizens, made no attempt to hold Lisbon against him. But Junot showed no desire to grant the Portuguese a constitution, and after seizing all the money in the royal treasury he divided the country into military governments under his generals, issuing, on 1st February, a proclamation that the house of Braganza had ceased to reign. He then began to hope that he himself might succeed the Braganzas, and for this purpose sought to conciliate the Portuguese by reducing the requisition demanded by Napoleon from forty millions of francs to twenty millions, and commenced a negotiation with the radical or French party in Portugal through Luca de Scabra da Silva to induce them to send a petition or deputation to the emperor, asking for Junot to be their king. But his attempts at conciliation were of no avail; and, when the Spanish general Bellesta, who had succeeded Taranco at Oporto, seized the French governor, General Quesnel, declared for the regent, and marched into Galicia, Junot departed from Lisbon, leaving the city in the hands of a regency, headed by the bishop of Oporto. The bishop at once sent to England for help, and encouraged fresh revolts all over the kingdom, till nearly every city in Portugal rose against the French and established its own junta of government. Meanwhile the English Government had willingly listened to the request of the bishop of Oporto, and ordered the small army which had been collected at Cork, under the command of Lieutenant-General Sir Arthur Wellesley, for an expedition to South America, to proceed to Portugal. Sir Arthur landed at the mouth of the Mondego river, advanced towards Lisbon, and after defeating Laborde's division at Roliça on 17th August, 1808, routed Junot himself at Vimieiro on 21st August. These victories were followed by the Convention of Cintra, by which Junot agreed to vacate Portugal and give up all the fortresses in his possession; this convention, however disappointing from a military point of view, was eminently satisfactory to the Portuguese people, who saw themselves as speedily delivered from the French as they had been conquered by them. The regency was again established, and at once despatched Domingos Antonio de Sousa Coutinho, a brother of the count of Linhares, to London, to ask that an English minister with full powers should be sent to Lisbon, and that Sir Arthur Wellesley might be appointed to reorganize their army. Their requests were complied with; the Right Honorable J. C. Villiers was sent to Lisbon, and, as Sir Arthur Wellesley could not be spared, Major-General Beresford, who had learned Portuguese when governor of Madeira, which he had occupied in the preceding year, was sent to command their army. Portugal, however, was not yet safe from the French; Sir John Moore's advance to Salamanca and his retreat to Corunna had left the country but slightly garrisoned, and, in spite of the braggadocio of the bishop, Oporto quickly fell into the hands of Marshal Soult. Fortunately Soult, like Junot, was led away by the idea of becoming king of Portugal, and did not advance on Lisbon, thus giving time for Sir Arthur Wellesley again to arrive in the country with a powerful army. In the interval the Portuguese, in spite of some spirited fights by General Silveira, had shown how little they could do in their disorganized state, and the English Government determined to send out English officers to organise them and to take 10,000 Portuguese into English pay. Meanwhile Sir Arthur Wellesley had driven Soult from Oporto, had advanced into Spain, and won the battle of Talavera. From these successes of the English general it is pitiable to turn to the Portuguese regency. With the departure of the king all the able men of the royal party seemed to have left the country; the leaders of the radical party were either in disgrace or had fled to France; and none were left to compose the regency save a set of intriguers, whose chief idea was to get as much money from England as possible. The best part of the nation had entered the army, hence Marshal Beresford, aided by the adjutant-general, Manuel de Brito Mousinho, soon organized a force which at Busaco proved itself worthy to fight beside the English soldiery. The regency got from bad to worse, till neither Beresford nor Wellington could work with it, and the English cabinet had to demand that Sir Charles Stuart (son of General Sir Charles Stuart), their ambassador at Lisbon, should receive a place upon it. His great ability and tact soon made him master, and a certain portion of the money sent by England to pay the Portuguese troops did then find its way to its proper destination. Yet the regency, even when thus strengthened, failed to make itself popular; and that there was a large radical party in Lisbon is sufficiently proved by the deputation of eighteen journalists to the Azores in September, 1810. The troubles of Portugal were not yet over; the most formidable invasion of all was to come. During the time of Masséna's campaign in Portugal the Portuguese showed the valor of a truly heroic nation. When Lord Wellington determined to retire to the lines of Torres Vedras, he commanded all the peasants to desert their fields and leave nothing for the French to subsist upon, and they obeyed him with touching fidelity. The Portuguese troops fully proved their value as soldiers when led and trained by such English generals as Pack and Ashworth, Bradford and John Hamilton, on every battlefield in the Peninsula and in the south of France, and especially at Salamanca and the Neville. They well deserved the praise bestowed upon them by Wellington and Beresford, and the enthusiastic reception which they met with when they returned home in 1814.

John VI.

Shortly after the conclusion of the war, in 1816, the mad queen Maria I. died, and the regent succeeded to the throne as King John VI. The English Government earnestly pressed him to return to Lisbon, where dissensions in the regency and the universal discontent urgently summoned him. But the new king was perpetually hampered by his intriguing and ambitious wife, Carlota Joaquina, who, in order to raise a party in her favor, had as early as 1805 promised a constitution to the Portuguese, and in 1812 had plotted to become independent queen of Brazil. The regency had become intensely unpopular, for Sir Charles Stuart and Marshal Beresford ruled despotically; and the mass of the people, who had been willing to endure the despotism of the English during the terrible war for existence, as well as the army, which had willingly obeyed the English officers on the field of battle, grew weary of foreign rule in time of peace and raised the cry of Portugal for the Portuguese. Directly after the war, in 1817, the first rising took place in Lisbon in the form of a pronunciamento of General Gomes Freire de Andrade, who had commanded the Portuguese contingent in the Russian campaign of 1812; but it was instantly and cruelly suppressed by Beresford and the regency, and the general and eleven others were executed. Yet the radical party was by no means conquered, and when Beresford went to Rio de Janeiro in 1820 advantage was taken of his absence by the people of Oporto, headed by certain officers in the garrison, to raise the cry for reform; the regency, unable to act without Beresford, gave way before a similar rising at Lisbon; the English officers were everywhere expelled; a new regency was proclaimed; Beresford was not allowed to land when he returned from Brazil; and a constituent assembly was summoned. The new assembly, consisting largely of men of the most radical opinions, at once abolished the Inquisition and the relics of feudalism, and proceeded to draw up an impracticable constitution, which showed that they had studied the glowing speeches of the men of the French Revolution and had not profited by a knowledge of their mistakes. Prussia, Austria, and Russia withdrew their ambassadors, and England insisted on John's returning to his kingdom. He accordingly left the Brazils to the government of his elder son Pedro, and set out for Portugal, where in 1822, at the earnest request of that son, he solemnly swore to obey the new constitution. He was at once met by the opposition of the queen and his younger son Dom Miguel, who refused to recognize the constitution; in consequence they were expelled from Lisbon. This event, with the invasion of Spain by the French to put down the rebellion of 1823, encouraged Francisco da Silveira, count of Amarate, to raise a pronunciamento in Tras-os-Montes; but the king at Lisbon declared, amid loud applause, that the constitution of 1822 was abrogated and his own absolutism restored, and he appointed the count of Palmella, the head of the English or constitutional party, to be his minister. But the absolutist party did not aim at a new form of constitutional government; they were desirous to reinstate the old absolutism. The queen and Dom Miguel headed a new plot; the king's friend, the marquis of Loulé, was assassinated; Palmella was imprisoned and the king himself shut up in his palace. The united action of the foreign ministers who had remained in Lisbon freed the king; the new insurrection was suppressed; Palmella was again appointed minister; and the king, with the two chief conspirators, the queen and Dom Miguel, left Portugal once more for the Brazils. In the following year (1826) John VI. died, leaving by his will his daughter, the infanta Isabel Maria, as regent, to the great disappointment of Dom Miguel, who had returned to Portugal with the expectation of receiving it as his inheritance, while his brother Dom Pedro ruled in Brazil.

Pedro IV.

The next twenty-five years are the darkest in the whole history of Portugal and the most complicated to analyze, for the establishment of parliamentary government was no easy task; it is almost impossible to follow the rapid changes which succeeded each other, and quite impossible to understand the varying motives of the different statesmen and generals. The keynote to the whole series of the disturbances is to be found in the influence of the army. Beresford's creation was a grand fighting machine; but armies, and more particularly generals, are almost certain to intrigue in times of peace. On ascending the united thrones Dom Pedro IV. proceeded to draw up a charter containing the bases of a moderate parliamentary government and sent it over to Portugal by the English minister, Sir Charles Stuart, and then abdicated the crown of Portugal in favor of his daughter, Donna Maria da Gloria, a child only seven years old, on condition that she married his brother Dom Miguel, who was to recognize the new constitution. The charter was received with joy by the parliamentary party, and Palmella became prime minister; but in 1827 the king foolishly appointed Dom Miguel to be regent in Portugal. This ambitious prince was exceedingly popular with the old nobility, the army, and the poor; and, having declared himself absolute king, he drove the whole constitutional or chartist party—Palmella, Saldanha, Villa Flor, Sampaio, and their adherents—into exile. They fled to England, where the young queen then was, but, although they found popular opinion strongly in their favor, they found also that the duke of Wellington and his Tory ministry highly approved of Dom Miguel's behavior, and that they persisted in confounding the moderate and the radical parties, and in believing that Palmella was a democrat. Meanwhile the reign of Dom Miguel had become a reign of terror, and a new movement was begun by the conjoined chartist and radical parties, who respectively advocated the charter of 1826 and the constitution of 1822, but who sank their differences to oppose Dom Miguel. The island of Ferceira (Azores) had never submitted to this prince, and there in 1829 the marquis of Palmella, the count of Villa Flor, and José Antonio

Guerreiro declared themselves regents for the young queen; and on 11th August, 1830, they defeated in Praia Bay the fleet sent against them by Dom Miguel. This victory was the first ray of hope to the chartist party; all who could get away from Portugal hastened to the Azores; and in 1831 Dom Pedro, having resigned the imperial crown of Brazil to his infant son, came to London to join his daughter and prepare for a vigorous struggle against his brother. He met with acquiescence, if not encouragement, from the Liberal Government of Earl Grey, and managed to raise a large loan; then he betook himself with all the troops he could raise to the Azores, where he appointed the count of Villa Flor general-in-chief and Captain Sartorius of the English navy commander of the fleet. In July, 1832, Dom Pedro arrived at Oporto with 7500 men, being enthusiastically welcomed by the citizens; Dom Miguel instantly laid siege to the city. The siege was a terrible one; want within the walls and cholera among the besiegers decimated the armies, and the only real success gained was the victory of Sartorius over the fleet of Dom Miguel on 11th October. In 1833 more vigorous action began; Major-General João Carlos Saldanha de Oliveira e Daun, count of Saldanha, an old officer of Beresford's and a member of the Palmella Government in 1825, took the command in Oporto and beat off the French general Bourmont, who had been engaged by Dom Miguel to command his forces; the count of Villa Flor sailed from Oporto to Algarves, defeated General Telles Jordão, and after a triumphal march northwards occupied Lisbon; and Captain Charles Napier, who had succeeded Sartorius, destroyed Dom Miguel's fleet off Cape St. Vincent in 1833. In this year Queen Maria came to Lisbon and was received with transports of delight, while Dom Pedro as regent again proclaimed the charter of 1826. The year 1834 was one of unbroken success for the chartists; England and France recognized the queen, and the Spanish ministry of Queen Isabella, knowing Dom Miguel to be a Carlist, sent two corps under Generals Rodil and Serrano to the help of Dom Pedro. Saldanha defeated the forces of the usurper at Torres Novas and Alamoster; Napier reduced Beira; Villa Flor, who had been made duke of Terceira, reduced Tras-os-Montes and won a victory at Asseiceira; Sá de Bandeira reduced Alemtejo; the combined Spanish and Portuguese armies surrounded the rest of Dom Miguel's adherents at Evora Monte; and Dom Miguel himself capitulated on 26th May. By the convention of Evora Monte the usurper, on condition of receiving a pension, promised to leave Portugal forever; and the cortes at Lisbon not only declared him and his heirs ineligible for the throne but forbade them to return to Portugal under penalty of death. This same cortes attempted to arrange the finances, and abolished the orders of the friars, who had hitherto kept alive the party of rebellion in the villages, and finally, at Dom Pedro's request—for he felt his health failing—declared the queen of age on 18th September, 1834. Dom Pedro, who had throughout been the heart and soul of his daughter's party, retired to Queluz (near Lisbon), where he died six days afterwards from the effects of his great labors and fatigues.

Maria II.

The death of Dom Pedro deprived Queen Maria II., who was now only fifteen, of her greatest support, but a very strong ministry was formed, with the duke of Palmella as president and the duke of Terceira at the war office. Such a ministry might have lasted for a long time, but neither the queen, the nobility, nor the people understood the principles of real constitutional government, and the army was a constant source of danger. Members of different parties, while not conceiving that all alike loved Portugal, believed sincerely in their own opinions: the party in power proscribed and exiled its opponents, while the party in opposition invariably appealed to arms instead of seeking to obtain office by legitimate parliamentary means. In addition, the country was ravaged by bands of brigands, who called themselves "Miguelites," and who perpetually escaped into Spain when attacked in force; and, as each Government refused to recognize or pay interest upon the loans raised by its predecessors, the financial credit of Portugal soon fell to a very low ebb in the money markets of Europe. It is unprofitable to examine here the principles of the chief statesmen of the time as new Governments quickly succeeded each other; it will be sufficient to notice only the chief pronunciamentos and appeals to arms, and to remark the gradual approach to real parliamentary government. Queen Maria da Gloria's reign is one of violent party struggles, for they can hardly be called civil wars, so little did they involve, and that of King Luis the reign of definite and peaceable parliamentary government. In her earlier years the queen was chiefly under the influence of her stepmother, the second wife of Dom Pedro, Amelia of Bavaria, and in 1835 she married the queen-dowager's brother, Augustus Charles Eugène Napoleon, duke of Leuchtenberg, second son of Eugène Beauharnais by the princess Augusta of Bavaria, who died two months after his marriage, in March, 1835. In the following January Maria married Prince Ferdinand of Saxe-Coburg-Gotha, nephew of Leopold, the first king of the Belgians; and it was his nomination to the post of commander-in-chief that brought about the first appeal to arms. In September, 1836, Fernando Soares da Caldeira headed a pronunciamento in Lisbon for the re-establishment of the constitution of 1822, which was completely successful, and resulted in the drawing up of a new constitution. The constitution of 1838, which was really that of 1822 slightly modified, managed to work till 1842, when one of the radical ministers, Antonio Bermudo de Costa Cabral, suddenly declared the charter of 1826 at Oporto. The duke of Terceira headed a successful pronunciamento in favor of the charter, and came into office with Costa Cabral as home secretary and virtual prime minister. Costa Cabral, who in 1845 was created count of Thomar, made himself very acceptable to the queen, and, interpreting the charter in the most royalist sense, even attempted to check the freedom of the press. It was now the turn of the radicals or Septembrists to have recourse to arms: after an attempt to place Saldanha in office, the opposition broke out into open insurrection under the viscount of Sá de Bandeira, the count of Bomfim, and the count das Antas. This new insurrection is known as the War of Maria da Fonte or "patuleia," and was not suppressed until the conclusion of the convention of Granada on 29th June, 1847, when a general amnesty was declared, Saldanha being continued in power. Queen Maria da Gloria died on 15th November, 1853, and her husband, the king-consort, Dom Ferdinand II., assumed the regency until his eldest son Dom Pedro V. came of age.

The era of peaceful parliamentary government which succeeded the stormy reign of Queen Maria II. has been one of prosperity for Portugal, and much of that peace and prosperity is due to the great literary and historical revival which is signalized by the names of João Baptista de Almeida Garrett and Antonio Feliciano de Castilho, of Alexandre Herculano de Carvalho e Araujo and Luis Augusto Rebello da Silva. Men were not wanting in the early part of the 19th century to advocate the formation of an Iberian republic or kingdom, comprising the whole of the Peninsula; but the revival of national pride in recalling the glorious past of Portuguese history, which has been the work alike of Herculano and Almeida Garrett in different lines, has breathed afresh the spirit of patriotism into a people who had been almost wearied out by continual pronunciamentos. The only political event of any importance during the reign of Dom Pedro V., who came of age and assumed the government in 1855, and who in 1857 married the princess Stephanie of Hohenzollern, was the

Pedro V.

affair of the "Charles et Georges." This French ship was engaged in what was undoubtedly the slave-trade, though slightly disguised, off the coast of Africa, when it was seized by the authorities of Mozambique, and, in accordance with the laws and treaties against the slave-trade, its captain, Roussel, was condemned to two years' imprisonment. The emperor Napoleon III., glad to have a chance of posing before the French people and counting on his close alliance with England, instantly sent a large fleet to the Tagus under Admiral Lavaud, and demanded compensation, which, as England showed no signs of assistance, Portugal was compelled to pay. The whole country, especially the city of Lisbon, was ravaged by cholera and yellow fever during this reign, itself evidence of the extreme neglect of all sanitary precautions; and on 11th November, 1861, the king, who refused to quit the pestilence-stricken capital, died of cholera, and was speedily followed to the grave by two of his brothers, Dom Ferdinand and Dom John.

Luis.[1]

At the time of Dom Pedro's death his brother and heir, Dom Luis, was travelling on the Continent; and his father, Dom Ferdinand, again assumed the regency until his son's return, soon after which Luis married Maria Pia of Savoy, daughter of Victor Emmanuel, king of Italy. The new king followed his brother's policy and allowed his ministers to fight their battles in the chambers without interference from himself. During his reign the old combatants of the reign of Maria da Gloria died off one by one,—Palmella, Terceira, Thomar, Saldanha, and Sá de Bandeira. Their successors in political leadership, the duke of Loulé, Aguiar, the marquis of Avila, and Antonio Manual Fontes Pereira de Mello, though not inferior in administrative ability, always avoided an appeal to arms, and therefore, if they do not contribute striking pages to the history of Portugal, certainly contribute more to the prosperity of the country. The last pronunciamento, or rather attempt at a pronunciamento, of the last survivor of Queen Maria's turbulent statesmen, the duke of Saldanha, in 1870, only proved how entirely the day of pronunciamentos had gone by. He conceived the notion that the duke of Loulé, as a freemason and an advanced progressist, was a favorite with the king, after the manner of the duke of Polignac and Charles X. of France; so, recalling a few such historical examples to the king's mind, he insisted on the duke's dismissal, and threatened an appeal to arms. The king, perceiving that Saldanha was in earnest, and knowing the great influence of the old man, consented to dismiss the duke of Loulé. After keeping Saldanha himself in office for four months, Luis sent him as ambassador to London notwithstanding his eighty years, where he could do no mischief, and where he died in 1876. The steady prosperity of Portugal has been largely due to the present form of government based on the charter of 1826, as modified in 1852, and is borne witness to by the reconstitution of the House of Peers in 1878 from an hereditary assembly to one of life peers. It is a notable fact that the two loans raised by the Portuguese government in 1880 and in 1882 were quickly subscribed, and mainly within Portugal itself. Of recent years much attention has been drawn to the Portuguese settlements in Africa, since the opening up of the interior has made them of vast importance on both the east and the west coast. The king, ministers, and people of Portugal are fully aware of the new vista to their prosperity thus disclosed to them, and the Portuguese travellers Serpa Pinto, Roberto Ivens, and Brito Capello have taken an important share in the explorations which have opened up the interior of Africa and paved the way for its development. Public works, however, have not been neglected, and Fontes Pereira de Mello, the leader of the "regenerador" party, who has been prime minister three times—from 1871 to 1877, from 1878 to 1882, and from 1883—has steadily improved and extended the railway and telegraph systems, and carried out the more difficult labors of sanitary reform. Education also has not been neglected, and a good system of secondary and primary education has been established, mainly owing to the labors of the Portuguese poet, Antonio Feliciano de Castilho. The share taken by the leaders of the great literary and historical revival—which dates from the conclusion of the civil wars of 1846 and the publication of the first volume of Herculano's *History of Portugal* in 1848—in Portuguese political and social reform is a marked feature of the modern parliamentary life of the country; and not only have the poets Almeida Garrett and Mendes Leal and the historian Rebello da Silva held office, but many of the most promising of the new generation of literary men, such as Latino Coelho and Pinheiro Chagas, have distinguished themselves in politics. Few countries so well realize the advantages of a constitutional and parliamentary form of government as Portugal; socialism possesses there a reforming, not a revolutionary force; unity of pride in their country inspired by great writers has made the modern Portuguese ambitious to revive the glories of the past, and united men of all shades of opinion in a common patriotism. The Camoens celebration of 1880 shows that the Brazilians were still proud of their mother-country, and that the Portuguese race all over the world was ready to develop new energy and perseverance, and to prove its true descent from the men who under Affonso Henriques overthrew the Moors, who under John I. and John IV. rejected the rule of the Spaniards, under Affonso de Albuquerque and João de Castro conquered the East, and who by the voyage of Vasco de Gama created a new era in the history of the world.

Bibliography.—The best continuous history of Portugal is still that of Heinrich Schaefer, in Heeren and Ukert's *Europäische Staats-Geschichte*, 1840–46, partly translated into Portuguese by J. L. Domingues de Mendonça (Lisbon, 1842–47), which quite eclipsed the very ordinary works of Diogo Lemos (20 vols., 1786–1820), Sousa Monteiro (10 vols., 1838), and J. F. Pereira (3 vols., 1846–48), and the two chief English and French histories up to that date,—J. Dunham's (along with that of Spain) in Lardner's *Cabinet Cyclopædia* (1838–43), and Bouchot's, in Duruy's *Histoire Universelle* (1846). After the publication of Schaefer's *History*, and not uninfluenced by it, Alexandre Herculano commenced his great work, the *Historia de Portugal* (4 vols., 1848–53), in which he overthrew old legends and treated history scientifically. Owing, however, to the persecution and libellous pamphlets of such men as Francisco Recreio, J. D. Fonseca Pereira, and A. C. Pereira, he closed his work at the year 1279; but from 1854 to 1857 he published his *Da Origem e Estabelecimento da Inquisição em Portugal*, which also caused a great outcry. Nevertheless his example was followed, and a series of extremely good histories has been issued during the last twenty years, notably L. A. Rebello da Silva's *Historia de Portugal pendente XVI. e XVII. Seculos* (5 vols., 1860–71), which covers the failure of Don Sebastian and the revolution of 1640; J. M. Latino Coelho's *Historia de Portugal desde os fins do XVIII. Seculo até* 1814 (1874); J. F. Fonseca Renevide's *Las Rainhas de Portugal* (1878); and the extremely interesting and illustrated *Historia de Portagal* in 37 parts by Antonio Ennes, B. Ribeiro, Edouard Vidal, G. Lobato, L. Cordeiro, and Pinheiro Chagas (1877–83). The new historical school, headed by the viscount of Santarem, has also spent much time upon the conquests of the Portuguese in India, and Herculano edited the *Roteiro de Vasco de Gama*; nor must the admirable editions of the old Portuguese navigators and travellers published by the Hakluyt Society be omitted, or the well-known *Life of Prince Henry of Portugal*, by R. H. Major (London, 1868), which has been translated into Portuguese by J. A. Ferreira Brandão (1876). The new school has paid attention to the publication of the early chronicles of Portugal, and since 1856 several volumes of *Portugalliæ Monumenta Historica* have been issued by the Lisbon Academy of Sciences under the direction of Herculano; but this work was not neglected by their predecessors, as appears in the *Collecção dos Livros ineditos de Historia Portugueza* edited by J. F. Corrêa de Serra for the academy (11 vols., 1790–1804), and the *Collecção dos principaes Auctores da Historia Portuegueza*, published in the same manner (1806). *Fœdera*, too, were not neglected during the present century; there exist two good collections: one, commenced by the viscount of Santarem as *Quadro elementar das Relacões politicas*

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[1] [He died October 19, 1889, at the age of fifty-one, and was succeeded by his son Carlos. He translated several of Shakespeare's tragedies into Portuguese.—AM. ED.]

e diplomaticas de Portugal, and continued by Rebello da Silva for the academy as *Corpo diplomatico Portuguez*, extends from the early days of the monarchy till 1640 (36 vols., 1856-78); the other, which is practically a continuation of the first, is called a *Collecção dos Actos publicos celebrados entre a Coroa de Portugal e as mais Potencias desde* 1640 *até ao Presente*, commenced by J. Ferreira Borges de Castro, and continued by J. Judice Biker (8 vols., 1856-66). Two works on constitutional history here deserve mention, *Memorias para a Historia das Inquirações dos primeiros Reinados de Portugal*, published (1816) by the Lisbon College of Diplomatics, and *Memorias para a Historia e Theoria das Cortes*, by the viscount of Santarem (Lisbon, 1828). Before noticing books treating exclusively of the history of the present century, a few special works and articles ought to be enumerated, such as the chevalier de Jant's *Relations de la France avec le Portugal au temps de Mazarin*, by Jules Tessier, (Paris, 1877); Vertot's *Revolutions de Portugal* (Paris, 1678), Miguel d'Antas, *Les faux D. Sebastien* (Paris, 1866); R. Carte's *History of the Revolutions of Portugal from the Foundation of that kingdom to the year* 1677, *with Letters of Sir R. Southwell during his Embassy there to the Duke of Ormond* (London, 1740), which are the best books on their respective subjects, and two articles in vol. ii. of the *Annaes das Sciencias Moraes e Politicas*, "D. João II. e la Nobreza," by L. A. Rebello da Silva, and "Apontamentos para a Historia da Conquista de Portugal por Filippe II.," by A. P. Lopes de Mendonça. The literature of the history of the last hundred years requires careful selection; the best work is, however, the *Historia da Guerra civil e do Estabelecimento do Governo parlementar em Portugal*, by Simão José da Luz Soriano (8 vols., 1866-82); for the Peninsular War see, besides Napier's history, the *Historia geral da Invasão dos Francezes em Portugal*, by Accursio das Neves (Lisbon, 1810-11), and *Excerptos historicos relativos a Guerra denominada da Peninsula e as anteriores de* 1801, *de Roussillon e Cataluña*, by Claudio de Chaby (1863). The period of the war of Dom Miguel is best seen in the *Memorias para a Historia do tempo que duron a Usurpação de D. Miguel*, by J. L. Freire de Carvalho (Lisbon, 1841-43); the *Historia da Liberdade em Portugal*, by J. G. Borros Cunha (Lisbon, [illegible]); *The Civil War in Portugal, and the Siege of Oporto by a British Officer of Hussars* [Colonel Badcock] (1835); and *The Wars of Succession of Spain and Portugal*, by William Bollaert (vol. i., 1870). For the ensuing period consult the *Despachos e Correspondencia do Duque de Palmella* (3 vols., 1851-54); the *Correspondencia official de Conde de Carneira com o Duque de Palmella* (1874); and the *Memoirs of the Duke of Saldanha*, by the count of Carnota (2 vols., 1880.) (H. M. S.)

PART III.—LITERATURE.

Portugal has a distinct literature as well as a distinct history, and one which is intimately bound up with the growth of the nation. The biographies, histories, and travels of the 16th century are unrivalled of their age in brilliancy and vigor, while the poetry of a land where all men are singers is not only admirable in itself but illustrates a continuous and undecided struggle between native and foreign schools. The period of the growth of national independence and of the victories over the Moors was that of the brilliant poetry of the Portuguese troubadours, which became at last truly characteristic; but the brilliancy speedily died away with peace and national unity, to be revived in the heroic period of Vasco de Gama and Albuquerque. For in the 16th century, after the classical school of Sá de Miranda had given a polish to the language, the national epics of Camoens and his followers were produced, which might have yielded more lasting results had not the Spanish dominion paralyzed all national life. In more modern times the reaction against mere imitations of foreign literature has resulted in the formation of a new native school by which much good work both in poetry and in historical research has already been accomplished.

Troubadours.

Provençal influence.

12th to 14th Century.—The Portuguese, Gallegan, and Bable dialects are subdivisions of that form of the Lingua Romana Rustica which was spoken in Galicia and the western provinces of the Iberian Peninsula, and which until the 15th century was the literary language of Castile itself. The remains of the early poets are necessarily scanty, but they are sufficient to show that the courtly troubadours of Portugal and Castile were certainly not inferior to the more noted singers of Provence. In some respects they were even superior, since, not being tied to the forms of a merely literary language such as the Provençal, they were able to borrow both form and matter from a vigorous national poetry which can be traced through the different races which successively occupied Portugal. The "alalála," which afterwards developed into the "aravía," the earliest form of the epic, is probably a legacy from the original Turanian inhabitants; the "guayado," a short lyric with the refrain "ay" or "guai," was derived from their Celtic successors; the "cantos de ledino" are evidences of the Roman conquest, which in turn gave place to the "chacones," or dance-songs of the Visigoths; while during the Arab dominion the sensuous "serranilhas" and "cantos de amigo" found a place in the family "cancioneiros," which were then compiled in imitation of the divans or tribal songs of the ruling race. This national poetry, however, was for long affected in its literary form by foreign influences. From the beginning of the reign of Affonso Henriques (1112) to the death of Dom Sancho II. (1248) the court was under direct Provençal influence; and it is not improbable that in 1146 the celebrated troubadour Marcabrun was himself attached to the suite of Donna Matilda on her marriage with Affonso Henriques, since he was certainly a visitor at the court in 1147. The poets Egas Moniz Coelho and Gonçalo Herminguez are commonly, though erroneously, referred to the time of Affonso Henriques, who was himself a poet; but the name (and poem) of only one undoubtedly Portuguese troubadour of this period has survived, João Soares de Panha (1145-1204). The history of Galician literature properly belongs to that of Spain, but it is important to remember that Portugal is perhaps even more than Castile the heir of its early efforts. Amongst the Galician poets who frequented the court of Sancho I. (1185-1211) and formed a strong opposition to the Italo-Provençal school were Affonso Gomez, Fernam Gonçalves de Senabria, and João Soares de Paiva. The most famous of their Provençal rivals, who doubtless were the more readily welcomed owing to the king's marriage with a daughter of Raymond Berenger IV., count of Provence and king of Aragon, were Peire Vidal, Peire Valeira, and Gavaudan o Velho, who in a "sirvente" written about 1210 incited the Christians to a crusade against the Moors. Affonso III. (1248-1279) returned from his residence at the court of St. Louis of France imbued with northern rather than with southern sentiments, and consequently during his reign French influences prevailed. The nobles who had accompanied him were "trouvères" rather than "troubadours," and to one of them, Affonso Lopes de Bayam, belongs the honor of writing the first Portuguese gesta, a *Gesta de Maldiser*. Other celebrated poets of this Franco-Provençal school were the "privados," or court poets, João de Abiom, the author of several sirventes and tensons, but, like De Bayam, the writer also of cantos de amigo and cantos de ledino, Fernão Garcia Esgaravunha, and João Garcia o Pinto, his brother. The privados were in their turn satirized by Martim Moxa and Lourenço and Diogo Pezelho, who belonged to the less privileged class of "segreis," a term applied to those singers who wandered from court to court. The king's songs have been lost, or at least cannot be identified, but he is reputed to have been no mean poet, and a sirvente against Alphonso X. of Castile, which appears from internal evidence to have been written by him, is still extant. To this period also belonged the privados Fernão Fernandes Cogominho, the writer of cantos de amigo and serranilhas, and Estevam Coelho, of whose works two lovely serranilhas remain of the purest Galician form and feeling. The works of these poets show that, notwithstanding foreign influence, the national forms had already obtained some degree of favor at court. Similarity in the literary language led to considerable intercourse between Portugal and Castile, and the Galicians Pero da Ponte and Affonso Eanes de Coton were entertained by Affonso III., while the Portuguese poets Pero Gomes Barroso, Payo Gomes Charrinho, and Gonçalo Eanes do Vinhal enjoyed the patronage of Alphonso the Wise. On the accession of Diniz (1279-1325) the court literature showed the decided southern and Provençal tendencies of this king, who from the number, variety, and beauty of his songs was himself the greatest poet of his time. Educated by Aymeric d'Ebrard of Cahors, afterwards bishop of Coimbra, he at first affected the mannerisms of the decaying school of Provence. With the courts of Love which he introduced came the Limousin decasyllabic in place of the national octosyllabic metre, and the ancient forms were lost in the intricacies of the ritournelle. This king's songs are marked by an exaggerated subjectivism, but among them quaint and graceful "pastorellas" are found, full of poetic life and truth, which show that the king was not blind to the beauty of his people's lyrics. Admiration led to imitation, and the close of his reign is marked by a distinct literary revival of the national poetry, which at his hands received a polish it had somewhat lacked before. The effects of Diniz's influence pervade the whole of Portuguese poetry, for not only was he in his pastorellas the forerunner of the great pastoral school, but by sanctifying to literary use the national storehouse of song he perpetuated among his people, even to the present day, lyric forms of great beauty. Dom Diniz completely overshadows the poets who were his courtiers and contemporaries, but amongst them the most notable were Estevam de Guarda, Ayras Peres Veyturon, Ruy Gonçalves, João Eanes, and João de Guilharda, though the last-named was rather a musician than a poet. Dom Affonso Sanches, a natural son of Dom Diniz, wrote partly in the Limousin and partly in the Galician style, and another son, Dom Pedro, Conde de Barcellos, who compiled a "livro das cantigas" and a "nobiliario" or peerage, was the author of several poems, but in an affected strain, which marked the approaching decay of lyric poetry. With the reign of Affonso IV. (1325–1357) began the reaction of the Castilian language against the Portuguese, but the quarrels of Ferdinand (1367–1383) with Henry II. of Castile were the fortunate cause of the formation of a second national school. For amongst its founders were the Galician poets who took refuge at the court of Portugal, and who were followers of Macias and Padron, including Vasco Pires de Camões, ancestor of the great Luis, while to this period must be properly assigned the poems of Egas Moniz Coelho and Gonçalo Herminguez.

Epic poetry.

Epic poetry was in Portugal as in Provence a later literary development than lyric. The popular aravías must have been numerous, to judge from the remains which are still found in the Azores and in the provinces of Beira and Algarves; and to the 13th century may be referred the *Loenda de Santa Iria* and the *Canção do Figueiral*. In its literary form the Breton "lai" was known to Dom Pedro, brother of Affonso II. (1211–1223), and a few poems in this style with music attached were written by him. The *Roman de Brut* is also quoted by Diniz, but it was through the marriage of John I. with Philippa of Lancaster (1387) that a knowledge of the Arthurian cycle spread through the Peninsula and led to the popularity of the *Prophecies of Merlin* and kindred works down to the 16th century. The patriotic pride of the people, which had before found vent in the aravías or tales of contests with the Arabs, sought a new literary expression for the rising national greatness, and the parent of Camões's great epic is the poem in which Affonso Giraldes celebrates the victory won by the united armies of Portugal and Castile over the Moors at the battle of the Salado (1340). Only a small portion is extant, but it shows considerable vigor and foreshadows the development which national pride was afterwards to take in the *Lusiads*.

Early prose.

The revolt against the subjectivism of lyric poetry which appeared in the narrative spirit of the epic showed itself now in another form, and to Affonso IV. belongs the credit of fully appreciating the new tendencies. Acting under his instructions, Vasco de Lobeira (d. 1403) became the author of the first Portuguese novel by turning into prose the romance of *Amadis of Gaul*, which led the way for a host of imitations bearing a similar title. The historical records of this period are comprised chiefly in the *Chronica da Conquista do Algarve*, the *Livro velho das Linhagens*, and the *Nobiliario do Collegio dos Nobres*. The theological tendencies of the people are aptly illustrated by works which, although in Latin, deserve mention. They are the *Concordantiæ Morales* and *Interpretatio Mystica* by St. Anthony of Lisbon (1195–1231), and the writings of Cardinal Alvaro Paes (d. 1353). The most learned scholar, however, of this period was Pedro Hispano, who became Pope John XXI. (d. 1277), and whose universal learning recalled the days of the great schoolmen.

Fifteenth century.

15th Century.—During this century lyric poetry was under the increasing influence of the Spanish school and of its leader Juan de Mena, whose praises were sung in some couplets by the infante Dom Pedro, son of John I. The chief imitators of this style were Luis de Azevedo, Ayres Telles (d. 1515), and Diogo Brandão (d. 1530). The Arthurian romances of *Dom Eurives* and *Branca-Flor* may be referred to this century; and the poems on the death of the infante Dom Pedro by Luis de Azevedo, and on the death of John II. by Diogo Brandão exhibit the literary form of the epic. The constable, son of Dom Pedro, felt the influence of the Italian Renaissance, and consequently became the founder of the Dantesque or allegorical school. His *Satyra da felice e infelice Vida* is an allegorical piece of some merit, but a better specimen of this style is the *Visão* by Duarte de Brito, a compound of the *Roman de la Rose* and the *Divina Commedia*. The *Fingimento de Amore* by Fernão Brandão also possesses many beauties.

The principal prose works of the time are the *Book of the Chase* written for John I. (1383–1433), the vivid and interesting *Chronicles* of Fernão Lopes (1380–1459), the Froissart of Portugal, and the *Chronicles* of Gomes Eanes de Azurara (d. 1473), Ruy de Pina (1440–1520), and Duarte Galvão (1445–1517). King Edward himself (1433–1438) was the author of *The Faithful Councillor* and *Instructions in Horsemanship*, while a *Treatise on Tactics* with several other works showed the powers of Affonso V. (1438–1481) as a general mathematician and natural philosopher, the cultivation of which may have been in part due to the lessons learned from the *Cyropædia* translated for him by Vasco de Lucena.

National and classical schools.

16th and 17th Centuries.—The golden age of Portuguese literature had now arrived, and to Bernardim Ribeiro (*c.* 1500) is due the honor of founding its characteristic school of romantic pastoral poetry. The rivers and mountains of his native land are the natural framework of a poet's fancy, and the revival of classical learning showed him in the *Eclogues* of Virgil a model which he was not slow to imitate. His *Eclogues*, written in "redondilhas" (octosyllabic nine or ten-lined stanzas), are accordingly the earliest in modern Europe, and, while replete with the charms and conceits of versification of the troubadours, show a truly poetic love of nature. He was also the writer of the first "sextinas" in redondilhas, and of many beautiful cantigas and elegies. To the same school, which was now the representative of all national feeling, belong Christovão Falcão, whose smaller poems are quite equal to those of Ribeiro, Garcia de Resende (1470–1554), compiler of the *Cancioneiro Geral*, a magnificent collection of poems by almost three hundred writers, beginning with Affonso Henriques, Gil Vicente (1470–1536), Jorge Ferreira de Vasconcellos (d. 1585), and Fernão Rodrigues Lobo Soropita (*c.* 1600). The last-named is chiefly known from three comic satires on the classical school and his *Introduction* to the poems of Camoens, which formed the basis of Faria e Sousa's *Commentary*. Except for the fact that a master-mind belongs to no school, Camoens himself might be claimed by these writers as a fellow-worker, for he was systematically either ignored or abused by the opposing school of classicists. His works are treated of at length elsewhere (see CAMOENS), but it is not out of place to remark here that his beauties are those of the national school and his defects the result of an imitation of the classicisms affected by his opponents. These were the followers of the school founded by Francisco de Sá de Miranda (1495–1558) on his return from Italy, where he acquired a love not only for the Renaissance, whose influence had been already felt by Ribeiro, but for the forms in which the new culture found expression. Much praise is due to him for the polish he gave to his country's literature, but by his classical affectations and the favor he showed to the Spanish language, in which his best works were written, he sowed the seeds of that decay which afterwards overtook Portuguese poetry. The eclogues, epistles, odes, elegies, and sonnets of this school are often perfect in form and contain much real poetry, but the classicisms which at first are graceful in their novelty weary in the end by their unreality, and in the hands of inferior artists degenerate into mere stage properties, used to conceal the want of genius. The shepherds and shepherdesses are no longer the idealized peasants of the troubadours but courtiers in masquerade, and the sense of this lowering of the ideal is sufficient to destroy the pleasure which would otherwise be derived from the polished language and poetic imagination. The imitators of Miranda were very numerous; the chief among them were Antonio de Ferreira (1528–1569), who was Horatian rather than Virgilian in feeling, and consequently produced but inferior eclogues, while his didactic epistles were the earliest Portuguese examples of that style, Diogo Bernardes (d. 1599), whose sacred songs are particularly good, Pedro de Andrade de Caminha (d. 1589), Fernão Alvares do Oriente (b. 1540), Don Manuel de Portugal (d. 1606), and Estevão Rodrigues de Castro (1559–1637). Among the lyric poets of the 17th century the chief of those who by their satirical and comic verses showed an inclination to the national rather than the classical school were Thomas de Noronha (d. 1651) and Jacinto Freire de Andrade (1597–1657), author of the *Fabulas de Narciso* and of various songs and sonnets published in the *Fenix Renascida* (1716–1728). Antonio Barbosa Bacellar (1610–1663) was the first writer of "saudades," and was followed in the same style by Simão Torrezão Coelho (d. 1642). Sonnets were of course written by every man of culture, but they rarely rose above the standard of mediocrity. Those of Manuel de Faria e Sousa (1590–1649), Duarte Ribeiro de Macedo (1618–1680), and André Nunes da Sylva (1630–1705) may, however, be reckoned among the best. The sacred poems of the last-named are also very good, but are surpassed by the *Jardim do Ceo* by Eloi de Sá Sotomaior, and by the poems of Sister Violante do Céo (1601–1693). The didactic epistles of Antonio Alvares da Cunha (1626–1690) are fair specimens of this class of poem.

Epics of 16th and 17th centuries.

The truly heroic life of Portugal during this period naturally demanded to be sung in a fitting strain, and the 16th and 17th centuries were consequently the era of epic poems. The earliest of these was the *Creação do Homen* by André Falcão de Resende (d. 1598), which from its similarity in style has been often attributed to Camoens (1524–1579), whose *Lusiads* appeared in 1572. Though the sole masterpiece of the country and the age, this last not unworthily eclipses other epics in which the brilliant passages are more or less numerous. Such are the *Primeiro Cerco de Diu* by Francisco de Andrade (1540–1614), the *Naufragio de Sepulveda* and the *Segundo Cerco de Diu* by Jeronymo Côrte-Real (1540–1593), both rather above the average, the *Elegiada* (1588) by Luis Pereira Brandão, the *Affonso Africano* (1611) by Vasco Mousinho de Quebedo, who shares with Côrte Real the honor of ranking next after Camoens, the *Ulysséa* by Gabriel Pereira de Castro (1571–1632), the *Viriato Tragico* by Braz Garcia Mascarenhas (1596–1656), the *Malaca Conquistada* by Francisco de Sá de Menezes (d. 1664), the *Ulyssipo* by Antonio de Souza de Macedo (1606–1682), and the *Destruição de Hespanha* (1671) by André da Silva Mascarenhas.

Drama.

The drama in Portugal was stifled in its birth. The miracle-plays of the people attained a high degree of excellence in the "autos" or sacred Christmas plays of Gil Vicente (1470–1536), but this writer was born half a century too soon for his work. His comedies, of which the best is *Inez Pereira*, are full of the rough wit which is found in the early Latin writers, but show a want of polish and dramatic conception which is fatal to their claims to high rank as works of art. The comedies of his contemporaries, Antonio Prestes, Jorge Pinto, and Jeronymo Ribeiro Soares, all show considerable talent, and the *Eufrosina* of Jorge Ferreira de Vasconcellos (d. 1585) most nearly approaches to a modern standard of excellence. Francisco Manuel de Mello (1611–1666) was the author in Portuguese of the *Auto do Fidalgo Aprendiz* as well as of several poems, but most of his works are in the Spanish language. Among the classicists Miranda was the author of the comedies *Os Estrangeiros* and *Os Vilhalpandos*, but his plays are inferior to those of Ferreira, whose dramatic works are in some respects superior to his poems. The chief of them, which was produced only a few years later than the *Sophonisba* of Trissino, is the tragedy *Inez de Castro*, but, though his subject was so fine, his treatment of it was not altogether satisfactory. There are also several plays by Camoens; but the influence of the Spanish language was by this time irresistible, and the result was that all serious dramas were written in Castilian, while Portuguese was reserved only for the lighter and more popular pieces, the best of which were collected by Coelho Rebello in *A Musa entretenida de varios Entremeses* (Coimbra, 1658).

Romances, etc.

In prose the imitations of *Amadis of Gaul* were followed by the school of the Palmeirims, which originated in the romance of chivalry *Palmeirim d' Inglaterra*. The first and second parts of this work were probably by the Spaniard Hurtado, and were only translated by Francisco de Morães (d. 1572); the third and fourth parts were written by Diogo Fernandes (*c.* 1580), and the fifth and sixth by Balthasar Gonçalves Lobato (*c.* 1600). But Morães, though thus missing the honor of being an originator, was probably the author of the scarcely less celebrated *Palmeirim de Oliva*. The *Livro de Cavalaria* by Fernão Lopes da Castanheda (d. 1559), the *Chronica do Emperador Clarimondo* by João de Barros (1496–1570), several works by Francisco Rodrigues Lobo (c. 1600), and the *Chronica do famoso Principa D. Clarisol de Bretanha* (1602) by B. G. Lobato are of a similar character. The pastoral novel originated in the *Menina e Moça* by Bernardim Ribeiro, a composition in prose and verse which gave rise through its imitation in Spanish by Jorge de Monte Mór (d. 1561) to the school of the Dianas. This style was in its turn imitated in Portuguese by Fernão Alvares do Oriente (b. 1540) in the *Lusitania Transformada*, and among other examples may be noted the *Ribeiras do Mondego* (1623) by Eloi de Sá Sotomaior, and the *Primavera*, *O Pastor Peregrino*, and *O Desenganado* (1601) by F. R. Lobo. The last-named was also the author of the more meritorious *Côrte na Aldêa*, a sort of *Friends in Council*, which was afterwards imitated in the *Serão politico* by Felix da Costanheira Turacem, the *nom-de-plume* of Lucus de St. Catherina (1660–1740). To the pastoral novel succeeded the allegories, of which *Grand Cyrus Clelia* and *Astrea* are the best examples. The inquisition, however, laid its ban upon them when they showed mystical tendencies, as in the *Pé de Rosa Fragrante*, *Cerva Branca*, etc.; but an adaptation of the *Pilgrim's Progress* was published by the inquisitor Alexandre de Gusmão (1629–1724), with a view to proving the efficacy of infant baptism, which was certainly not the intention of Bunyan. The Decameronic tales took the form in this period of the *Contos e Historias de Proveito e Exemplo* (1589) by Gonçalo Fernandes Trancoso, the *Infortunios tragicos da constante Florinda* (1625) by Gaspar Pires de Rebello, and the *Allivio de Tristes* (1672), *Retiro de Cuidados* (1681), and *Roda da Fortuna* (1692) by Mattheus Ribeiro.

History.

The pride in the national greatness which found poetical expression in the epic also caused the rise of a great school of historians. The older royal chroniclers were followed by Garcia de Resende (1470–1554), Christovão Rodrigues Acenheiro (b. 1474), and Damião de Goes (1501–1573). Their chronicles are graphic and interesting, though inferior in style to the works of their successor, who was the most brilliant early historian Portugal can boast. This was João de Barros (1496–1570), author of the *Conquest of the Indies*, which was aftewards continued in the *Asia Portugueza* by Manuel de Faria e Sousa (1590–1649), a learned and facile writer, from whose pen are also the *Europa, Africa*, and *America Portugueza*, a *Commentary* on Camoens, and numerous other works. The style of Barros is both elegant and energetic, and the criticism and accuracy which he displays make him still an authority of the first rank. The next greatest historian after Barros was the monk Bernardo de Brito (1569–1617), author of *Monarchia Lusitana*, of which there is a continuation by Antonio Brandão (1584–1637), and of the *Chronicles of the Cistercians* and of *D. Sebastião*. The elegant Latinist and best antiquary of the 16th century, André de Resende (1498–1573), whose talents were recognized by Erasmus, produced the *De antiquitatibus Lusitaniæ* and the *Life of the Infante D. Duarte*: and the *History of the Discovery and Conquest of India* by Fernão Lopes Castanheda (d. 1559), the *Chronicles of D. Sebastião* by Bernardo da Cruz (1530–1586) and by Manuel de Menenzes (d. 1628), the *Life of D. João de Castro* by Jacinto Freire de Andrade (1597–1657), which is still the type of perfect biography, the *Chronicles of Scanderberg* and *D John III.* by Francisco de Andrade (1540–1614), the *Commentaries of Affonso d'Albuquerque* (1500–1580), compiled by his son, and the works of Diogo do Couto (1542–1616) and Duarte Nunes do Leão (d. 1608) supply a mass of interesting historical material. To Antonio Barbosa Bacellar (1610–1663) is due an account of the *Siege and Capture of Recife*; and the *True Account of Prester John* (1540) by Francisco Alvares, the *Travels* in China, Tartary, etc., of Fernão Mendes Pinto (1509–1580), and in Persia (1610) of Pedro Teixeira, the account of the *Mission of Aleixo de Menezes to the Christians of St. Thomas* by Antonio de Gouvea (d. 1628), and the *History of Tangier* by Fernando de Menezes (1614–1699) are all classical works and full of interest.

Religious works.

Among religious works may be mentioned those of Diogo de Paiva de Andrade (1528–1575) and of Diogo de Gouvea (d. 1576), the *Commentaries* of the Hebrew scholar Jeronymo de Azambuja (1520–1565), the *Life of St. Francis Xavier* by João de Lucena (1550–1600), the *Commentaries on the Minor Prophets* by Bernardo de Brito (1569–1617), the *Lives of St. Dominic* and other saints by Luis de Sousa (1555–1632), the *Agiologio Lusitano* by Jorge Cordoso (1616–1669), the *Sermons* of the great preachers Gaspar Pires de Rebello (*c.* 1625) and Antonio Vieira (1608–1697), the *Clavis Prophetarum* of the last-named, and the works of Bartholomeu do Quental (1626–1698), founder of the Portuguese branch of the Oratorians.

Scientific writers

The scientific writers of the period are not numerous, being represented chiefly by the cosmographer Pedro Nunes (1492–1577), one of the greatest mathematicians of his time, Estevão Rodrigues de Castro (1559–1637), author of a *Commentary on Hippocrates* and various other medical works, and the astronomer Manuel Boccarro Francez (1588–1662).

Eighteenth century.

18th Century.—During the preceding century there had been founded in imitation of the Italians numerous "arcadias" or literary clubs under fantastic titles, such as "Ambientes," "Solitarios," etc. Their influence was insignificant, and their existence would call for no remark were they not the forerunners of the academies, which during the 18th century saved Portuguese literature from total extinction. In the year 1714 was founded the Lisbon Royal Academy of Sciences, which was succeeded by the Portuguese Academy, whose first president was the learned historian Francisco Xavier de Menezes, count of Ericeira (1673–1743), author of the epic *Henriqueida*. His numerous translations of the works of Boileau and other French writers had considerable influence on Portuguese literature, and the founding in 1757 of the "Arcadia de Lisbôa," in which the great minister the marquis of Pombal was supreme, led to a wider spread of the teachings of the Encyclopædists. The arcadia ceased to exist in 1774, but was followed in 1779 by the Royal Academy of Sciences, founded by the duke of Lafões, and by the "Nova Arcadia," which flourished between 1790 and 1806. As regards poetry these academies were little more than manufactories of verse, the only lyric poets of the early part of the century being Thomas Pinto Brandão (1664–1743) and Antonio de Lima Barros Pereira (b. 1687); but their members, though wanting in poetical originality, showed considerable industry in historical research. The *Bibliotheca Lusitana* by Diogo Barbosa Machado (1682–1772) is a complete biographical dictionary of the Peninsula, and the *Life of the Infante D. Henrique* by Francisco José Freire (1719–1773) and the *General History of Portugal* by Damião Antonio de Lemos (1715–1789) are standard works, while the *Memorias de Litteratura* of the Royal Academy of Sciences contains much information about the literature of the 16th and 17th centuries. But the real founder of scientific history in Portugal, as opposed to mere collections of legends and traditions, was João Pedro Ribeiro (1759–1839) whose *Researches in Portuguese Chronology* show an historical skepticism far in advance of his age. To the same group of workers for the academy in the historical department belong Francisco de St. Luis, cardinal-archbishop of Lisbon (1766–1845), Francisco Manuel Trigoso (1777–1838), and José Francisco Corrêa da Serra (1750–1823), who edited the *Early Portuguese Chronicles*. In the latter half of this century a revival in poetry also took place, and the works of Antonio Diniz da Cruz e Silva (1731–1800), author of *Hyssope*, acquired for him the title of the Portuguese Boileau. With him were associated Pedro Antonio Corrêa Garção (1724–1772), author of the comedy *Assemblea* and the *Cantata de Dido*, Domingos dos Reis Quita (1728–1770), the best pastoral poet of the period, and the Brazilian Claudio Manuel da Costa (1729–1789). But to Francisco Manuel do Nascimento (1734–1819), who wrote under the *nom-de-plume* of Filinto Elysio, must be assigned the honor of being the reviver of letters in Portugal, not only by his elegant lyric poems but more especially by his miscellaneous writings and by his opposition to foreign imitations. His school of "Filintists" found rivals in the "Elmanists" led by Manuel Maria de Barbosa du Bocage (1766–1806), who, though less original than Nascimento, had perhaps greater influence. His poetical works are numerous, and he was, besides, the author of three tragedies, *Viriatus*, *Affonso Henriques*, and *Vasco de Gama*, which had some success. The poems of Antonio Ribeiro dos Sanctos (1745–1818), the satires of Nicolau Tolentino de Almeida (1741–1811), and the sonnets of Paulino Antonio Cabral de Vasconcellos (b. 1720) are all reckoned among the good work of the 18th century. But the best as well as the last work of this school is the epic *Oriente* (1814) by José Agostinho de Macedo (1761–1831), whose contemporary, José Anastasio da Cunha, was condemned by the Inquisition for the heresy contained in his *Oração Universal*. The tragedies *Osmia*, by Catharina de Sousa, countess of Vimieiro (1749–1824), and *Nova Castro*, by João Baptista Gomes (d. 1803) call for especial notice, as do the vaudevilles *Don Quixote* and *Esopaida* by Antonio José da Silva (1705–1739), while the national taste further showed itself in the favorable reception given to the comedies of his successor, Alexandre Antonio de Lima (b. 1699).

Modern verse.

19th Century.—The political troubles of 1820 led to the expatriation of João Baptista de Almeida Garrett (Jonio Duriense) (1799–1854) and Alexandre Herculano (1810–1879), and the retreat to a monastery of Antonio Feliciano de Castilho (Memnide Egynense) (1800–1875). The first two were followers of Nascimento, the last of Bocage; but, while the enforced studies of Castilho only increased his classicist proclivities, the exile of Garrett and Herculano brought them into contact with romanticism. The effects are seen in Garrett's *D. Branca*, *João Minimo*, and *Flores sem Fructo*, and later on in his most famous work, the *Folhas Cahidas*. R. A. de Bulhão Pato, F. Gomes de Amorim, and E. Vidal have also written in the same style, but their poems have a less truthful ring than those of Garrett, who is also the author of both the earliest and the best examples of the modern Portuguese drama, *Gil Vicente*, *Alfageme*, and *Luis de Sousa*. The principal works of Castilho are *A Primavera*, *Amor e Melancolia*, and *Excavações Poeticas;* and the writers who may chiefly be claimed as his followers are Sarmento, J. M. de Costa e Silva the dramatist, Cabral de Mello, and Fernandes Leitão. The publication in 1848 of *O Trovador*, a collection of modern lyrics, marks the foundation of the school of Coimbra. Its leader, João de Lemos, the lyric poet, found fellow-workers in José Freire de Serpa, the impressionable author of *Solãos*, and José da Silva Mendes Leal, author of the dramas *A Alva Estrella*, *A Madre Silva*, and *Os Homens de Marmore*, and various lyric poems. The most popular modern poet Luis Augusto Palmeirim, the dramatist A. Pereira da Cunha, Antonio de Serpa, and João de Andrade Corvo, author of the novel *Um Anno da Côrte*, all belong to this school, the prevailing characteristic of which at its foundation was a profound admiration for Chateaubriand and his royalist and religious opinions. The second phase of this school dates from the *Novo Trovador*, in which the influence of Aimé Martin and Krause on its originator, Soares de Passos, is plainly visible. The poems of Passos are tinged with a melancholy which presaged his early death and he philosophizes in the *Firmamento*, the *Escravo*, and the *Morte de Socrates* somewhat in the same strain as the English Lake poets. The third phase of the school of Coimbra is represented by the *Flores do Campo* and *Folhas Soltas* of João de Deus the poet of love and revolution. Of the same school the *Visão dos Tempos* by Theophilo Braga is an attempt at a new revelation, and the *Odes Modernas* by Anthero do Quental are socialistic, but both writers show more than ordinary power. Other modern poets are Alberto Telles, Sousa Viterbo, Candido de Figueiredo, Gomes Leal, Thomas Ribeiro, A. J. Viale, and Guilherme de Azevedo. The plays of C. C. Branco and Ernesto Biester are above the average, and King Luis has worthily followed the traditions of his race in his translations of the plays of Shakespeare. The historical novels of Herculano are much admired by his countrymen, as well as those of L. A. Rebello da Silva; and the works of J. G. Gomes Coelho (Julio Diniz), A. de Oliveira Marreca, Mendez Leal, Bernardim Ribeiro, Arnal do Gama, Teixeira de Vasconcellos, and Camillo Castello Branco, with his accuracy of description, have some reputation; but the best modern novel, judged by an English standard, is *O Crime do Padre Amaro* by Eça de Queiroz. As the growth of Portuguese independence was coeval with the work of the troubadours, and the discoveries and conquests of the heroic age gave birth to the epic of Camoens, so, in like manner, the political revival of the 19th century has given rise to a school of great historians, the chief of whom was Alexandre Herculano. The exile of Herculano had brought him into contact with both English and French romanticism, as appears in his early poems and his historical novels, in which the influence of Lamartine and Scott is plainly visible, but in later life he was attracted to the new German school of historians founded by Ranke, and perceived that his true vocation was scientific history. His chief work has been the disentanglement of the early history of Portugal from the mass of legends which had clustered round it, and his *History of Portugal* and *The Origin of the Inquisition in Portugal* are lasting monuments of industry and criticism. But Herculano perceived that, before a true knowledge could be gained of Portuguese history, a critical study must be made of early documents, so, using his official position, he commenced the publication for the academy of a magnificent edition of the *Origines* of Portuguese history. The viscount of Santarem began a similar work in his collections of *Fœdera*, though his fame will rest rather on his researches into the history of the great maritime discoveries of the 15th and 16th centuries. L. A. Rebello da Silva continued the work of Santarem in the publication of the *Corpo Diplomatico*, and his *History of Portugal in the 17th and 18th Centuries* is only inferior to the great work of Herculano. These historians inspired many others, among whom may be mentioned Fonseca Benevides, F. F. de la Figaniere, Claudio de Chaby, and Simão José da Luz Soriano. The strength of this school is no doubt partly due to the extreme vigor of the reactionaries who were first called into existence by Herculano's attacks on superstitious legends. Their work is brilliant if not convincing, and it would not therefore be right to pass over without mention such names as F. Recreio, Pinheiro Chagas, and Affonso Ennes. In general literature the name of Francisco Alexandre Lobo (1763–1844) stands out prominently as the foremost man of the century, and the Portuguese equal of De Maistre, whilst Thomas de Carvalho, Rodrigo de Fonseca, Cesar Machado, Lopes de Mendonça, F. Adolpho Coelho, Theophilo Braga, Innocencio Francisco da Silva, and F. D. Vieira have all won a position as critics and essayists. Political liberty has gone hand in hand with the freedom of the press, and here again Herculano appears as the founder of the *Panorama*, in which he had the assistance of most of the writers above-mentioned. Besides these the most influential journalists are Teixeira de Vasconcellos, Rodrigues de Sampaio, and J. M. Latino Coelho. While the press remains free and can boast of such writers Portuguese literature will certainly increase in strength and vigor, and maintain the feeling of national pride and independence which appears so strongly in the works of Garrett and Herculano, and will always prevent a union with Spain.

Modern Prose.

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PORUS, the name of the Indian king who withstood Alexander the Great on the banks of the Hydaspes (Jhelum). He was afterwards confirmed in his kingdom by the conqueror, and still held the position of a Macedonian satrap when assassinated sometime between 321 and 315 B.C. See India, vol. xii. p. 826, and Persia, vol. xviii. p. 597. His cousin, also named Porus, with whom he was on bad terms, ruled over Gandaris beyond the Hydraotes (Ravi), and was subdued by Hephæstion.

POSEIDON, the ancient Greek god of the sea and of water generally, was fabled to be the son of Cronus and Rhea, and brother of Zeus and Pluto. When the three brothers deposed their father Cronus the kingdom of the sea fell by lot to Poseidon. With his wife, Amphitrite, he dwelt in the depths of the sea; at Ægæ he had a golden house beneath the waves. In his hand he bore a trident (a three-pronged fish-spear), wherewith he lashed the sea into fury. But, while he caused storms and shipwrecks, he could also send favoring winds. He was the god of navigation, adored by all who sailed the sea. His temples stood especially on headlands and isthmuses. As god of the sea he disputed with other deities for the possession of the land—with Athene for Athens and Trœzen, with Helios for Corinth, with Hera for Argos, with Zeus for Ægina, etc. Earthquakes were thought to be produced by Poseidon shaking the earth—hence his epithet of "Earth-shaker," and hence he was worshipped even in inland places, like Apamea in Phrygia, which had suffered from earthquakes. Hence also may have arisen the custom in some places of sacrificing moles to him. The great sea-wave which often accompanies an earthquake was also his work; the destruction of Helice in Achaia by such a wave (373 B.C.) was attributed to his wrath. Once when an earthquake shook the ground where a Spartan army was encamped, the whole army sang a hymn to Poseidon. The island of Delos was thought to have been raised by him from the bottom of the sea, and in 237 B.C., when a new island appeared between Thera and Therasia, the Rhodians founded a temple of Poseidon on it. Thessaly was said to have been a lake until this god opened a way for the waters through the Vale of Tempe. Poseidon was also the god of springs, which he produced by striking the rock with his trident, as he did on the acropolis of Athens when he was disputing with Athene for the sovereignty of Athens. This dispute was represented on the western pediment of the Parthenon. As he gave, so he could withhold springs of water; thus the waterless neighborhood of Argos was supposed to suffer from his anger. Black bulls were sacrificed to him; in Ionia and Thessaly bull-fights took place in his honor; at a festival of his at Ephesus the cupbearers were called "bulls," and the god himself was surnamed "Bull Poseidon." The horse was especially associated with his worship; he was said to have produced the first horse by striking the ground in Thessaly with his trident. At a fountain in Argolis horses bitted and bridled were sacrificed to him by being drowned in the water, and similarly Sextus Pompeius sought to propitiate him by throwing horses into the sea. He bore the surname of "Horse Neptune," and was regarded as the tamer as well as the creator of the steed. His worship was thought by Herodotus to have been derived from the Libyans. It had special seats in Thessaly, Bœotia, and the Peloponnesus. He had a famous cave-like temple at Tænarum in Laconia. On the island of Tenos he was worshipped as the physician, and crowds gathered from the neighboring islands to offer sacrifice. At Mycale in Asia Minor the Panionium or place of general assembly of the Ionian Greeks, was sacred to him. In the Trojan War Poseidon sided with the Greeks because he had been cheated of his reward by Laomedon, the former king of Troy, for whom he had built the city walls. The offspring of his numerous amours were mostly wild and cruel like the sea; such were the Læstrygones, Polyphemus, Cycnus, Antæus, Busiris, Procrustes, Sciron, and Orion. Alcinous, king of the sea-faring Phæacians in the *Odyssey*, traced his lineage to Poseidon. By far the most famous of the festivals of Poseidon was that celebrated every second year on the Isthmus of Corinth and hence called the "Isthmian festival" (see vol. x. p. 59). Pine trees were sacred to Poseidon; a row of them stood close to his temple on the isthmus. Amongst the Ionians the stormy month which precedes the winter solstice was called by the name of Poseidon. He was described as dark-haired, broad-breasted, and blue-eyed. In works of art he appeared holding a trident and with a dolphin on his hand or under his feet; sometimes he was represented riding a bull, a horse, or a sea-horse, or in a chariot, often surrounded by the Tritons, Nereids, and other fabulous creatures of the sea. There were colossal statues of him at Helice in Achaia, on the Isthmus of Corinth (set up by the Greeks after the Persian wars), and at Tenos. The derivation of his name is uncertain; some refer it to the same root as *πότος ποταμός*, etc.; others compare *πότνια*. In modern Greece St. Nicholas has taken the place of Poseidon as patron of sailors. But the Zachynthians have a special sea-god, half man, half fish, who dwells under the sea, rides on dolphins or in a car drawn by dolphins, and wields a trident. He seems to combine the attributes of Poseidon and Nereus. For the Roman sea-god, see Neptune.

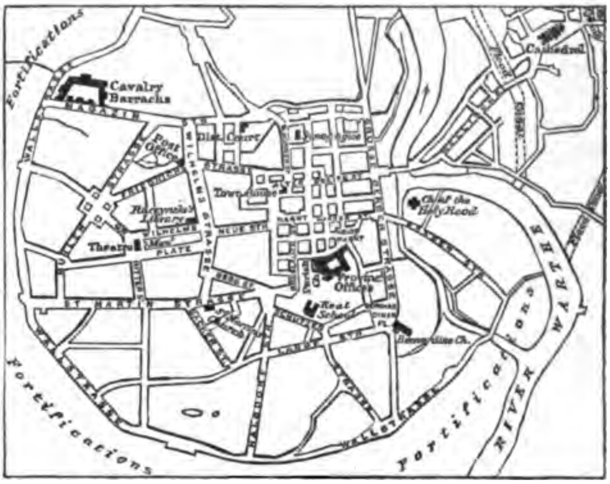
POSEN, a province in the east of Prussia, with an area (11,180 square miles) nearly equal to that of Belgium, is bounded on the N. by the province of Prussia, on the E. by Russian Poland, on the S. by Silesia, and on the W. by Brandenburg. It belongs physically to the great north German plain, and consists of a low plateau intersected by the beds of the Netze, the Warthe, and the Obra. The three rivers just named drain into the Oder, but part of the province falls within the basin of the Vistula, which forms the frontier for a short distance on the northeast. The surface of the whole district is dotted with small lakes and ponds, and there are many broad fens and marshes. The soil on the whole is light and sandy, but much of the land reclaimed in the boggy districts is very fertile. Upwards of 61 per cent. of the area is under cultivation, while 13 per cent. is occupied by pasture and meadows and 20 per cent. by forests. The principal crops are wheat, rye, oats, barley, potatoes, and hops (compare Prussia); the vine is cultivated to some extent in the southwest corner, and tobacco is also grown. The marshy tracts often afford excellent pasture and support large numbers of cattle, sheep, and goats. The mineral resources of the province are practically restricted to brown coal and salt, about 26,000 tons of the former and 75,000 tons of the latter being raised in 1882. The industry is confined to a few points, and is of comparatively little importance. Besides beer and brandy, the chief products are machinery, cloth, tobacco, and bricks. Trade, carried on briskly in timber and agricultural produce, is facilitated by the network of navigable rivers and canals. Both industry and trade are somewhat cramped by the duties imposed at the Russian frontier. The population of the province in 1880 was 1,703,397, including 1,112,962 Roman Catholics, 532,498 Protestants, and 56,609 Jews. The Roman Catholics are mainly Poles, of whom there are about 950,000 in Posen, while the great bulk of the 750,000 Germans are Protestants. About 65 per cent. of the population is returned as "rural" in spite of the large number of so-called "towns," only seven of which, however, have more than 10,000 inhabitants. The largest are Posen and Bromberg. The province of Posen enjoys the unenviable distinction of being the worst educated corner of the German dominions, a fact illustrated by the high ratio of illiterate recruits (9.75 per cent. in 1882–83). It is represented in the German reichstag by fifteen and in the Prussian parliament by twenty-nine deputies.

History.—The history of the district of Posen, comprehending great part of the cradle of the old kingdom of Poland, including its most ancient capital (Gnesen), falls properly within the scope of the article POLAND (*q.v.*). Its political connection with Prussia began in 1772, when the districts to the north of the Netze fell to the share of that power in the first partition of Poland. The rest followed in 1793, and was united with the Netze district to form the province of South Prussia. After the peace of Tilsit Posen was incorporated with the grand-duchy of Warsaw, but in 1815 it reverted to Prussia under the style of the "grand duchy of Posen." In 1848 the Polish inhabitants of the province revolted and had to be put down by force; and a thoroughly harmonious union of the two elements of the population is still unattained.

The tide of German immigration into Posen began at an early period and flowed very strongly in the 13th and following centuries. The industrious German settlers were heartily welcomed by the Polish nobles and were the founders of most of the towns, in which they lived after their own customs and were governed by their own laws. They established the few manufactures of which the district can boast, introduced the cultivation of hops, reclaimed the waste soil, and did much to improve agriculture generally. In the 16th century Protestantism was widely diffused by their means. A strong reaction, however, set in in the following century, and persecution of the Protestants went hand in hand with the ravages of war in hastening the political, intellectual, and agricultural decline of the territory. By the 18th century the burghers had sunk to the level of "städtische Bauern," or peasants with municipal privileges, and poverty and misery were widely spread. The Prussian rule, in spite of many defects, proved so beneficial that even Napoleon was compelled to praise it.

Posen contains a numerous Polish noblesse, many of the members of which are very poor. A double transformation is going on in the ownership of the ground, the large estates passing into the hands of the peasants and Polish proprietors giving place to German. A few years ago between 60 and 70 per cent. of the soil was occupied by "latifundia," while at present it is pretty equally divided between those and peasant holdings. In the four years 1878–81, inclusive, the land in the possession of Germans increased at the expense of Polish landowners by upwards of 100,000 acres. The peasant-farmers are generally deeply in debt, partly owing to the educational and communal burdens, but mainly owing to the pernicious custom of "Leibgedinge," according to which an able-bodied man in the prime of life will give up his holding in return for an annuity from his successor. In some instances two annuitants of this kind are found living on the same small patch of ground in addition to the actual cultivator.

POSEN (Polish, *Poznán*), capital of the above province, the seat of a Roman Catholic archbishop, and the headquarters of a corps of the German army, is situated at the confluence of the Cybina and Warthe, 150 miles to the east of Berlin and 90 miles to the north of Breslau. It is a fortress of the first rank and of great strategic importance; the works consist of a citadel and inner line of bastions, and an outer circle of twelve detached forts. The principal part of the town lies on the west bank of the Warthe, and comprises the so-called Alstadt and the well built modern quarter that has sprung up under the Prussian régime. On the other bank is the Wallischei, a poor district inhabited by Poles. Among the older buildings none calls for remark except the town-house, a quaint specimen of the Slavonic adaptation of Romanesque forms. The chief modern buildings are the various military and public offices, the law courts, the theatre, the real school, and the Raczynski library. The churches are devoid of architectural interest, but the cathedral contains numerous interesting objects of art, including two bronze-gilt statues of the first Christian kings of Poland, by Rauch. The manufactures of Posen are multifarious enough, including machinery, carriages, tobacco, copper boilers and vats, military requisites, chemicals, etc.; but there is nothing that can be called a staple industry. A lively trade is carried on in the agricultural products of Russia and Poland, and several well-attended fairs and markets are held. In 1880 Posen contained 65,713 inhabitants, including 35,725 Roman Catholics, 22,869 Protestants, and 7063 Jews. The German inhabitants are at present considerably more numerous than the Poles, though it would seem that the latter have increased in a greater ratio since 1875. The Jewish element is stronger here (10.7 per cent.) than in any other town in Germany. The garrison consists of 7000 men.



Plan of Posen.

Posen, one of the oldest towns in Poland and the residence of some of the early Polish princes, became the seat of a Christian bishop towards the end of the 10th century. The original settlement was on the east bank of the Warthe, but the new or German town, established on the west bank about the year 1250, soon became the more important half of the double city. Posen was a royal free town, and was directly represented in the Polish diet down to 1733. In the Middle Ages it became a great depôt of the trade between Germany and the west of Europe on the one hand and Poland and Russia on the other. Numerous foreign merchants took up their abode here, including a strong colony of Scotsmen, who exported raw produce to Edinburgh. The town attained the climax of its prosperity in the 16th century, when its population is variously estimated at from 30,000 to 80,000. The intolerance shown to the Protestants, the troubles of the Thirty Years' War, the visitation of the plague, and other causes, however, soon conspired to change the state of affairs, and in the 18th century the town had only 5000 inhabitants. New life was infused into it on its annexation by Prussia at the second partition of Poland, and since then its progress has been limited only by its position as a fortress. The relations of the German and Polish elements of the population continue to be somewhat strained.

POSIDONIUS, a distinguished Stoic philosopher, the most learned man of his time (*c.* 130–50 B.C.) and perhaps of all the school; by birth a Syrian from Apamea, a pupil of Panætius, he spent after his teacher's death many years in travel and scientific researches in Spain (particularly at Gades), Africa, Italy, Gaul, Liguria, Sicily, and on the eastern shores of the Adriatic. When he settled as a teacher at Rhodes his fame attracted numerous scholars; next to Panætius he did most, by writings and personal intercourse, to spread Stoicism in the Roman world; he became well known to many of the leading men, as Marius, Rutilius Rufus, Pompey, and Cicero. The last-named studied under him (78–77 B.C.), and speaks as his warm admirer and personal friend.

Strabo mentions him as a contemporary.[1] The date of his birth has not been fixed; it may have been 135, 130, or 125 B.C.; according to Lucian, he lived to be eighty-four. He visited Rome—*e.g.*, in 86 B.C. on an embassy; but it is doubtful if he ever resided there as a teacher. His works, now lost, were written in an attractive style and proved a mine of information to later writers. The titles and subjects of more than twenty of them are known. In common with other Stoics of the middle period, he displays eclectic tendencies. His admiration for Plato led him to write a commentary on the *Timæus;* in another way it is shown by important modifications which he made in psychological doctrine. Unquestionably more of a polymath than a philosopher, he appears to us uncritical, or credulous even, and superficial. But at the time his spirit of inquiry provoked Strabo's criticism as something alien to the school (*τὸ αἰτιολογικὸν καὶ τὸ ἀριστοτελίζον ὅπερ ἐκκλίνουσιν οἱ ἡμέτεροι*). In natural science he took a genuine interest, as his contributions to geography, natural history, mathematics, and astronomy sufficiently attest. He sought to determine the distance and magnitude of the sun, to calculate the diameter of the earth and the influence of the moon on the tides. His history of the period from 146 to 88 B.C., in fifty-two books, must have been a valuable storehouse of facts. Cicero, who submitted to his criticism the memoirs which he had written in Greek of his consulship, made use of writings of Posidonius in *De Natura Deorum*, b. ii., and *De Divinatione*, b. i., and the author of the pseudo-Aristotelian treatise *De Mundo* also borrowed from him.

Zeller, *Philosophie der Griechen*, iii. 1, 570–584 (in Eng. trans., *Eclecticism*, 56–70); C. Müller *Fragmenta Historicorum Græcorum*, iii. 245–296; J. Bake, *Posidonii Rhodii Reliquiæ*, Leyden, 1815 (a valuable monograph); R. Scheppig, *De Posidonio rerum gentium terrarum scriptore*, Berlin, 1869; R. Hirzel, *Untersuchungen zu Ciceros philosophischen Schriften*, i. 191 *sq.;* ii. 257 *sq.*, 325 *sq.*, 477–535, 756–789; iii. 342–378 (Leipsic, 1877). See STOICISM.

POSITIVISM, or POSITIVE PHILOSOPHY. See COMTE.

POSSESSION is a legal term derived from Roman law. The Roman conception of possession has been generally adopted, but the Roman deductions from the conception have not been universally followed. The subject of possession, in itself a difficult one, has become more difficult owing to the various senses in which the term has been interpreted. Thus it has been said to be either a right or a fact conferring a right, or both together. The latter is the view of Savigny, the leading authority upon the subject (*Recht des Besitzes*, translated by Sir Erskine Perry, 1848). Further, there is a want of agreement among legal writers as to the amount of right or rights that it confers. All that can be said with safety is that possession stands in a position intermediate between simple detention and absolute ownership, and that it implies two elements, a physical and a mental one—physical detention and mental intention to hold the thing possessed as one's own. In the words of the *Digest*, "Apiscimur possessionem corpore et animo neque per se animo aut per se corpore" (xli. 2, 3, 1). The difficulties which have been stated being borne in mind, the definition of Professor Hunter may be accepted as being at least as good as any other that has been suggested: "Possession is the occupation of anything with the intention of exercising the rights of ownership in respect of it" (*Roman Law*, p. 209). Possession is inchoate or incomplete ownership; it is on its way to become ownership. In the case of the public domain of Rome (*ager publicus*) the possession was really the important matter, the *dominium* being practically of no value. Possession in Roman law was either *natural* or *civil*. The former was mere occupation, the latter such occupation as ripened by prescription into ownership. Possession exclusive against the world (including the true owner) was called "adverse possession." A servitude, such as a right of way, could not be held in true possession, but was said to be in "quasi-possession." The quasi-possessor had, however, possessory remedies. In Roman law a broad distinction was drawn between possession and ownership (*dominium*).[2] They were protected by different remedies,—possession by interdict, ownership by action. This difference can only be explained by history. Here again, unfortunately, authorities differ. According to Savigny, a Roman citizen who had become a tenant of part of the *ager publicus* could not by any length of holding obtain more than a quasi-ownership, but one of which it would have been morally unjust to have deprived him. "The only legal remedies of which the tenants could avail themselves, if ejected or threatened with disturbance, were the possessory interdicts, summary processes of Roman law which were either expressly devised by the prætor for their protection, or else, according to another theory, had in older times, been employed for the provisional maintenance of possessions pending the settlement of questions of legal right" (Maine, *Ancient Law*, ch. viii.). Savigny regards the protection of possession as an extension of the protection of the person. The same view was taken by the English Court of Exchequer in Rogers v. Spence, 13 Meeson and Welsby's *Reports*, 581. According to Professor Hunter (*Roman Law*, pp. 206, 221), Savigny overlooked the needs of aliens. It was the needs of aliens, incapable of the full proprietary rights of Roman citizens, that led to the invention by the prætor of a means of giving them equitable rights in the land, and protecting them in the enjoyment of these rights. Savigny attributes only two rights to possession in Roman law—acquisition of ownership by possession for a given time (*usucapio*, *longi temporis possessio*) and protection of possession from disturbance (*interdictum*). Others have included further rights,—*inter alia*, the right to use force in defence of possession, and the right to have the burden of proof, in a contest as to the title, thrown upon the adversary: "In pari causa possessor potior haberi debet." The position of the possessor in Roman law was a very strong one. If a *bona fide* possessor, he could bring an action for *furtum* even against the owner; if a *mala fide* possessor of land, he was so far protected that he could not be ejected by force. A *mala fide* possessor of movables could, however, acquire no rights.[3]

It has been already stated that there is both a physical and a mental element in the conception of possession. This does not necessarily mean that corporal contact is in all cases requisite, or that the intention to hold the thing possessed as one's own may not be abandoned for a time. The control may be potential as well as actual. An estate may be possessed without the possessor going upon the land at all, and the possession of goods may be given by delivering the key of the warehouse in which they are stored. In international law the possession of part as giving the right to the whole has been of great importance. The possession of the coast of a newly-discovered country gives a right to the inland territory within certain limits (see Twiss, *International Law*, vol. i., p. 170). Where goods are pledged or bailed for a specific purpose the intention of the pledgor or bailor to hold them as his own is suspended during the existence of the limited right of the pledgee or bailee, to whom a fragment of the possession has passed. In Roman law the pledgor had *possessio ad usucapionem*.

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[1] [This statement rests upon a doubtful interpretation of Strabo by Athenæus.—AM. ED.]

[2] The distinction is very important, as it affects the contract of sale. The contract was not to transfer ownership, as in English law, but only *vacua possessio*.

[3] This does not agree with English law, where in certain cases a thief can give a good title to stolen goods, though he has no title himself.

the pledgee *possessio ad interdicta*. The possession of the pledgee or bailee has been called "derivative possession." Possession may be exercised through another ("animo nostro, corpore alieno"), as through a servant, who has not true possession.[1] Possession so exercised has been called "representative possession." As soon as the representative determines to assume control on his own behalf or to submit to the control of another, the possession of the principal is gone. Possession may be transferred or lost. It is lost when either the *corpus* or the *animus* (to use the terms of Roman law) ceases to exist. It may be lost by the representative in cases where the principal might have lost it.

In both Roman and English law the possessory tended to supersede the proprietary remedies from their greater convenience,—that is to say, the plaintiff based his claim or the defendant his right upon possession rather than property. The English possessory action may have been directly suggested by the interdict. Bracton (103b) identifies the assise of novel disseisin, the most common form of possessory action, with the interdict *unde vi*. In England ejectment had practically superseded other real actions before the latter were (with the exception of dower, writ of dower, and *quare impedit*) expressly abolished by 3 and 4 Will. IV. c. 27, s. 36. The action for the recovery of land, introduced by the Judicature Acts, is the modern representative of the action of ejectment. The right of a party to recover possession is enforced by a writ of possession.

Possession gives in English law, speaking generally, much the same rights as in Roman law. Thus it serves to found a title (see LIMITATION, PRESCRIPTION), and to throw the onus of proof upon the claimant. In an action for the recovery of land the defendant need only allege that he is in possession by himself or his tenant, and (where such an allegation is necessary) that he had no notice to quit. The chief differences between Roman and English law, arising to some extent from the differences in the history of the two systems, are that the former did not give to derivative possessors (except in the case of pledge) the remedies of possessors, as does English law, and that Roman law is stricter than English in requiring that possession to found *usucapio* should (except in the case of *jus aquæ ducendæ*) be *ex justo titulo*, or under color of right (see PRESCRIPTION). There is one case of constructive possession which is peculiar to English law,—that is, where possession is said to be given by a deed operating under the Statute of Uses (see "Orme's Case," *Law Reports*, 8 Common Pleas, 281).

In English law the doctrine of possession becomes practically important in the following cases. (1) Possession serves as a convenient means of division of estates (see REAL ESTATE). One of the divisions of estates is into estates in possession and estates in reversion or remainder. It also serves as a division of PERSONAL ESTATE (*q.v.*). A chose in action is said to be reduced into possession when the right of recovery by legal proceedings has become a right of enjoyment. (2) Possession gives a title against a wrongdoer. In the case of real property it is regarded as *prima facie* evidence of seisin.[2] In the case of personal property the mere possession of a finder is sufficient to enable him to maintain an action of trover against one who deprives him of the chattel[3] (see the leading case of Armory v. Delamire, 1 Strange's *Reports*, 504). (3) What is called "unity of possession" is one of the means whereby an easement is extinguished. Thus the owner of close A may have had a right of way over close B, while the latter belonged to a different owner. If the two closes come to be owned by the same person, the right of way is extinguished, but may under certain circumstances revive on the separation of the ownership. (4) Possession is very important as an element in determining the title to goods under 13 Eliz. c. 5, the Bills of Sale Act, 1878 (41 and 42 Vict. c. 31, ss. 4, 8), and the Bankruptcy Act, 1883 (46 and 47 Vict. c. 52, s. 44). It may be said that as a general rule retention of possession by the transferor on an absolute assignment or a colorable delivery of possession to the transferee is strong *prima facie* evidence of fraud. "Apparent possession" is defined by section 4 of the Bills of Sale Act. (5) Possession of goods or documents of title to goods is generally sufficient to enable agents and others to give a good title under the Factors' Acts (see FACTORS). (6) In criminal law the question of possession is important in founding the distinction between larceny and embezzlement. If the goods are in the possession of the master and he gives them to the custody of his servant for a specific purpose, and the servant steals them, it is larceny; if they have never come into the master's possession, as if a clerk receives money on his master's behalf, it is embezzlement. Recent possession of stolen goods is always regarded as a presumption that the person in whose possession they are stole them or received them knowing them to have been stolen. In the case of a charge of receiving stolen goods evidence may be given that there was found in the possession of the accused other property stolen within the preceding period of twelve months, 34 and 35 Vict. c. 112, s. 19. (For possession in criminal law, see Stephen, *Digest of the Criminal Law*, note xi.). (7) Actions of possession of ships fall within the jurisdiction of the Admiralty Division. This jurisdiction in the case of British vessels depends upon the Admiralty Court Act, 1861 (24 Vict. c. 10, s. 8), in the case of foreign vessels (in which the jurisdiction is rarely exercised) upon the general powers of the court as a maritime court.

The doctrines of adverse possession (in the old English sense, which was not identical with the Roman law, for the real owner must have actually or by fiction been disseised) and of *possessio fratris* are now of only antiquarian interest. The Statutes of Limitation, 3 and 4 Will. IV. c. 27 and 37 and 38 Vict. c. 57, have superseded the first. The only question now is, not whether possession has been adverse or not, but whether twelve years have elapsed since the right accrued (see LIMITATION). The maxim "possessio fratris de feodo simplici sororem facit esse hæredem" (Coke upon Littleton, 14b) has been altered by the rules of descent introduced by 3 and 4 Will. IV. c. 106, under which descent is traced from the purchaser. At one time possessory suits were occasionally maintained in England, and more frequently in Ireland, for the quieting of possession after proof of three years' possession before the filing of the bill. But such suits are now obsolete (see Neill *v.* Duke of Devonshire, 8 *Appeal Cases*, 146). There was one characteristic case in old English law in which possession was maintained by means of what was called "continual claim," made yearly in due form, where the person having the right was prevented by force or fear from exercising it (Coke upon Littleton, 253b). Continual claim was abolished by 3 and 4 Will. IV. c. 27, s. 11.

Scotland.—In Scotland possessory actions still exist *eo nomine*. Actions of molestation, of removing, and of mails and duties are examples. A possessory judgment is one which entitles a person who has been in possession under a written title for seven years to continue his possession (Watson, *Law Dict.*, s. v. "Possessory Judgment").

United States.—Here the law in general agrees with that of England. But in Maryland, New Hampshire, North Carolina, and Vermont the doctrine of *possessio fratris* apparently still exists (Bouvier, *Law Dict.*, "Possessio Fratris"). Possessory rights are taxed in some of the States. Louisiana follows Roman law closely. Possession of incorporeal rights (to use the unscientific language of the Code) is called quasi-possession, and the division of possession into natural and civil is maintained (Civil Code, §§ 3389–3419).

In addition to the authorities cited may be mentioned Smith, *Dict. of Antiquities*, s.v. "Possessio"; Markby, *Elements of Law*, ch. viii.; Holland, *Elements of Jurisprudence*, ch. xi.; Holmes, *The Common Law* (lect. vi.). (J. W†.)

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[1] Much of the law of master and servant is based upon the Roman law of master and slave. The servant, like the slave, has not possession of his master's goods even though they are in his custody, unless, indeed, the circumstances are such that he ceases to be a servant and becomes a bailee.

[2] "Seisin" and "possession" are used sometimes as synonyms, as generally by Bracton; at other times they are distinguished: thus there can be possession of a term of years, but no seisin (Noy, *Maxims*, p. 2). It seems doubtful, however, how far in English law a tenant for years has true possession, for he is in law only a bailiff or servant of the landlord. But he certainly has possessory remedies, like the quasi-possessor in Roman law.

[3] Compare the *Code Napoléon*, art. 2279: "En fait de meubles la possession vaut titre."

POST-OFFICE.

THE germ of the modern postal systems of the world is to be looked for, obviously, in the earliest organized establishment of a staff of Government couriers. When, or under what precise circumstances, such an establishment was first made available by a state for the carriage of the letters of private persons there is no satisfactory evidence to show. That there must have been, even in early times, a connection, more or less authorized, between the transmission of public and of private correspondence is highly probable. Even financial reasons would soon dictate a formal permission to Government couriers to carry letters for individuals—under regulation and restriction, of course—although at the outset such a practice may well have been rather connived at than allowed. In the postal system of Spain and the German empire there is express record of such a permission in the month of April, 1544; and within fifteen or sixteen years that permission had grown into a legalized and regulated monopoly, whence the counts of Taxis drew part of their profits as postmasters-general. For the purposes of this article, however, it is enough to note that in Great Britain existing private letters of the 15th century—some, perhaps, of the 14th—bear endorsements which show that they were conveyed by relays of men and horses maintained under the control of the Government, and primarily intended for its special service. In several Continental states the universities had inland postal establishments of a rudimentary sort at an early date. The university of Paris, for example, organized a postal service almost at the beginning of the 13th century, and it lasted in a measure until the year 1719. In various parts of Europe mercantile guilds and brotherhoods were licensed to establish posts for commercial purposes. But everywhere—as far as the accessible evidence extends—foreign posts were under state control.

GREAT BRITAIN.

Early History (*c.* 1533-1836).

Sixteenth century.

As early as the middle of the 13th century entries occur in the wardrobe accounts of the kings of England of payments to royal messengers—variously designated "cokinus," "nuncius," or "garcio"—for the conveyance of letters to various parts of the country. In the supervision of these royal messengers lies the germ of the office of postmaster-general. The first English postmaster of whom a distinct account can be given is Sir Brian Tuke, who is described (1533) in the records as "Magister Nunciorum, Cursorum, sive Postarum," "both in England and in other parts of the king's dominions beyond the seas." But long subsequent to this appointment of a postmaster-general the details of the service were frequently regulated by proclamations and by orders in council. Thus, in the curious collection of royal proclamations in the library of the Society of Antiquaries there is one of Philip and Mary (undated, but apparently of 1555) which regulates the supply of horses for the conveyance of letters to Dover.[1] Again, in July, 1556, the lords of the council ordered "that the postes betweene this and the Northe should eche of them keepe a booke, and make entrye of every lettre that he shall receive, the tyme of the deliverie thereof unto his hands, with the parties names that shall bring it unto him." Much of the business of the foreign postal service to and from England during the earlier years of Queen Elizabeth was managed by the incorporated "merchant strangers," who appointed a special postmaster amongst themselves. When that office chanced to fall vacant in 1568 they quarrelled about a successor; and the quarrel cost them their privilege.[2]

Under James I.

The accession of James I. to the English throne, by necessitating a more frequent communication between London and Scotland, led to improvements in the postal service. Some years earlier special posts had been established by the magistrates of certain Scottish towns for the conveyance of their despatches to and from the court. Thus in 1590 a messenger was appointed by the magistrates of Aberdeen with the title of "council-post."[3] The new royal orders of 1603 directed (1) that the postmasters at the various stages should enjoy the privilege of letting horses to "those riding in post (that is to say) with horn and guide," by commission or otherwise, and to that end they were charged to keep or have in readiness a sufficient number of post-horses; (2) that the lawful charge for the hire of each horse should be, for public messengers, at the rate of 2½d. [5 cents] a mile, "besides the guides' groats," private travellers being left to make their own agreements. Finally, it was directed that every postmaster should keep at least two horses for the express conveyance of Government letters, and should forward such letters within a quarter of an hour of their receipt, and that the posts should travel at the rate of not less than 7 miles an hour in summer and 5 miles in winter.[4]

The De Questers.

In 1607 the king granted to James Stanhope, first Lord Stanhope of Harrington, and to his son Charles Stanhope, afterwards second Lord Stanhope, jointly and to the survivor of them, the postmastership of England under the title of "Master of the Posts and Messengers," with a fee of 100 marks [$323.13] a year, together with all "avails and profits" belonging to the office. In 1619 a separate office of "postmaster-general of England for foreign parts" was created, by new letters patent, in favor of Matthew de Quester[5] and Matthew de Quester the younger. The new office was regarded by the existing postmaster-general, Charles, Lord Stanhope, as an infringement of his own patent. A long dispute ensued in the King's Bench and before the Lords of the Council.[6] In 1626 by an order in council liberty was granted to all companies of merchants, including the Merchants Adventurers, to send their letters and dispatches by messengers of their own choosing. A year afterwards this liberty was revoked, except for the Company of Merchants Adventurers. Lord Stanhope, however, continued to carry letters abroad by his agents, and obtained a warrant prohibiting De Quester from interfering. It shows strikingly the confusion of postal affairs at this period to find a statement addressed to the privy council by the postmasters of England to the effect that they had received no payments "ever since the last day of

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[1] In his able account of this remarkable collection the late Mr. Robert Lemon has overlooked the proclamation here referred to, probably from its want of a date, his own arrangement being chronological.

[2] F. Windebank to Sir W. Cecil: "All the Italians were unwilling to give their voices to Raphael, . . . but inclined to favor Godfrey" (*Dom. Cor. Eliz.*, xlviii. § 65, State Paper Office). Raphael was a German, Godfrey an Englishman.

[3] Kennedy, *Annals of Aberdeen*, vol. i. p. 262.

[4] *Book of Proclamations*, p. 67 (S. P. O.; now in Rolls House); *Report from the Secret Committee on the Post-Office*, 1844, Appendix, pp. 38-40.

[5] Or "De l'Equester," as he is called in Latch's *Reports of King's Bench Cases*, p. 87.

[6] These disputes were much embittered by the growing jealousies of English against foreign merchants. The proofs of this in the state correspondence of Elizabeth's day are abundant, but there were many statesmen who took larger views. See *e.g.*, John Johnson's "Brief Declaration for the . . . erecting and maintaining of the Staple . . . in England" (June, 1582). *Dom. Corresp. Eliz.*, cliv. No. 30; and compare the same writer's "Discourse for the repairing the decayed State of the Merchants," etc. (22d July, 1577), *ib.*, cxiv., No. 39, with Leake's "Discourse," etc., of the same year (*ib.*, cxi. 1 *sq.*), and with John Hales's "Letter to Sir W. Cecil" (20th March, 1559), *ib.*, iii., where he describes the merchant strangers as being "spies for foreign princes," and with Cecil's "Reasons to move a Forbearing of the Restitution of the Intercourse to Antwerp" (1564), *ib.*, xxxv., No. 33 (in Rolls House).

November, 1621, till this present time, June, 1628,"—the arrears amounting to £22,626 [$109,962.36].

Witherings.

The rights of the postmasters were also infringed by private individuals, as by one Samuel Jude in 1629 in the west of England.[1] In 1632 the foreign postmastership was assigned by the De Questers to William Frizell and Thomas Witherings. Letters-patent were granted to them jointly, 15th March, 1633.[2] Witherings took the laboring oar, and probably ought to rank as the first of the many conspicuous postal reformers in the long history of the British post-office. Under him one Richard Poole obtained a special postmastership for the service of the court. A petition subsequently presented by him to the House of Lords contains curious proof of the jealousies which Witherings's successful administration of his office excited. Among the earliest measures of improvement taken under the new patent was an acceleration of the Continental mail service. For this purpose the patentees made a contract with the count of Thurn and Taxis, hereditary postmaster of the empire and of Spain. At this time there was still but one mail weekly between London, Antwerp and Brussels, and the transit occupied from four to five days. By a subsequent contract with Count Thurn two mails weekly were secured and the transit made ordinarily in two days.[3] In June, 1635, Witherings submitted to the king a proposal (still preserved in the State-Paper office) "for settling of staffets or pacquet-posts betwixt London and all parts of His Majesty's dominions, for the carrying and re-carrying of his subjects' letters," which contains some curious incidental notices of the state of the internal communication of the kingdom at that time. The net charge to the crown of the existing posts is stated to be £3400 [$16,524] per annum. Letters, it is said, "being now carried by carriers or footposts 16 or 18 miles a day, it is full two months before any answer can be received from Scotland or Ireland to London, If any of His Majesty's subjects shall write to Madrid in Spain, he shall receive answer sooner and surer than he shall out of Scotland or Ireland." By the new plan it was proposed that all letters for the northern road should be put into one "portmantle," and directed to Edinburgh, with separate bags directed to such postmasters as lived upon the road near to any city or town corporate. The journey from London to Edinburgh was to be performed within three days. The scheme was approved of on 31st July, 1635, the proclamation establishing eight main postal lines—namely, the great northern road, to Ireland by Holyhead, to Ireland by Bristol, to the marches of Wales by Shrewsbury, to Plymouth, to Dover, to Harwich and to Yarmouth. The postage of a single letter was fixed at 2d. [4 cents] if under 80 miles, 4d. [8 cents] if between 80 and 140 miles, 6d. [12 cents] if above 140 miles, 8d. [16 cents] if to Scotland. And it was further provided that from the beginning of this service no other messengers or footposts should carry letters to any places so provided, except common known carriers, or a particular messenger "sent on purpose with a letter by any man for his own occasions," or a letter by a friend, on pain of exemplary punishment.[4] In February, 1638, another royal proclamation ratified an agreement between Witherings and De Noveau, postmaster to the French king, for the conveyance of the mails into France by Calais, Boulogne, Abbeville, and Amiens.[5]

But in 1640 the active postmaster was accused of divers abuses and misdemeanors, and his office sequestrated into the hands of Philip Burlamachi of London, merchant, who was to execute the same under the inspection of the principal secretary of state.[6] Witherings then assigned his patent to Robert Rich, earl of Warwick, and a long contest ensued in both Houses of Parliament. The sequestration was declared by a vote in parliament in 1642 to be illegal. Nevertheless the dispute gave repeated occupation to both Houses during the period from 1641 to 1647, and was diversified by several affrays, in which violent hands were laid upon the mails. In 1643 the post-office yielded only £5000 [$24,300] a year. In 1644 the Lords and Commons by a joint ordinance appointed Edmund Prideaux "to be master of the posts, messengers and couriers." In 1646 the opinion of the judges was taken on the validity of Witherings's patent (assigned to Lord Warwick), and they pronounced that "the clauses of restraint in the said patent are void and not good in law; that notwithstanding these clauses be void, the patent is good for the rest."[7] It is evident, therefore, that any prohibition to carry letters must be by Act of Parliament, to have force of law.

Under Cromwell.

In 1650 an attempt was made by the common council of London to organize a new postal system on the great roads, to run twice a week. This scheme they temporarily carried into effect as respects Scotland. But Mr. Attorney-General Prideaux speedily obtained the intervention of the council of state. He urged on the council of state that, if the new enterprise were permitted, besides intrenching on the rights of the parliament, some other means would have to be devised for payment of the postmasters. Both Houses resolved (1) that the offices of postmasters, inland and foreign, were, and ought to be, in the sole power and disposal of the parliament, and (2) that it should be referred to the council of state to take into consideration all existing claims in relation thereto. Of these there were no less than five under the various patents which had been granted and assigned. Thereupon the Protector was advised that the management of the post-office should be entrusted to John Thurloe by patent under the broad seal of the Commonwealth immediately upon the expiration of John Manley's existing contract. Thurloe was to give security for payment of the existing rent of £10,000 [$48,600] a year. Ultimately the posts, both inland and foreign, were farmed to John Manley for £10,000 a year, by an agreement made in 1653. Meanwhile, and pending the decision of the council upon the question so submitted to it, a remarkable step in postal reform was taken by an attorney at York, named John Hill, who placed relays of post-horses between that city and London, and undertook the conveyance of letters and parcels at half the former rates of charge. He also formed local and limited partnerships in various parts of the kingdom for the extension of his plan, which aimed to establish eventually a general penny postage for England, a twopenny postage for Scotland, and a fourpenny postage for Ireland. But the post-office was looked upon by the Government of the day as, first, a means of revenue, and secondly, a means of political espionage.[8] The new letter-carriers were (lit-

John Hill's reforms.

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[1] See *Analytical Index to the Remembrancia*, 418, as quoted by H. B. Wheatley in the *Academy* of 27th December, 1879, p. 464.

[2] Minute in "House of Lords' Papers" (1638), *Fourth Report of Hist. MSS. Commission*, 1874, App. The papers there calendared contain many proofs of Witherings's activity and ability. See also appendix to *Fifth Report*, 1875, and "A proclamation concerning the Postmaster of England for Forraigne Parts" (19th July, 1632), in Rymer's *Fœdera*, xix. 385.

[3] *Egerton MS.* (Brit. Mus.), No. 2548, f. 5 *sq.*

[4] Rymer, *Fœdera*, xix. 649.

[5] *Ibid.*, xx. 192.

[6] *Ibid.*, xx. 429.

[7] *Journals of the House of Commons*, ii. 81, 82, 95, 470, 498, 500, 501, 658 *sq.*; *Journals of the House of Lords*, v, 343, 387, 450, 469–473, 500 *sq.*; *Report from Secret Committee on the Post-Office*, Appendix, 60–69.

[8] Some instructive illustrations of this may be seen (in the state-paper department of the General Record Office) among the correspondence between secretary Sir John Coke and Lord Conway, and also in many other state letters, as well after the outbreak of the great rebellion as before it. And there is in the Bodleian Library at Oxford (MS. Rawlinson, A. 477) a curiously minute account of the methods alleged to have been pursued in the systematic and periodical examination of letters intrusted to the post-office. The paper is not authenticated by any signature, and is undated. But it is an original document of the time of Charles II., addressed to Mr. Bridgman, clerk of the council, and drawn up in order to recommend the adoption of a like practice, but with greater dexterity in the manipulation than was used by Dr. Dorislaus and Samuel Morland, who, according to this narrative, formed the Cromwellian board of examiners for post-office letters, and who read without exception all that were addressed to foreign parts.

erally) "trampled down" by Cromwell's soldiery. The inventor had a narrow escape from severe punishment. He lived to publish (1659) the details of his plan, at the eve of the Restoration, in a pamphlet entitled *A Penny Post: or a Vindication of the Liberty and Birthright of every Englishman in carrying Merchants' and other Man's letters, against any Restraint of Farmers*, etc. It is very probable that this publication[1] helped to prepare the way for those measures of partial but valuable and far-reaching reform which were effected during the reign of Charles II. The rates of postage and the rights and duties of postmasters were settled under the Protectorate by an Act of Parliament of 1657, c. 30. In 1659 the item "by postage of letters in farm, £14,000 [$68,040]," appears in a report on the public revenue.[2]

Under Charles II.

The Government of the Restoration continued to farm the post-office upon conditions very similar to those imposed by the Act of 1657, but for a larger sum. Henry Bishop was the first postmaster-general in the reign of Charles II., and he contracted to pay to the king a yearly rent of £21,500 [$104,490], these new arrangements being embodied in the Act 12 Charles II. c. 35, entitled "An Act for Erecting and Establishing a Post-Office." A clause proposing to frank all letters addressed to or sent by members of parliament during the session was, after considerable debate, ultimately rejected by the Lords. But the indenture enrolled with the letters-patent contained a proviso for the free carriage of all letters to or from the king, the great officers of state, and also the single inland letters only of the members of that present parliament during the continuance of that session. It also provided that the lessee should permit the secretaries of state for the time being, or either of them, from time to time, to have the survey and inspection of all letters at their discretion. Bishop was succeeded by Daniel O'Neill[3] in 1662, on similar terms. In the consequent proclamation, issued on 25th May, 1663, it was commanded that "no postmasters or other officers that shall be employed in the conveying of letters, or distributing of the same, or any other person or persons, . . . *except by the immediate warrant of our principal secretaries of state*, shall presume to open any letters or pacquets not directed unto themselves." In 1677 the general post-office comprised in the chief office, under Henry Bennet, earl of Arlington, as postmaster-general, seventy-five persons, and its profits were farmed for £43,000 [$208,980] a year. There were then throughout England and Scotland 182 deputy-postmasters, and in Ireland 18 officers at the Dublin office and 45 country postmasters. "The number of letters missive," says a writer of the same year, "is now prodigiously great. . . . A letter comprising one whole sheet of paper is conveyed 80 miles for twopence. Every twenty-four hours the post goes 120 miles, and in five days an answer may be had from a place 300 miles distant."[4]

By an Act of the 15th Charles II. ("An Act for Settling the Profits of the Post-Office on H.R.H. the Duke of York, and his Heirs-Male," and by a subsequent proclamation issued in August, 1683, it was directed that the postmaster-general should "take effectual care for the conveyance of all bye-letters, by establishing correspondences . . . . in all considerable market-towns with the next adjacent post-stage," and the rights of the postmasters as to hiring horses were again emphasized.

Dockwra's London penny post.

It was during the possession of the post-office profits by the duke of York that a London penny post was established by the joint enterprise of William Dockwra, a searcher at the customs house, and of Robert Murray, a clerk in the excise office. The working-out of the plan fell to the first-named, and in his hands it gave in April, 1680—although but for a short time—far more extensive postal facilities to the Londoners than even those so memorably afforded 160 years later by the plans of Sir Rowland Hill. The London of that day was small, and easily manageable. Dockwra carried, registered, and *insured* for a penny, both letters and parcels up to a pound in weight and £10 [$48.60] in value. He took what had been the Mansion of Sir Robert Abdy in Lime Street as a chief office, established seven sorting and district offices (thus anticipating one of the most recent improvements of the present time) and between 400 and 500 receiving-houses and wall-boxes. He established hourly collections, with a maximum of ten deliveries daily for the central part of the city, and a minimum of six for the suburbs. Outlying villages, such as Hackney and Islington, had four daily deliveries; and his letter-carriers collected for each despatch of the general post-office throughout the whole of the city and suburbs. Suits were laid against him in the court of King's Bench for infringing on the duke of York's patent, and the jealousies of the farmers eventually prevailed. The penny post was made a branch of the general post. Dockwra, after the revolution of 1688, obtained a pension of £500 [$2,430] a year (for a limited term) in compensation of his losses. In 1697 he was made comptroller of the London office. Eleven years later his improvements were outvied by Charles Povey, the author of schemes for improving coinage, and also of a very curious volume, often wrongly ascribed to Defoe, entitled *The Visions of Sir Heister Ryley*. Povey took upon himself to set up a foot-post under the name of the "halfpenny carriage," appointed receiving-houses, and employed several persons to collect and deliver letters for hire within the cities of London and Westminster and borough of Southwark, "to the great prejudice of the revenue," as was represented by the postmaster-general to the lords of the treasury. Povey was compelled to desist.

Early Scottish postal system.

At this period the postal system of Scotland was distinct from that of England. It had been reorganized early in the reign of Charles II., who in September, 1662, had appointed Patrick Grahame of Inchbrakie to be postmaster-general of Scotland for life at a salary of £500 [$202.50] Scots. But it would seem from the proceedings of the Scottish privy council that the rights and duties of the office were ill defined; for immediately after the appointment of Grahame the council commissioned Robert Mein, merchant and keeper of the letter-office in Edinburgh, to establish posts between Scotland and Ireland, ordained that Linlithgow, Kilsyth, Glasgow, Kilmarnock, Dumboag, Ballantrae, and Portpatrick should be stages on the route, and granted him the sum of £200 sterling [$81.00] to build a packet-boat to carry the mail from Portpatrick to Donaghadee.[5]

Early colonial posts.

The colonial post-office at this period was naturally more rudimentary still. Perhaps the earliest official notice of it is to be seen in the following paragraph from the records of the general courts of Massachusetts in 1639. "It is ordered that notice be given that Richard Fairbanks his house in Boston is the place appointed for all letters which are brought from beyond the seas, or are to be sent thither to be left with him; and he is to take care that they are to be delivered or sent according to the directions; and he is allowed for every letter a penny, and must answer all miscarriages through his own neglect in this kind." That court in 1667 was petitioned to make better postal arrangements, the petitioners alleging the frequent "loss of letters whereby merchants, especially with their friends and employers in foreign parts, are greatly damnified; many times the letters are imputed (?) and thrown upon the exchange, so that those who will may take them up, no person, without some satisfaction, being willing to trouble their houses therewith." In Virginia the postal system was yet more primitive. The colonial law of 1657 required every planter to provide a messenger to convey the dispatches as they arrived to the next plantation, and so on, on pain of forfeiting a hogshead of tobacco in default. The Government of New York in 1672 established "a post to goe monthly from New York to Boston," advertising "those that bee disposed to send letters, to bring them to the secretary's office, where, in a lockt box, they shall be preserved till the messenger calls for them, all persons paying the post before the bagg be sealed up."[1] Thirty years later this monthly post had become a fortnightly one, as we see by the following paragraph in the *Boston News-Letter*. "By order of the postmaster-general of North America. These are to give notice, That on Monday night, the 6th of December, the Western post between Boston and New York sets out once a fortnight, the three winter months of December, January, and February, and to go alternately from Boston to Saybrook and Hartford, to exchange the mayle of letters with the New York Ryder; the first turn for Saybrook, to meet the New York Ryder on Saturday night the 11th currant; and the second turn he sets out at Boston on Monday night the 20th currant, to meet the New York Ryder at Hartford, on Saturday night the 25th currant, to exchange Mayles; and all persons that sends letters from Boston to Connecticut from and after the 13th inst. are hereby notified first to pay the Postage on the same."[2] This office of postmaster-general for America had been created in 1692.

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[1] There is a copy in the library of the British Museum, from which Mr. H. B. Wheatley has given the abstract quoted above.

[2] *Journals of the House of Commons*, vii. 627.

[3] The trusted friend but not always the trusted adviser of the duke of Ormonde. O'Neill's correspondence exists among the duke's papers, in part at Kilkenny Castle, in part (extensively) amongst the Carte MSS. in the Bodleian; and it abounds in incidental illustrations of postal administration in both England and Ireland.

[4] Quoted in *Gent. Mag.* (1815), xxxv. pp. 309, 310.

[5] Lang, *Historical Summary of the Post-Office in Scotland*, 4, 5.

Act of consolidation.

We have now traced the postal communications of different portions of the British empire from their earliest beginnings until the eve of the passing of the Act of the 9th of Queen Anne which consolidated them into one establishment, and which, as to organization, continued to be the great charter of the post-office until the date of the important reforms of 1838-50, mainly introduced by the energy, skill, and characteristic pertinacity of Sir Rowland Hill. The Act of Anne largely increased the powers of the postmaster-general. It reorganized the chief letter-offices of Edinburgh, Dublin, and New York, and settled new offices in the West Indies and elsewhere. It established three rates of single postage, viz., English, 3d. [6 cents] if under 80 miles and 4d. [8 cents] if above, and 6d. [12 cents] to Edinburgh or Dublin. It continued to the postmaster-general the sole privilege "to provide horses to persons riding post." And it gave, for the first time, parliamentary sanction to the power, formerly questionable, of the secretaries of state with respect to the opening of letters, by enacting that "from and after the first day of June, 1711, no person or persons shall presume . . . to open, detain, or delay . . . any letter or letters . . . after the same is or shall be delivered into the general or other post-office, . . . and before delivery to the persons to whom they are directed, or for their use, *except by an express warrant in writing under the hand of one of the principal secretaries of state, for every such opening, detaining, or delaying.*"

Cross-road posts.

Nine years after the passing of the Act of Anne the cross-posts were farmed to the well-known "humble" Ralph Allen,—the lover of peace and of humanity.[3] Allen became the inventor of the cross-roads postal system, having made an agreement that the new profits so created should be his own during his lifetime. His improvements were so successful that he is said to have netted during forty-two years an average profit of nearly £12,000 [$58,320] a year.

The postal revenue of Great Britain, meanwhile, was as shown by Table I.

TABLE I.—*Gross and Net Income*, 1724-1774.

	Gross Produce.			Net Revenue.		
	£	s.	d.	£	s.	d.
1724	178,071	16	9	96,339	7	5
1734	176,334	3	1	91,701	11	0
1744	194,461	8	7	85,114	9	4
1754	214,300	10	6	97,365	5	1
1764	225,326	5	8	116,182	8	5
1774	313,032	14	6	164,077	8	4

Permanent pensions.

The system of burdening the post-office revenue with pensions, nearly all of which had not the slightest connection with the postal service, and some of which were unconnected with any sort of service that can possibly be called public, was begun by Charles II., who granted to Barbara, duchess of Cleveland, £4700 [$22,842] a year, and to the earl of Rochester £4000 [$19,440] a year out of that revenue. The example was followed until, in 1694, the list of pensions so chargeable stood thus:

Earl of Rochester	£4,000	Lord Keeper	£2,000
Duchess of Cleveland	4,700	William Dockwra (until 1697)	500
Duke of Leeds	8,500		
Duke of Schomberg	4,000		
Earl of Bath	2,500	Total	£21,200

Queen Anne granted a pension of £5000 [$24,300] to the duke of Marlborough, charged in like manner. In March, 1857 the existing pensions ceased to be payable by the post-office, and became chargeable to the consolidated fund.

Palmer's mail-coaches.

The first important and enduring impulse to the development of the latent powers of the post-office, both as a public agency and as a source of revenue, was given by the shrewdness and energy of the manager of the Bath theatre, John Palmer. Palmer's notice was attracted to the subject in October, 1782. His avocations had made him familiar with that great western road which was still in such peculiar favor, alike with people of fashion and with the gentlemen of the highway. So habitual were the robberies of the post that they came to be regarded by its officials as among the necessary conditions of human affairs. They urged on the public the precaution of sending all bank-notes and bills of exchange in halves, and pointed the warning with a philosophical remark, that, "*there are no other means of preventing robberies with effect*, as it has been proved that the strongest carts that could be made, lined and bound with iron, were soon broken open by a robber."

At this period, in addition to the recognized perils of the roads, the postal system was characterized by extreme irregularity in the departure of mails and delivery of letters, by an average speed of about 3½ miles in the hour, and by a rapidly-increasing diversion of correspondence into illicit channels. The net revenue, which had averaged £167,176 [$812,475.36] during the ten years ending with 1773, averaged but £159,625 [$775,777.50] during the ten years ending with 1783. Yet, when Palmer suggested that by building mail-coaches of a construction expressly adapted to run at a good speed, by furnishing a liberal supply of horses, and by attaching an armed guard to each coach the public would be greatly benefited, and the post-office revenue considerably increased, the officials pertinaciously opposed the plan and maintained that the existing system was all but perfect. Lord Camden, however, brought the plan under the personal notice of Pitt. No sooner was the minister convinced of its merits than he insisted on its being tried. The experiment was made in August, 1784, and its success exceeded all anticipation. The following table will show the rapid progress of the postal revenue under the new arrangements.

It had been at first proposed to reward Palmer by a grant for life of two and a half per cent. on a certain proportion of the increased net revenue, which would eventually have given him some £10,000 [48,600] a a year; but this proposition fell through, in consequence either of technical difficulties created by the Post-Office Act or of the opposition of the post-office authorities. Pitt, however, appointed Palmer to be comptroller-general of postal revenues, an office which

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[1] Miles, "History of the Post-Office," in the American *Banker's Magazine*, n. s., vii. 358 *sq.*

[2] Buckingham, *Specimens of Newspaper Literature* (Boston, 1850), i. 16, 17.

[3] "Is there a variance? enter but his door,
Balked are the courts; the contest is no more."
Pope's "humble Allen" was also the "Allworthy" of Fielding.

TABLE II.—*Gross and Net Income*, 1784-1805.

Year.	Gross Income.			Net Revenue.		
	£	s.	d.	£	s.	d.
1784	420,101	1	8	196,513	16	7
1785	463,753	8	4	261,409	18	2
1790	533,198	1	9	331,179	18	8
1795	745,238	0	0	414,548	11	7
1800	1,083,950	0	0	720,981	17	1
1805	1,317,842	0	0	944,382	8	4

was soon made too hot for him to hold. He obtained a pension of £3000 [$14,580] a year, and ultimately, by the Act 53 Geo. III. c. 157, after his case had received the sanction of five successive majorities against Government, an additional sum of £50,000 [$243,000]. Every sort of obstruction was placed in the way of his reward, although nearly a million had been added to the annual public revenue, and during a quarter of a century the mails had been conveyed over an aggregate of some seventy millions of miles without the occurrence of one serious mail robbery.[1]

Scottish and Irish post-office, 1708-1801.

Scotland shared in the advantages of the mail-coach system from the first. Shortly before its introduction the local penny post was set on foot in Edinburgh by Peter Williamson, the keeper of a coffee-room in the hall of Parliament House. He employed four letter-carriers, in uniform, appointed receivers in various parts of the city, and established hourly deliveries.[2] The officials of the post, when the success of the plan had become fully apparent, gave Williamson a pension, and absorbed his business, the acquisition of which was subsequently confirmed by the Act 34 Geo. III. c. 17. A dead-letter office was established in 1784. The entire staff of the Edinburgh post-office, which consisted in 1708 of seven persons, now comprised twenty-five, the cost of the office being £1406 [$6,833.16]. In 1796 the number of functionaries had increased to forty, and the cost to £3278 [$15,931.08].[3] But in Ireland the old state of things continued until the present century. In 1801 only three public carriages in the whole country conveyed mails. There were, indeed, few roads of any sort, and none on which coaches could travel faster than four miles an hour.[4] At this period the gross receipts of the Irish post-office were £80,040 [$388,994.40]; the charges of management and collection were £59,216 [$287,789.76], or at the rate of more than 70 per cent.; whilst in Scotland the receipts were £100,651 [$489,163.86], and the charges £16,896 [$82,114.56], or somewhat less than 17 per cent.[5]

Franklin.

In the American colonies postal improvements may be dated from the administration of Franklin, who was virtually the last colonial postmaster-general, as well as unquestionably the best. In one shape or another he had forty years' experience of postal work, having been appointed postmaster at Philadelphia as early as October, 1737. When he became postmaster-general in 1753 he bestirred himself for the improvement of his department in that practical painstaking way with which he was wont to guide any plough he had once put his hand to, whatever the ground it had to work in. He visited all the chief post-offices throughout Pennsylvania, New Jersey, New York, and New England, looking at everything with his own eyes. His administration cannot be better summed up than we find it to be in a sentence or two which he wrote soon after his dismissal. Up to the date of his appointment, he says, "the American post-office had never paid anything to that of Britain. We [*i.e.*, himself and his assistant] were to have £600 [$2,916] a year between us, if we could make that sum out of the profits of the office. . . . In the first four years the office became above £900 [$4,374] in debt to us. But it soon after began to repay us; and before I was displaced by a freak of the minister's, we had brought it to yield three times as much clear revenue to the crown as the post-office of Ireland. Since that imprudent transaction they have received from it—not one farthing."

The interval between the development of Palmer's improved methods (as far as that development was permitted by the authorities), which we take to be pretty nearly contemporaneous with the parliamentary settlement of his claims, and the still more important reforms introduced twenty-seven years later by Sir Rowland Hill, is chiefly marked by the growth of the packet system, under the influence of steam navigation, and by the elaborate investigations of the revenue commissioners of 1826 and the following years. Undoubtedly the inquiries of these commissioners attracted a larger share of public attention to the management of the post-office than had theretofore been bestowed on it; but, if anything had been wanted to throw into bolder relief Hill's intelligent and persevering exertions, these reports supply the want in ample measure. In some important particulars they mark out practical and most valuable reforms, but they are so clumsy in arrangement, so resilient in the treatment of the various branches of the service, and so crowded with petty details as to contrast most unfavorably with the lucid order and vigorous reasoning of Rowland Hill's *Post-Office Reform*. While the functionaries of the post-office are criticised with a severity so salient as to wear an appearance at times of almost personal hostility, the truth that a very large and liberal increase of public facilities would be likely to benefit the revenue much more materially than small economies in salaries and perquisites seems scarcely to have dawned on the minds of the commissioners. Even in dealing with new accommodation actually provided—that of the money-order office—whilst taking just exception to the unofficial character of its management, they incline rather to its abolition than to its reform.

Packet services.

As early as 1788 the cost of the packets employed by the post-office attracted parliamentary attention. In that year the "commissioners of fees and gratuities" reported that in the preceding seventeen years the total cost of this branch had amounted to £1,038,133 [$5,045,326.38]; and they naturally laid stress on the circumstance that many officers of the post-office were owners of such packets, even down to the chamber-keeper. At this time part of the packet service was performed by hired vessels, and part by vessels which were the property of the crown. The commissioners recommended that the latter should be sold, and the entire service be provided for by public and competitive tender. The subject was again inquired into by the Finance Committee of 1798, which reported that the recommendation of 1788 had not been fully acted upon, and expressed its concurrence in that recommendation. The plan was then to a considerable extent enforced. But the war rapidly increased the expenditure. The average (£61,000 [$296,460]) of 1771–87 had increased in 1797 to £78,439 [$381,213.54], in 1810 to £105,000 [$510,300], in 1814 to £160,603 [$780,530.58]. In the succeeding years of peace the expense fell to an average of about £85,000 [$413,100]. As early as 1818 the "Rob Roy" plied regularly between Greenock and Belfast; but no use was made of steam navigation for the postal service until 1821, when the postmaster-general established crown packets. The expenditure under the new system, from that date to 1829 inclusive, was thus reported by the commissioners of revenue inquiry in 1830.

TABLE III.—*Cost of Packet Service.*[6]

Year.		Year.	
1820[7]	£85,000	1825	£110,898
1821[8]	134,868	1826	144,592
1822	115,429	1827	159,250
1823	93,725	1828	117,290
1824	116,062	1829	108,306

The general administration of postal affairs at this period was still characterized by repeated advances in the letter rates, and the twenty years previous to Rowland Hill's reforms by a stationary revenue. The following table (IV.) will show the gross receipts, the charges of collection and management the net revenue (omitting fractions of a pound) of the post-office of Great Britain. We give the figures for the year 1808 for the purpose of comparison.

Year.	Gross Income.	Charges of Collection, etc.	Charges per cent. of Gross Income.	Net Revenue.	Population of United Kingdom.
1808	£1,552,087	£451,481	29	£1,100,606	...
1815–16	2,193,741	594,045	27	1,599,696	19,552,000
1818–19	2,209,212	719,622	32½	1,489,590	...
1820–21	2,182,235	686,290	29	1,495,945	20,928,000
1824–25	2,255,239	655,914	29	1,599,825	22,362,000
1826–27	2,392,272	747,018	31	1,645,254	...
1836–37	2,206,736	609,220	27½	1,597,516	25,605,000
1838–39	2,346,278	686,768	29	1,659,510	...

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[1] *Debates of both Houses of Parliament in* 1808 *relative to the Agreement for the Reform and Improvement of the Post-Office*, passim.

[2] Lang, *Historical Summary of the Post-Office in Scotland*, 15.

[3] *Appendix to Seventh Report from Select Committee on Finance* (1797), reprinted in collective series of reports, xii. 209.

[4] *Minutes of Evidence before Select Committee on Taxation of Internal Communication* (1887), evidence of Sir Edward Lees, 397.

[5] *Report, etc., of Select Committee on Postage.*

[6] *Twenty-second Report of the Commissioners of Revenue Inquiry*, 4–6.

[7] Last year of exclusive sailing packets.

[8] First year of steam-packets.

Governmental interference with correspondence.

Before passing to the reform of 1839 we have to revert to that important feature in postal history,—the interference with correspondence for judicial or political purposes. We have already seen (1) that this assumption had no parliamentary sanction until the enactment of the 9th of Queen Anne; (2) that the enactment differed from the royal proclamations in directing a special warrant for each opening or detention of correspondence. It is a significant gloss on the statute to find that for nearly a century (namely, until 1798 inclusive) it was not the practice to record such warrants regularly in any official book.[1] Of the use to which the power was applied the state trials afford some remarkable instances. At the trial of Bishop Atterbury, for example, in 1723 certain letters were offered in evidence which a clerk of the post-office deposed on oath "to be true copies from the originals, which were stopped at the post-office and copied, and sent forward as directed." Hereupon Atterbury very naturally asked this witness "if he had any express warrant under the hand of one of the principal secretaries of state for opening the said letters." But the Lords shelved his objection and put a stop to his inquiry on the grounds of public inexpediency. Twenty-nine peers recorded their protest against this decision.[2] But the practice thus sanctioned appears to have been pushed to such lengths as to elicit in April, 1735, a strong protest and censure from the House of Commons. In the preceding February complaints were made by several members that not only were their letters charged at the post-office, but they were often broken open and perused by the clerks, that the practice of breaking open letters was become frequent, and was so publicly known that "the liberty given to break open letters . . . could now serve no purpose but to enable the idle clerks about that office to pry into the private affairs of every merchant and of every gentleman in the kingdom."[3] A committee of inquiry was appointed, and after receiving its report the House resolved that it was "an high infringement of the privileges of the . . . Commons of Great Britain in Parliament for any postmaster, his deputies, or agents, in Great Britain or Ireland, to open or look into, by any means whatever, any letter directed or signed by the proper hand of any member, without an express warrant in writing under the hand of one of the principal secretaries of state for every such opening and looking into; or to detain or delay any letter directed to, or signed with the name of any member, unless there shall be just reason to suspect some counterfeit of it, without an express warrant of a principal secretary of state for every such detaining or delaying."

Sir Rowland Hill's Reforms (1836–1842).

Rowland Hill's proposals for reform.

Rowland Hill's pamphlet (*Post-Office Reform*) of 1837 took for its starting-point the fact that, whereas the postal revenue showed for the past twenty years a positive though slight diminution, it ought to have showed an increase of £507,700 [$2,467,422] a year in order to have simply kept pace with the growth of population (see Table IV. above), and an increase of nearly four times that amount in order to have kept pace with the growth of the analogous though far less exorbitant duties imposed on stage-coaches. The stage-coach duties had produced in 1815 £217,671 [$1,057,881.06]. In 1835 they produced £498,497 [$2,442,695,42]. In 1837 there did not exist any precise account of the number of letters transmitted through the general post-office. Hill, however, was able to prepare a sufficiently approximate estimate from the data of the London district post, and from the sums collected for postage. He thus calculated the number of chargeable letters at about 88,600,000, that of franked letters at 7,400,000, and that of newspapers at 30,000,000, giving a gross total of about 126,000,000. At this period the total cost of management and distribution was £696,569 [$3,385,325.34]. In the finance accounts of the year (1837) deductions are made from the gross revenue for letters "refused, missent, redirected," and the like, which amount to about £122,000 [$592,920]. An analysis of the component parts of this expenditure assigned £426,517 [$2,072,872.62] to cost of primary distribution and £270,052 [$1,312,452.72] to cost of secondary distribution and miscellaneous charges. A further analysis of the primary distribution expenditure gave £282,308 [$1,372,016.88] as the probable outgoings for receipt and delivery and £144,209 [$700,855.74] as the probable outgoings for transit. In other words, the expenditure which hinged upon the *distance* the letters had to be conveyed was £144,000 [$699,840], and that which had nothing to do with distance was £282,000 [$1,370,520]. Applying to these figures the estimated number of letters and newspapers (126,000,000) passing through the office, there resulted a probable average cost of $\frac{84}{100}$ of a penny for each, of which $\frac{28}{100}$ was cost of transit and $\frac{56}{100}$ cost of receipt, delivery, etc. Taking into account, however, the much greater weight of newspapers and franked letters as compared with chargeable letters, the apparent average cost of *transit* became, by this estimate, but about $\frac{9}{100}$, or less than $\frac{1}{10}$ of a penny.

A detailed estimate of the cost of conveying a letter from London to Edinburgh, founded upon the average weight of the Edinburgh mail, gave a still lower proportion, since it reduced the apparent cost of transit, on the average, to the thirty-sixth part of one penny. Hill inferred that, if the charge for postage were to be made proportionate to the whole expense incurred in the receipt, transit, and delivery of the letter, and in the collection of its postage, it must be made *uniformly* the same from every post-town to every other post-town in the United Kingdom, unless it could be shown how we are to collect so small a sum as the thirty-sixth part of a penny. And, inasmuch as it would take a ninefold weight to make the expense of transit amount to one farthing, he further inferred that, taxation apart, the charge ought to be precisely the same for every packet of moderate weight, without reference to the number of its enclosures.

At this period the rate of postage actually imposed (beyond the limits of the London district office) varied from 4d. [8 cents] to 1s. 8d. [40.5 cents] for a single letter, which was interpreted to mean a single piece of paper not exceeding an ounce in weight; a second piece of paper or any other enclosure, however small, constituted the packet a double letter. A single sheet of paper, if it at all exceeded an ounce in weight, was charged with fourfold postage. The average charge on inland general post letters was nearly 9d. [18 cents] for each. Apart from the necessary commercial evils of an excessive taxation, the effects upon the postal service itself were injurious,—on the one hand, a complicated system of accounts, involving both great waste of time and great temptation to fraud in their settlement, and, on the other, a constant invitation to the violation of the sacredness of correspondence, by making it part of daily official work to expose letters to a strong light expressly to ascertain their contents. These mischiefs it was proposed to remove by enacting that the charge for primary distribution,—that is to say, the postage on all letters received in a post-town, and delivered in the same or in any other post-town in the British Isles,—should be at the uniform rate of one penny [2 cents] for each half-ounce,—all letters and other papers, whether single or multiple, forming one packet, and not weighing more than half an ounce, being charged one penny [2 cents], and heavier packets, to any convenient limit, being charged an additional penny for each additional half-ounce. And it was further proposed that stamped covers should be sold to the public at such a price as to include the postage, which would thus be collected in advance.[4] By the public generally, and pre-eminently by the trading public, the plan was received with great favor. By the functionaries of the post-office it was at once denounced as ruinous and ridiculed as visionary. Lord Lichfield, then postmaster-general, said in the House of Lords that, if the anticipated increase of letters should be realized, the mails would have to carry twelve times as much in weight, and therefore the charge for transmission, instead of being £100,000 [$486,000] as then, must increase to twelve times that amount. The walls of the post-office would burst; the whole area in which the building stood would not be large enough to receive the clerks and the letters.[1] The latter part of this prediction indeed has been abundantly verified, but not within the period or under the circumstances then referred to. In the course of the following year (1838) petitions were poured into the House of Commons. A select committee was appointed, which reported as follows:

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[1] *Report of Secret Committee on the Post-Office* (1844), p. 9.

[2] *Lord's Journals*, xxii. 183-186; Howell's *State Trials*, xvi. 540 *sq.*

[3] *Parliamentary History*, ix. 842 *sq.*

[4] *Post-Office Reform*, 27 *sq.*

Parliamentary action.

> "The principal points which appear to your committee to have been established in evidence are the following: (1) the exceedingly slow advance and occasionally retrograde movement of the post-office revenue during the . . . last twenty years; (2) the fact of the charge of postage exceeding the cost in a manifold proportion; (3) the fact of postage being evaded most extensively by all classes of society, and of correspondence being suppressed, more especially among the middle and working classes of the people, and this in consequence, as all the witnesses, including many of the post-office authorities, think, of the excessively high scale of taxation; (4) the fact of very injurious effects resulting from this state of things to the commerce and industry of the country, and to the social habits and moral condition of the people; (5) the fact, as far as conclusions can be drawn from very imperfect data, that whenever on former occasions large reductions in the rates have been made, these reductions have been followed in short periods of time by an extension of correspondence proportionate to the contraction of the rates; (6) and, as matters of inference from fact and of opinion—(i.) that the only remedies for the evils above stated are a reduction of the rates, and the establishment of additional deliveries, and more frequent despatches of letters; (ii.) that owing to the rapid extension of railroads there is an urgent and daily-increasing necessity for making such changes; (iii.) that any moderate reduction in the rates would occasion loss to the revenue, without in any material degree diminishing the present amount of letters irregularly conveyed, or giving rise to the growth of new correspondence; (iv.) that the principle of a low uniform rate is just in itself, and, when combined with prepayment and collection by means of a stamp, would be exceedingly convenient and highly satisfactory to the public."

Nature of reforms.

During the session of parliament which followed the presentation of this report about 2000 petitions in favor of uniform penny postage were presented to both Houses, and at length the chancellor of the exchequer brought in a Bill to enable the treasury to carry that reform into effect. The measure was carried in the House of Commons by a majority of 100, and became law on 17th August, 1839. A new but only temporary office under the treasury was created to enable Rowland Hill to superintend (although, as it proved, under very inadequate arrangements) the working out of his plan. The first step taken was to reduce, on 5th December, 1839, the London district postage to 1d. [2 cents] and the general inland postage to 4d. [8 cents] the half-ounce (existing lower rates being continued). On 10th January, 1840, the uniform penny rate came into operation throughout the United Kingdom,—the scale of weight advancing from 1d. [2 cents] for each of the first two half-ounces, by gradations of 2d. [4 cents] for each additional ounce, or fraction of an ounce, up to 16 ounces. The postage was to be prepaid, and if not to be charged at double rates. Parliamentary franking was abolished. Postage stamps (see below, p. 602 *sq.*) were introduced in May following. The facilities of despatch were soon afterwards increased by the establishment of day mails.

But on the important point of simplification in the internal economy of the post-office, with the object of reducing its cost without diminishing its working power, very little was done. In carrying out the new measures the officers were, as the chancellor of the exchequer (Baring) expressed it on one occasion, "unwilling horses." Nor need a word more be said in proof of the assertion than is contained in a naive passage of Colonel Maberly's evidence before the postal committee of 1843. "My constant language to the heads of the departments was,—'This plan, we know, will fail. It is your duty to take care that no obstruction is placed in the way of it by the heads of the department, and by the post-office. The allegation, I have not the least doubt, will be made at a subsequent period, that this plan has failed in consequence of the unwillingness of the Government to carry it into fair execution. It is our duty, as servants of the Government, to take care that no blame eventually shall fall on the Government through any unwillingness of ours to carry it into proper effect.'" And again: "*After the first week*, it was evident, from the number of letters being so much below Mr. Hill's anticipations, that it must fail, inasmuch as it wholly rested upon the number of letters; for without that you could not possibly collect the revenue anticipated."

Results.

The plan, then, had to work in the face of rooted mistrust on the part of the workers. Its author was (for a term of two years, afterwards prolonged to three) the officer, not of the post-office, but of the treasury. He could only recommend measures the most indispensable through the chancellor of the exchequer; and, when Goulburn succeeded Baring, the chancellor was very much of Colonel Maberly's way of thinking. It happened, too, that the scheme had to be tried and carried through at a period of severe commercial depression. Nevertheless, the results actually attained in the first two years were briefly these: (1) the chargeable letters delivered in the United Kingdom, exclusive of that part of the Government correspondence which theretofore passed free, had already increased from the rate of about 75,000,000 a year to that of 196,500,000; (2) the London district post letters had increased from about 13,000,000 to 23,000,000, or nearly in the ratio of the reduction of the rates; (3) the illicit conveyance of letters was substantially suppressed; (4) the gross revenue, exclusive of repayments, yielded about a million and a half per annum, which was about 63 per cent. of the amount of the gross revenue in 1839. These results at so early a stage, and in the face of so many obstructions, amply vindicated the policy of the new system. But by its enemies that system was loudly declared to be a failure, until the progressive and striking evidence of year after year silenced opposition by an exhaustive process.

Seven years later (1849) the 196,500,000 letters delivered throughout the United Kingdom in 1842 had increased to nearly 329,000,000. In addition, the following administrative improvements had been effected: (1) the time for posting letters at the London receiving-houses extended; (2) the limitation of weight abolished; (3) an additional daily despatch to London from the neighboring (as yet independent) villages; (4) the postal arrangements of 120 of the largest cities and great towns revised; (5) unlimited writing on inland newspapers authorized on payment of an additional penny; (6) a summary process established for recovery of postage from the senders of unpaid letters when refused; (7) a book-post established; (8) registration reduced from one shilling to sixpence; (9) a third mail daily put on the railway (without additional charge) from the towns of the northwestern district to London, and day mails extended within a radius of 20 miles round the metropolis; (10) a service of parliamentary returns for private Bills, provided for; (11) measures taken, against many obstacles, for the complete consolidation of the two heretofore distinct corps of letter-carriers,—an improvement (on the whole) of detail, which led to other improvements thereafter.[2]

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[1] *Mirror of Parliament*, debate of 18th December, 1837. But Lord Lichfield was an excellent public servant, and many reforms were made by him.

[2] Hill, *History of Penny Postage* (1880), Appendix A (*Life*, etc.,

Improvements, more conspicuous still, in the money-order branch of the postal service will be noticed in a subsequent section of this article (page 587).

Later History (1842–1885).

When Sir R. Hill initiated his great reform the postmastership-general was in the hands of the earl of Lichfield, the thirty-first in succession to that office after Sir Brian Tuke. It was under Lord Lichfield that the legislation of 1839 was carried out in 1840 and in 1841. In September of the last-named year Lord Lichfield was succeeded by Viscount Lowther.

Opening and detention of letters.

In the summer of 1844 public attention was aroused in a remarkable manner to a branch of post-office administration which hitherto had been kept almost wholly out of sight. The statement that the letters of Mazzini, then a political refugee, who had long been resident in England, had been systematically opened, and their contents communicated to foreign Governments, by Sir James Graham, secretary of state for the home department, aroused much indignation. The arrest of the brothers Bandiera,[1] largely in consequence of information derived from their correspondence with Mazzini, and their subsequent execution at Cosenza made a thorough investigation into the circumstances a public necessity. The consequent parliamentary inquiry of August, 1844, after retracing the earlier events connected with the exercise of the discretional power of inspection which parliament had vested in the secretaries of state in 1710, elicited the fact that in 1806 Lord Spencer, then secretary for the home department, introduced for the first time the practice of recording in an official book all warrants issued for the detention and opening of letters, and also the additional fact that from the year 1822 onwards the warrants themselves had been preserved. The whole number of such warrants issued from 1806 to the middle of 1844 inclusive was stated to be 323, of which no less than 53 had been issued in the years 1841–44 inclusive, a number exceeding that of any previous period of like extent. It further appeared that the whole recorded number of warrants from the beginning of the century was 372, which the committee classified under the following heads:

Subject-Matters in relation to which Warrants were issued for the Opening of Letters, 1799–1844.

Bank of England	18	Letters returned	7
Bankruptcy	2	Address copied	1
Murder, theft, fraud, etc.	144	Forged frank	1
Treason, sedition, etc.	77	Uncertain	89
Prisoners of war	18		
Revenue	5	Total	372
Foreign correspondence	20		

The committee of 1844 proceeded to report that "the warrants issued during the present century may be divided into two classes,—1st, those issued in furtherance of criminal justice. . . . 2d, those issued for the purpose of discovering the designs of persons known or suspected to be engaged in proceedings dangerous to the state, or (as in Mazzini's case) *deeply involving British interests*, and carried on in the United Kingdom, or in British possessions beyond the seas. . . Warrants of the second description originate with the home office. The principal secretary of state, of his own discretion, determines when to issue them, and gives instructions accordingly to the under-secretary, whose office is then purely ministerial. The mode of preparing them, and keeping record of them in a private book, is the same as in the case of criminal warrants. *There is no record kept of the grounds on which they are issued*, except so far as correspondence preserved at the home office may lead to infer them.[2] . . . The letters which have been detained and opened are, unless retained by special order, as sometimes happens in criminal cases, closed and resealed, without affixing any mark to indicate that they have been so detained and opened, and are forwarded by post according to their respective superscriptions."[3]

Almost forty years later a like question was again raised in the House of Commons (March, 1882) by some Irish members, in relation to an alleged examination of correspondence at Dublin for political reasons. Sir William Harcourt on that occasion spoke thus: "This power is with the secretary of state in England. . . In Ireland it belongs to the Irish Government. . . . It is a power which is given for purposes of state, and the very essence of the power is that no account [of its exercise] can be rendered. To render an account would be to defeat the very object for which the power was granted. If the minister is not fit to exercise the power so entrusted, upon the responsibility cast upon him, he is not fit to occupy the post of secretary of state."[4] The House of Commons accepted this explanation; and in view of many recent and grave incidents, both in Ireland and in America, it would be hard to justify any other conclusion.

Increase in postal business (1839–57).

The increase in the number of postal deliveries and in that of the receiving-houses and branch-offices, together with the numerous improvements introduced into the working economy of the post-office, when Rowland Hill at length obtained the means of fully carrying out his reforms by his appointment as secretary, speedily gave a more vigorous impulse to the progress of the net revenue than had theretofore obtained. During the seven years 1845–51 inclusive the average was but £810,951 [$3,941,221.86]. During the seven years 1852–57 inclusive the average was £1,166,448 [$5,668,937.38]—the average of the gross income during the same septennial period having been £2,681,835 [$13,033,718.10]. The following table (V.) shows the details (omitting fractions of a pound) for the entire period from 1838, the last complete year of the old rates of postage, to 1857 inclusive:

Number of Letters; Gross and Net Income, 1838–1857.

Year ending	Estimated No. of Chargeable Letters.	Gross Income.	Cost of Management.	Net Revenue.	Postage charged on Government.
		£	£	£	£
Jan. 5, 1838	...	2,339,737	687,313	1,652,424	38,528
" 1839	...	2,346,278	686,768	1,659,509	45,156
" 1840	75,908,000	2,390,763	756,999	1,633,764	44,277
" 1841	168,768,344	1,359,466	858,677	500,789	90,761
" 1842	196,500,191	1,499,418	938,168	561,249	113,255
" 1843	208,434,451	1,578,145	977,504	600,641	122,161
" 1844	220,450,306	1,620,867	980,650	640,217	116,503
" 1845	242,091,684	1,705,067	985,110	719,957	109,232
" 1846	271,410,789	1,887,576	1,125,594	761,982	101,190
" 1847	299,586,762	1,963,857	1,138,745	825,112	100,354
" 1848	322,146,243	2,181,016	1,196,520	984,496	121,290
" 1849	328,830,184	2,143,679	1,403,250	740,429	115,902
" 1850	337,399,199	2,165,349	1,324,562	840,787	106,923
" 1851	347,069,071	2,264,684	1,460,785	803,898	109,523
" 1852	360,647,187	2,422,168	1,304,163	1,118,004	167,129
" 1853	379,501,499	2,434,326	1,343,907	1,090,419	124,977
" 1854	410,817,489	2,574,407	1,400,679	1,173,727	134,112
Dec. 31, 1854	443,649,301	2,701,862	1,506,556	1,195,306	185,236
" 1855	456,216,176	2,716,420	1,651,364	1,065,056	173,560
" 1856	478,393,803	2,867,954	1,660,229	1,207,725	154,229
" 1857	504,421,000	3,035,713	1,720,815	1,314,898	135,517

Briefly, within a period of eighteen years under the penny rate the number of letters became more than sixfold what it was under the exorbitant rates of 1838. When the change was first made the increase of letters was in the ratio of 122.25 per cent. during the year. The second year showed an increase on the first of about 16 per cent. During the next fifteen years the average increase was at the rate of about 6 per cent. per annum. Although this enormous increase of business, coupled with the increasing preponderance of railway mail conveyance (invaluable, but costly), carried up the post-office expenditure from £757,000 [$3,679,020] to £1,720,800 [$8,363,088], yet the net revenue of 1857 was within £320,000 [$1,555,200] of the net revenue of 1839. During the year 1857 the number of newspapers delivered in the United Kingdom was about 71,000,000, and that of book-packets (the cheap carriage of which is one of the most serviceable and praiseworthy of modern postal improvements) about 6,000,000.

Growth and changes (1858–85).

During the succeeding quarter of a century, 1858–84, the achievements of the period 1835–57 have been eminently surpassed. The postmasters-general of the new epoch have been assisted and seconded by a series of public servants, not a few of whom added to the conspicuous energies of Sir R. Hill more of those not less estimable qualities—suavity of

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ii. 438). Part of the strenuousness of the opposition to this measure arose, it must be owned, from the "high-handedness" which in Sir R. Hill's character somewhat marred very noble faculties. The change worked much harm to some humble but hardworking and meritorious functionaries.

[1] *Ricordi dei fratelli Bandiera e die loro compagni di martirio* in *Cosenza* (Paris, 1844), p. 47.

[2] *Report from the Secret Committee on the Post-Office* (1844), p. 11.

[3] *Ibid.*, pp. 14-17.

[4] Hansard, *Debates*, vol. cclxvii. cols. 294-296 (session of 1882).

TABLE VII.—*United Kingdom. Estimated Inland Delivery of Letters*, 1839-1884.[1]

Year ending 31st December until 1876, and thereafter the Financial Year ending 31st March.	Delivered in England and Wales. By Country Offices.	Increase per cent. per annum.	In London District, including Local Letters.	Increase per cent. per annum.	Total in England and Wales.	Increase per cent. per annum.	Average number to each person.	Total in Scotland.	Increase per cent. per annum.	Average number to each person.	Total in Ireland.	Increase per cent. per annum.	Average number to each person.	Total in United Kingdom.	Increase per cent. per annum.	Average number to each person.
Estimated No. of Letters, 1839	......	....	......	....	60,000,000	....	4	8,000,000	....	3	8,000,000	....	1	76,000,000	....	3
" Franks, 1839	......	....	......	....	5,172,000	....		336,000	....		1,056,000	....		6,563,000	....	
" Letters, 1840	88,000,000	....	44,000,000	....	132,000,000	120.0	8	19,000,000	148.5	7	18,000,000	119.2	2	169,000,000	22.2	7
Average of 5 years, 1841-45..	122,000,000	10.7	57,000,000	9.0	179,000,000	10.2	11	24,000,000	9.2	9	24,000,000	9.5	3	227,000,000	16.0	8
" 1846-50..	180,000,000	5.5	79,000,000	5.5	259,000,000	5.2	15	34,000,000	4.7	12	34,000,000	5.8	4	327,000,000	5.8	12
" 1851-55..	233,000,000	6.5	97,000,000	5.0	330,000,000	6.0	18	41,000,000	5.2	14	39,000,000	3.5	6	410,000,000	5.7	15
" 1856-60..	302,000,000	4.2	125,000,000	5.5	427,000,000	4.5	22	51,000,000	3.2	16	45,000,000	3.0	7	523,000,000	4.2	18
" 1861-65..	373,000,000	5.7	161,000,000	5 7	534,000,000	5.7	29	61,000,000	0.5	20	53,000,000	3.2	9	648,000,000	5.5	23
" 1866-70..	472,000,000	4.2	192,000,000	3.2	664,000,000	4.0	31	76,000,000	4.7	24	60,000,000	3.2	11	800,000,000	4.0	26
Year 1871	501,000,000	0.5	220,000,000	7.0	721,000,000	2.6	32	80,000,000	1.2	24	66,000,000	3.0	13	867,000,000	2.3	27
" 1875	580,081,400	4.8	266,771,000	6.5	846,852,400	5.3	35	90,976,400	0.9	26	70,563,300	0.8	13	1,008,392,100	4.4	31
" 1879-80	640,033,900	2.2	310,077,900	4.8	950,111,800	3.0	38	101,918,300	3.0	28	75,967,400	....	14	1,127,997,500	2.8	33
" 1880-81	650,952,700	1.7	330,419,300	6.6	981,372,000	3.3	38	104,995,200	3.0	29	78,799,700	3.8	15	1,165,166,900	3.3	34
" 1881-82	685,169,600	5.3	352,147,100	6.6	1,037,316,700	5.7	40	109,799,900	4.6	29	82,238,200	4.4	16	1,229,354,800	5.5	35
" 1882-83	713,089,100	4.1	364,558,100	3.5	1,077,647,200	3.9	41	116,509,800	6.1	31	86,479,200	5.2	17	1,280,636,200	4.2	36
" 1883-84	736,962,700	3.3	375,229,500	2.9	1,112,192,200	3.2	41	122,204,800	4.6	32	87,689,900	1.4	17	1,322,086,900	3.2	37

manner, tact in dealing with large bodies of inferiors, reverence for the good doings of past times—than had fallen to his lot. Salient among such stand the names of Sir John Tilley, Mr. Frank Ives Scudamore, and Mr. Stevenson Blackwood. Among the postmasters-general the Earl of Elgin (1859), Lord Stanley of Alderley (1860), Lord Hartington (December, 1868), Lord John Manners (February, 1874), and the forty-fourth postmaster-general Henry Fawcett[2] (April, 1880, to November, 1884) hold eminent place.

This period includes—(1) the establishment of postal savings banks (1861), in which Mr. Gladstone, as chancellor of the exchequer, had a very large share, and (2) the transfer to the state of the telegraphic service (1870). The origin and growth of each of these pregnant improvements is narrated in a separate section of this article. Scarcely less important than these are (3) the introduction of postal cards (October, 1870) and (4) the establishment (August, 1883) of a parcel post. The last-named measure will probably, in its results, prove to be a public boon of almost unexampled magnitude. At its outset it checks railway abuses, both of overcharge and of excessive delays, which had grown to be enormous evils. Minor but most valuable ameliorations of the postal service begin with the abolition of the half-ounce limit (1877), and include the provision of new and excellent post-office buildings, great improvement of the system of registration, extensive accelerations of mails in various parts of the empire, increased postal deliveries, and, not least in importance, a most just amelioration (greatly needed) of the position of sub-postmasters, of clerks, of sorters, and of letter-carriers. Certain minor improvements cannot be more briefly or better epitomized than in the words of a writer in the *Standard* newspaper of 10th January, 1879.

"The half-ounce weights chanced to be just above the weight of a letter written on full-sized post paper, and, when that was the maximum weight allowed, the margin was so fine that a little thicker paper than usual, or slightly larger envelope, sufficed to turn the scale, and all but strictly business correspondents were continually landing those whom they favored with their communications in the annoyance of a surcharge for deficient prepayment of postage. By the extension to an ounce all that worry and annoyance has been swept away, and no inconsiderable benefit has been conferred besides on people whose missives are of necessity somewhat more ponderous than ordinary. Quite recently the post-office has introduced another great improvement, which the public, not having yet had time to appreciate, do not utilize to the extent it deserves,—that is, the system of ensuring, which is little less than absolute security for money and articles of value sent through the post by means of registration. The fee for a registered letter, which was at one time as much as half a crown [$1.21½], and has within easy recollection been as high as a shilling, was reduced early in 1878 from 4d. [8 cents] to 2d. [4 cents], with the result that something like 6,500,000 of registered letters were sent in 1878, as compared with 4,316,000 in the previous year, and with 1,300,000 twenty years ago. This number would be largely increased if all the official registered packets were included. Not only has the fee been reduced to what may be considered the lowest possible point, but letters are registered by rural postmen on their rounds, and registration envelopes have been issued by the department to facilitate registration by the public. The envelopes have been devised with care, and seem well suited for the purpose, being strong as well as cheap. They are sold at prices varying from 2½d. [4½ cents] to 3d. [6 cents] each (which includes the registration fee), and are in five useful sizes, from small note size to a large cover suitable for bankers and merchants. But the reduction in the charge and the sale of envelopes are not the only improvements which have been made in the registration system, for the post-office now undertakes to make good, up to £2 [$9.72], the value of any registered letter which it loses, simply stipulating, in the case of money, that one of its own envelopes shall be used. It is on every account most desirable that money and articles of value should not be loosely committed to the post, and with the facilities for transmitting letters securely which are now offered, people who choose to run the risk of loss deserve very little sympathy if the chance goes against them. As regards international communication it is enough to merely mention the beneficent results of the postal union, under which the postage to most places on the Continent and abroad has been reduced to the uniform rate of 2½d. [5 cents] for a letter not exceeding half an ounce in weight; while to a second category of more distant places under foreign dominion the charge for the letter of half an ounce is 6d. [12 cents]."

Table VI. gives the estimate of the number of letters (only) which passed in both directions between the United Kingdom and foreign countries and colonies in 1864.

France	6,771,000	West Indies, Pacific, and Brazils	1,727,000
Canada, British North America, and United States	4,865,000	Belgium	924,000
Prussia, Hamburg, and Bremen	4,408,000	Italy	827,000
East Indies, China, etc.	3,632,000	Spain	617,000
Australia	2,915,000	Holland	600,000
		Total	27,281,000

There were also about 21,500,000 books, papers, and patterns.

Latest statistics (1885).

Meanwhile the estimated number of chargeable letters delivered within the United Kingdom during the year had grown from 504,421,000, at which it stood in 1857, to upwards of 700,000,000 in 1867, and to 1,057,732,000 in 1877. In the year 1884 the number was reported[1] as 1,322,086,900 (exclusive of 153,586,100 post-cards). The growth of other departments of the postal service is fully in proportion to that of the letters of inland delivery, as may be seen by the following tables (VIII., IX.), (see Table VII., on page 586).

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[1] *Thirtieth Report of the Postmaster-General*, 1884, p. 14.

[2] The Right Hon. Henry Fawcett (1833-1884), under whose exceptionally vigorous, able, and statesmanlike administration many improvements of the postal system were introduced, was born at Salisbury in 1833. He was educated at King's College, London, and Trinity Hall, Cambridge, and after graduating in 1856 as seventh wrangler began his studies for the English bar. A weakness in the eyes had occasionally interrupted his studies before the great calamity which befell him while out shooting in September, 1858, when a gun accident totally deprived him of sight. The exceptional interest of his career lies in its complete fulfilment of his resolution that he would not allow the calamity "to interfere with his discharge of duty or the enjoyment of life." Even as regards physical exercise his resolution was practically fulfilled, for he continued to engage in riding, fishing, skating, swimming, and rowing with as keen enjoyment as before. As regards the chief interests of his life the result of the accident was probably beneficial rather than otherwise. Returning to Cambridge, he devoted himself to the systematic study of political economy, and in 1863 he was chosen professor of that subject. In 1867 he was married to Millicent, daughter of Mr. Newson Garrett of Aldeburgh, Suffolk, who assisted him in the preparation of several of his works on political economy, and also wrote independently on the same subject. The best known of Mr. Fawcett's treatises is his *Manual of Political Economy* (1863). In this science he followed substantially the old lines, but a certain freshness attaches to his views from his deep practical interest in the welfare of the working-classes. After several attempts to enter parliament, he was in 1865 chosen for Brighton, which he represented till 1874. Shortly after losing his seat for that borough he was returned for Hackney. On the accession of Mr. Gladstone to office in 1880 he was made postmaster-general, and a member of the privy council. He died from pleurisy, after a few days' illness, 7th November, 1884.

The statistics of post-cards, book-packets, and newspapers delivered in the United Kingdom in different years from 1872 to 1884 stand thus (Table VIII.):

Estimated Number of Post-Cards.[2]

Year.	England & Wales. Number.	Increase per cent. per ann.	Scotland. Number.	Increase per cent. per ann.	Ireland. Number.	Increase per cent. per ann.	United Kingdom. Number.	Increase per cent. per ann.
1872	64,000,000	....	8,000,000	....	4,000,000	....	76,000,000	....
1875	73,369,100	11.6	9,206,300	6.7	4,540,900	5.5	87,116,300	10.7
1878-79	94,471,500	9.8	11,599,000	4.8	5,375,200	5.0	111,445,700	9.0
1881-82	114,251,500	10.4	14,651,400	9.3	6,426,100	6.9	135,329,000	10.1
1882-83	121,243,300	6.1	15,541,800	6.1	7,230,900	12.5	144,016,000	6.4
1883-84	128,564,800	6.0	17,496,400	9.3	7,624,900	5.4	153,586,100	6.6

Estimated Number of Book-Packets and Circulars.

Year.	England & Wales. Number.	Increase per cent. per ann.	Scotland. Number.	Increase per cent. per ann.	Ireland. Number.	Increase per cent. per ann.	United Kingdom. Number.	Increase per cent. per ann.
1872	90,000,000	....	13,000,000	....	11,000,000	....	114,000,000	....
1875	133,394,900	15.2	15,723,700	....	9,548,000	....	158,666,600	11.7
1878-79	164,789,400	4.5	21,320,100	....	10,967,000	6.7	197,076,500	4.1
1881-82	228,999,400	12.3	27,875,000	15.0	14,164,300	16.9	271,038,700	12.8
1882-83	244,713,800	6.9	25,896,000	3.7	14,596,000	3.1	285,206,400	6.3
1883-84	249,347,900	1.9	31,353,700	7.8	13,892,900	4.9 (dec.)	294,594,500	2.2

Estimated Number of Newspapers.

Year.	England & Wales. Number.	Increase per cent. per ann.	Scotland. Number.	Increase per cent. per ann.	Ireland. Number.	Increase per cent. per ann.	United Kingdom. Number.	Increase per cent. per ann.
1872	87,000,000	....	12,000,000	....	10,000,000	....	109,000,000	....
1875	93,345,600	2.3	13,819,100	4.5	13,884,700	10.2	121,049,400	3.4
1878-79	100,424,300	2.2	14,477,500	....	15,993,500	3.6	130,895,300	1.8
1881-82	108,651,700	5.7	15,477,300	2.4	16,660,100	4.7	140,789,100	5.2
1882-83	108,613,500	....	15,784,000	2.0	16,204,500	....	140,602,000	....
1883-84	109,945,100	1.2	16,729,000	5.6	16,027,800	1.1	142,702,300	1.5

Table IX. (compare with Table VI.) gives the estimated number of letters, etc., which passed between the United Kingdom and countries abroad during the year ending 31st March, 1884.[3]

	Received from Countries abroad.		Despatched to Countries abroad.		Total.
	Letters and post-cards.	Book Packets and News-papers.	Letters and post-cards.	Book Packets and News-papers.	
African Colonies (Brit.)	1,049,000	885,000	1,645,600	2,832,600	6,412,200
Argentine Republic	96,200	55,300	168,700	182,000	502,200
Australia and New Zealand	1,801,500	1,949,500	2,229,000	4,431,300	10,411,300
Austria-Hungary	579,400	281,700	695,400	505,700	2,062,200
Belgium	1,620,000	662,700	1,784,400	747,300	4,814,400
Brazil	177,300	50,100	266,400	343,200	837,000
Canada	1,505,000	1,120,800	1,862,200	2,139,200	6,627,200
Denmark	443,400	197,000	453,900	179,400	1,273,700
Egypt	452,400	184,700	684,500	565,200	1,886,800
France and Algeria	7,555,700	7,127,700	8,247,200	4,579,400	27,500,000
Germany	6,880,800	2,963,600	7,129,000	3,143,500	20,116,900
Greece	123,600	54,900	123,900	135,000	437,400
Holland	1,500,400	428,300	1,595,100	609,200	4,133,000
India and Ceylon	2,248,000	806,000	2,652,700	4,065,200	9,771,900
Italy	1,821,500	643,700	2,738,500	1,655,700	6,859,400
Norway	362,200	62,000	457,800	159,800	1,041,800
Portugal	399,800	83,800	351,900	337,000	1,172,500
Russia	628,200	251,600	718,000	477,800	2,075,600
Spain	846,400	467,400	909,500	858,400	3,081,700
Sweden	377,800	95,300	460,700	239,300	1,173,100
Switzerland	892,900	384,100	985,500	617,200	2,879,700
Turkey	337,300	89,100	392,600	461,800	1,280,800
United States	7,579,800	7,851,400	9,068,900	8,389,800	32,909,900
West Indies (British)	266,500	109,200	355,700	597,800	1,328,200

Meanwhile the position of many efficient workers in the postal service, who had helped to bring about these satisfactory results, stood greatly in need of improvement. The humbler class of clerks, most of the sorters, and the entire body of metropolitan letter-carriers were prominent in expressing discontent, and they were able to show good grounds for it. The telegraphists soon followed with like representations, though their hardships were assuredly less. The result has been a large measure of amelioration in pay and in position, effected in part by Lord John Manners, and more especially by Mr. Fawcett, who in 1883 estimated that these improvements would involve an annual cost of about £63,000 [$306,180].

Employment of women. The systematic employment of women in Her Majesty's postal and telegraph service was for a long time an experiment and a problem. It may now be said, most accurately, that, on the whole, the experiment is grandly successful; and the problem fully solved. In telegraphic labor female counter-clerks and telegraphists were actively employed before the transfer to the state. The postmaster-general of 1870 (Lord Hartington) did but accept what he found established. Under the new regulation, he employed women as telegraphists for eight hours daily, at scales of pay which varied from eight shillings a week to thirty, according to age, intelligence, and practical experience of the work. At first the women were put into separate galleries, afterwards into the same galleries with men and boys; and the change was found to work advantageously for all. As regards the postal service proper, the *general* introduction thereinto of female labor was effected, under the rule of Lord John Manners, by Sir John Tilley. The situations were eagerly sought for. At the close of 1880 there were in the three capital cities of London, Edinburgh, and Dublin alone very nearly a thousand female telegraphists; and throughout the kingdom a number not much inferior of women of various grades, employed in minor postal services, over and above the number of those whose employment is but an incident of their family position, as the wives and daughters of sub-postmasters and the like. The best and the most entirely successful experiment of all was that of 1875, which offered postal clerkships expressly to "gentlewomen," and conspicuously to the daughters of officers of the army and navy and of officials in the civil service, admissible only between seventeen and twenty years of age after six months' satisfactory probation, and organized in 1876 into two classes, each under a lady superior, who holds the position of a staff-officer. All promotions are made according to merit. Those of class I. have £80 [$388.80] to £100 [$486], and the "principal female clerks £100 [$486] to £150 [$729] a year; class II. £40 [$194.40] to £75 [$364.50]. The same work which formerly occupied male clerks at £80 [$388.80] to £240 [$1166.40] is now equally well done by female clerks at £40 [$194.40] to £75 [$364.50], and so in proportion with the other classes."[4]

Subjoined are (1) the latest financial statement of postal *expenditure* for the year 1883–84, and (2) some comparisons of the net revenue of the post-office at various periods.

United Kingdom.—Expenditure for year ending 1st March, 1884.

Post-office services, postal savings banks, annuities branch, etc.	£4,507,500
Mail-packet service	721,100
Telegraph service	1,707,000
Grand total	£6,935,600

In 1643 the net revenue was about £5000 [$24,300] a year. In 1653 it was farmed to John Manley for £10,000 [$48,600] a year, and ten years afterwards to Daniel O'Neill for £21,500 [$104,490]. In 1677 the farm rent was raised to £43,000 [$208,980]. In 1685 the net revenue had grown to £65,000 [$315,900], in 1707 to £111,426 [$541,530.36], in 1790 to £331,180 [$1,609,534.80], in 1800 to £720,982 [$3,503,972.52]. In 1808 the net revenue (for Great Britain) was £1,100,606 [$5,348,945.16], in 1820–21 £1,495,945 [$7,270,292.70], in 1839 £1,659,510 [$8,065,218.60], in 1849 £740,429 [$3,598,484.94], in 1859 £1,349,676 [$6,359,425.36], in 1869 £2,198,220[5] [$10,683,349.20], in 1881 £2,597,768 [$12,625,152.48], in 1882 (inclusive of telegraphs) £3,100,475 [$15,068,308.50], in 1883 £3,061,748 [$14,880,095.28], and in 1884 £2,897,427[6] [$14,081,495.22].

Money-Order Department.

The money-order branch of the post-office was for forty years the private enterprise of three post-office clerks known as "Stow and Company." It was commenced in 1792, Money orders. with the special object of facilitating the safe conveyance of small sums to soldiers and sailors, but was soon extended to all classes of small remitters. The postmaster-general sanctioned the scheme without interposing in the management. Each of the three partners advanced £1000 [$4860] to carry it on; and each of them seems, during the greater portion of the period, to have derived about £200 [$972] a year in profit. In 1830 the amount of remittances from London was only about £10,000 [$48,600]. The percentage was eightpence in the pound, out of which threepence were allotted to each of the postmasters receiving and paying, the remaining twopence forming the profit of the partners. On 6th December, 1838, the office was converted into an official department under the postmaster-general,—the then partners receiving due compensation. The commission was reduced to a fixed charge of 1s. 6d. [36 cents] for sums exceeding £2 [$9.72] and under £5 [$24.30], and of 6d. [12 cents] for all sums not exceeding £2 [$9.72]. In 1840 these rates were reduced to 6d. [12 cents] and 3d. [6 cents] respectively. The number and aggregate amount of the orders issued (inland, colonial, and foreign) in different periods from the reorganization (1839) until 1884 are as follows (Table X.):

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[1] *Thirtieth Report of the Postmaster-General*, 1884, p. 1; cp. *Statistical Abstract of United Kingdom* (1884), p. 157.

[2] *Thirtieth Report of the Postmaster-General*, 1884, p. 15.

[3] *Ibid.*, pp. 16, 17.

[4] *Quarterly Review*, 1881, vol. cli. p. 187—an article by Lady John Manners.

[5] Average of five years, and exclusive of telegraphs.

[6] In the *Thirtieth Report of the Postmaster-General* (1884) the amount is stated as £2,687,100 [$13,059,306]. The statement in the text is from the *Analyzed Account of the Public Income and Expenditure*, presented to parliament by the treasury in July, 1884, and is unquestionably the correct one. The comparative deficiency as compared with 1883 is due to the expenditure of £350,000 [$1,701,000] for plant in the telegraphs and parcel-post departments.

Years.	Number.	Amount.
1839	188,921	£313,124
1844	2,806,803	5,695,395
1849	4,248,891	8,152,643
1854	5,466,244	10,462,411
1861–65 (average)	8,055,227	16,624,503
1866–70	9,720,030	19,847,258
1875	16,819,874	27,688,255
1876[1] (first three months only)	4,436,858	7,194,943
1878–79	17,740,622	27,303,093
1879–80	17,307,573	26,371,020
1880–81	16,935,005	26,003,582
1881–82[2]	15,383,033	25,393,574
1882–83	15,090,858	27,597,883
1883–84	14,663,635	27,629,879

Postal notes.

From 1871 to the end of 1877, the rates having been reduced to 1d. [2 cents] for sums under 10s. [$2.43] and 2d. [4 cents] for sums of 10s. [$2.43] and under 20s. [$4.86], increasing by a graduated scale of 1d. [2 cents] for each additional £1 [$4.86] or fraction thereof, inland orders failed to be remunerative; and it was only by reckoning as profit the amount of unclaimed and forfeited orders that the cost to the office of inland orders could be covered. But, as the loss was only on orders for very small sums, Mr. Chetwynd proposed to meet it by issuing postal notes payable at any post-office without previous notice. When the plan was submitted to a committee appointed by the treasury, it was objected that the postal note as a remitting medium would be less secure than the money order. The objection was met in part by giving a discretionary power to fill in the name of the post-office and also that of the payee, and no practical inconvenience or cause of complaint seems to have resulted. And in like manner another objection which was urged against the new form of money order in several quarters, and very strongly in the *Banker's Magazine*—namely, that they would prove to be an issue of Government small notes under another name—has derived no support from experience. "It is found," says the postmaster-general, "that the average time [during] which these orders are in circulation is six days,—a fact which shows that there was no foundation for the idea that they would be used as currency."[3] The statistics of notes issued under the provisions of the Postal Orders Act, 43 and 44 Vict. c. 33 (1880), are as follows (Table XI.):

	Number.	Value.
1881 (quarter ending 31st March	646,989	£292,150
1881–82	4,462,920	2,006,918
1882–83	7,980,328	3,451,284
1883–84	12,286,556	5,028,663
Total	25,376,793	£10,779,015

The postal notes most largely in request are those of 1s. [24 cents], 5s. [$1.21], 10s. [$2.43], and 20s. [$4.86]. In 1884 plans were under the postmaster-general's consideration for improving the regulations and for extending the system to the colonies. Meanwhile the money-order business, which for several years past had been constantly declining both in number and in value, was on the increase. In foreign[4] and in colonial orders the increase was in the number as well as in the amount. The inland orders showed an increase in value of nearly two millions sterling (£1,856,091) [$9,020,602.26] in 1882–83 as compared with 1881–82, although their number was smaller by 386,531. In 1883–84 there was a decrease of 0.84 per cent. in the value as compared with that of 1882–83, whilst the increase in the number of postal orders during the same year was more than four millions, the increase in value being more than £1,500,000 [$7,290,000].

The relative amount of the money-order business of the chief towns of the United Kingdom is shown in Table XII.[5] It states the number and amount of the orders paid in each town on one day only (5th May, 1876), and for the sake of comparison the corresponding figures for one day in 1884 (5th May) are appended:

5th May, 1876.	Total of Orders paid.		Paid through Bankers.	
	Number.	Amount.	Number.	Amount.
London (general post-office)	8778	£14,802	8339	£14,073
Edinburgh	594	1,060	380	657
Dublin	1181	1,550	731	983
Manchester	1056	2,166	215	506
Liverpool	1019	2,466	73	115
Glasgow	882	1,855	526	1,169
Bristol	535	1,140	171	496
Leeds	500	948	95	258
Hull	898	935	13	20

5th May, 1884.	Total of Orders paid.		Paid through Bankers.		Postal Orders.	
	Number.	Am't.	Number.	Amount.	Number.	Am't.
London (general post-office).	9117	£16,278	8,784	£15,608	89	£24
Edinburgh[6]	420	760	254	885	307	134
Dublin	935	1,350	776	1,112	547	196
Manchester	960	1,914	no record	no record	519	210
Liverpool	1074	2,755	"	"	371	166
Glasgow	1088	2,174	"	"	98	98
Bristol	339	752	"	"	271	114
Leeds	420	765	"	"	319	148
Hull	294	617	"	"	158	67

Postal Savings Banks.

Savings banks.

The establishment of post-office savings banks was practically suggested in the year 1860 by Mr. Charles William Sykes of Huddersfield, whose suggestion was cordially received by Mr. Gladstone, then chancellor of the exchequer, to whose conspicuous exertions in parliament the effectual working-out of the measure and also many and great improvements in its details are substantially and unquestionably due. Half a century earlier (1807) it had been proposed to utilize the then existing (and very rudimentary) money-order branch of the post-office for the collection and transmission of savings from all parts of the country to a central savings bank to be established in London. A Bill to that effect was brought into the House of Commons by Mr. Whitbread, but it failed to receive adequate support, and was withdrawn. When Mr. Sykes revived the proposal of 1807 the number of savings banks managed by trustees was 638, but of these about 350 were open only for a few hours on a single day of the week. Only twenty throughout the kingdom were open daily. Twenty-four towns containing upwards of ten thousand inhabitants each were without any savings bank. Fourteen entire counties were without any. In the existing banks the average amount of a deposit was £4, 6s. 5d. [$20.94].

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[1] From 1877 onwards the official accounts are made up to 31st March in each year.

[2] The figures for this year are those given in the general tabular recapitulation of the appendix to the *Twenty-eighth Report of Postmaster-General*, 1882, p. 40. In the body of the same report (p. 8) they are stated at £14,880,821 [$72,320,790.06] and £23,848,936 [$115,905,828.96] respectively. The tabular figures are those also of the *Twenty-ninth Report*, 1883, and of the *Thirtieth Report*, 1884.

[3] *Twenty-eighth Report of Postmaster-General*, 1882, p. 8.

[4] The rate of commission on foreign money orders was reduced on 1st January, 1883, by one-third. To all countries within the Postal Union (see *infra*, p. 600 *sq.*) it is now 6d. [12 cents] for sums not exceeding £2 [$9.72]; 1s. for £5 [$24.30]; 1s. 6d. [35 cents] for £7 [$34.02]; 2s. [49 cents] for £10 [$48.60].

[5] Fractions of £1 [$4.86] are omitted.

[6] The figures for 7th May are given, as the 5th was a partial holiday in Edinburgh.

Mr. Gladstone's Bill—entitled "An Act to grant additional facilities for depositing small savings at interest, with the security of Government for the due repayment thereof"—received the royal assent on the 17th of May, 1861, and was brought into operation on the 16th of September following. The banks first opened were situated in places theretofore unprovided. In February, 1862, the Act was brought into operation both in Scotland and in Ireland. Within two years nearly all the money-order offices of the United Kingdom became savings banks; about 367,000 new deposit accounts were opened, representing an aggregate payment of £4,702,000 [$22,851,720], including a sum of more than £500,000 [$2,430,000] transferred from trustee savings banks the accounts of which were closed. At the end of 1863 the number of accounts in the post-office banks was 319,669, with an aggregate deposit of £3,377,480 [$16,414,552.80]. The average amount of each deposit was £3, 2s. 11d. [$15.28]. In 1867 the number of post-office savings banks in the United Kingdom was 3629, that of depositors in them 854,983, the amount standing to their credit £9,749,929 [$47,386,654.94]. The average amount of each deposit was about £2, 18s. [$14.09]. At the end of 1878 there were in the United Kingdom 5831 post-office savings banks; the number of depositors was 1,892,756; and the amount standing to their credit, inclusive of interest, was £30,411,563 [$147,800,196.18]. At the end of 1882 the number of banks was 6999, the number of depositors 2,858,976, and the amount standing to their credit £39,037,821 [$189,723,810.06]. This sum was increased at the end of the ordinary financial year, 31st March, 1883 (the savings banks accounts being made up, in conformity with the Act of 1861, to 31st December), to £40,087,000 [$194,822,820]. The average amount of each deposit was about £2 [$9.72], as against £4, 6s. 5d. [$21.04] in the trustee savings banks prior to the passing of the Act of 1861.

On 31st December, 1883, the number of depositors was 3,105,642, and the aggregate amount standing to their credit (including interest) was £41,768,808 [$202,996,406.88]; the amount of expenses remaining unpaid was about £11,000 [$53,460]. The aggregate value of securities and amount of cash in the hands of the national debt commissioners was £43,294,949 [$210,413,452.14]. The amount of cash in the hands of Her Majesty's postmaster-general was £316,853 [$1,539,905.58]. The aggregate assets were £43,697,932 [$212,371,949.52]. The surplus of assets over liabilities was £1,918,116 [$9,322,043.76]. At the beginning of 1884 the total amount received from depositors, including interest, stood at £173,660,388 [$843,989,491.68], the total amount repaid to depositors at £131,891,580 [$640,993,078.80]. The aggregate number of deposits from the outset of postal savings banks was 62,154,832, that of withdrawals 21,612,727, the number of accounts opened 9,225,575, that of accounts closed 6,119,933, that of accounts remaining open 3,105,642. The total cost of these banks was £2,698,547 [$13,114,938.42]. The aggregate number of transactions of all kinds was 83,767,559. The average cost of each transaction was $7\frac{7}{10}$d. [$15\frac{4}{10}$ cents]. It marks the accuracy of the Government actuaries to note that, prior to the passing of the Savings Banks Act of 1861, the estimated cost of each transaction thereunder was stated at 7d. [14 cents].

Investment in Government stock.

Any depositor in the post-office savings bank can invest his deposit in Government stock by making proper application to the controller of the savings bank department, London, provided that the sum be not less than £10 [$48.60], or than the amount of the current price of £10 [$48.60] stock together with the commission, whichever sum is the smaller; not more than £100 [$486] stock can be credited to an account in any year ending 31st December, or £300 [$1,458] stock in all. Within seven days from the receipt of the application the depositor's account is charged with the current price of the stock purchased, with the commission, the depositor receiving an investment certificate as evidence of the transfer.

As to investments in stock, the postmaster-general reports in 1884 that the total amount of Government stock on 31st December, 1883, standing to the credit of depositors was £1,519,983 [$7,387,117.38] held by 20,767 persons, against £1,143,717 [$5,558,464.62] held by 16,609 persons in 1882,—an increase of £376,266 [$1,828,652.76] in amount and of 4158 in the number of stockholders. The average amount of stock held by each person at the end of the year was £73, 3s. 10d. [$355.71], as compared with £68, 17s. 3d. [$334.67] in 1882. During the seven years 1877 to 1883, inclusive, the *average* sum annually paid into exchequer (under § 14 of the Act above named) as the excess of accruing interest was £127,192 [$618,153.12].

The apportionment of the outstanding accounts and their relation in each part of the United Kingdom to the population, respectively, stood as follows at the close of each of the years 1881, 1882, and 1883[1]:

TABLE XIII.—*Number and Amount of Open Accounts in Post-Office Savings Banks.*

	Year 1881.		Year 1882.	
	No.	Amount.[2]	No.	Amount.[2]
England	2,818,113	£32.670,807	2,643,785	£39,037,821
Wales	87,054	1,016,920		
Small islands	5,779	84,183		
Scotland	99,566	699,688	108,701	
Ireland	97,100	1,723,895	106,490	
Total	2,607,612	£36,194,495	2,858,976	£39,087,821

	Year 1883.			
	No.	Amount with Interest.	Proportion to Population.	Average of each Deposit.
England, Wales & adjacent isles	2,874,458	£41,768,808	1 to 9	£18 10 6
Scotland	116,208		1 to 33	7 5 8
Ireland	114,976		1 to 44	17 16 11
Total	3,105,642			

During the year 1883 nearly two millions and three quarters sterling (£2,730,987 [$13,272,596.82]) of postal savings bank deposits were made in excess of those of the year 1882. Only seven small trustee savings banks were closed during the year 1883. During that year 323 new postal savings banks were opened in England and Wales, 33 in Scotland, and 14 in Ireland. At the close of the year the total number for the United Kingdom was 7369. On 31st March, 1884, that number was increased to 7475. The year 1874 counts among the flourishing years of trade, 1884 among the depressed years. But since 1874 the aggregate amount of savings deposits in postal banks has very nearly doubled without any noticeable diminution in the business transacted by the trustee savings banks, and the number of depositors has also nearly doubled.

In England the county of Middlesex ranks first with 512,229 depositors (1881) and an aggregate deposit of £7,146,375 [$34,731,382.50]; in Wales, Glamorganshire with 32,573 depositors and £371,419 [$1,805,096.34]; in Scotland, Lanarkshire with 14,763 depositors and £104,550 [$508,113]; in Ireland, Dublin county with 26,480 depositors and £367,672 [$1,786,885.92]. At the close of 1882 the aggregate sum due to depositors in the last-named county had increased to £398,994 [$1,939,110.84]. The increase of late years in the Irish deposits is, it may be added, very conspicuous, and extends to every county of the kingdom. The aggregate sum due to depositors throughout Ireland in 1873 was £845,550 [$4,109,373]; in 1878 it was £1,325,806 [$6,443,417.16]; and in 1882 £1,925,460 [$9,357,735.60]; in addition to £125,000 [$607,500] of Government stock standing to the credit of depositors, or, in the whole, £2,050,460 [$9,965,235.60].

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[1] The figures of 1881 are from a return dated 10th August, 1882 (Commons' Session Papers, 1882, No. 347). The figures of 1882 are from *Twenty-ninth Report of the Postmaster-General*, 1883; those of 1883 from the *Thirtieth Report*, 1884.

[2] Including fractions of £1 [$4.86], omitted in the particulars above.

Of the 638 trustee saving banks which existed in the United Kingdom at the date of the establishment of the post-office system 230 have been closed. Fifteen new trustee banks have been opened; so that the number now existing is 423, as compared with 7475 post-office savings banks.

Annuities and life insurances.

Under the Act 45 and 46 Vict. c. 51 (1882) the postmaster-general will insure the lives of persons of either sex between the ages of fourteen and sixty-five, inclusive, for any sum not less than £5 [$24.30] or more than £100 [$486]; but when the amount does not exceed £5 [24.30] the earlier limit of age is eight years. An annuity, immediate or deferred for any sum not less than £1 [$4.86] or not more than £100, [£486] will be granted by the postmaster-general under the same Act, to any person not under five years of age. The transaction takes place through the medium of the savings banks departments. Husband and wife may each purchase an annuity up to the maximum amount, and each may be insured up to the full amount of £100 [$486]. Conditions of contract in the case of annuities depend upon the age and sex of the purchaser, together with, where the annuity is deferred, the number of years which are to elapse before the commencement of the annuity; they also vary according as the purchase money is to be returned or not. The premiums charged for insurances vary with the age of the insurer and the mode in which the insurance is effected. The insurer, if not under sixteen years of age, enjoys the right of nominating the person to whom the money due at his or her death is to be paid. The contracts for annuities and life insurances in connection with the savings bank branch of the post-office began on 17th April, 1865. The following table (XIV.) shows the amount of business done in different periods down to the year 1883:

Year.	Annuities.												Fees.[2]	Life Insurances.					
	Immediate.					Deferred.								Contracts entered into		Receipts.		Payments.	
	Contracts entered into.		Receipts.	Payments.		Contracts entered into		Receipts.		Payments.[1]									
	No.	Amount of Annuities.	Amount of Purchase Money.	No.	Amount of Annuities.	No.	Amount of Annuities and Monthly Allowances.	No.	Amount of Purchase Money and Instalments of Premium.	No.	Amount.	Amount.	No.	Amount of Insurances.	No.	Amount of Premiums.	No.	Amount of Claims on Death and Surrender.
1865	87	£2,100	£22,738	32	£423	45	£949	67	£1342	...	...	£139	547	£40,647	1,076	£1,165	...	...
1870[3]	306	6,120	67,738	2,529	26,099	57	1195	514	3529	9	£346	347	385	31,254	9,274	5,877	39	£1676
1875	582	7,926	85,781	11,129	63,641	34	768	661	3548	10	526	421	370	32,022	14,549	9,500	84	3127
1880	892	13,249	146,562	14,933	101,734	41	847	621	4406	119	1570	695	258	20,378	15,379	10,506	125	3886
1881	956	16,434	184,787	15,808	121,111	66	1876	686	5243	131	1763	873	300	23,900	15,883	10,967	114	3675
1882	799	13,435	155,528	16,729	122,123	72	1502	772	6449	156	2827	727	284	18,447	16,069	11,069	141	5604
1883	770	14,141	159,630	17,302	130,058	104	2120	830	7240	163	1898	790	256	20,600	16,156	11,338	129	5431

Postal Telegraphs.

Early proposals.

To the chamber of commerce of Edinburgh belongs the honor of effectually originating that public demand for the transfer of the telegraphic service of the United Kingdom from commercial companies to the state which led to the passing of the Acts of Parliament of 1868 and 1869. There had, indeed, been several like proposals by individuals in preceding years. Mr. Thomas Allan proposed such a transfer in 1854. Two years later the scheme was advocated by Mr. Baines of the general post-office, and afterwards by Mr. Ricardo. But these proposals had no practical effect until after the action taken at Edinburgh, mainly at the instance of Mr. (now Sir) George Harrison, convener of the chamber. The committee of inquiry then appointed showed conclusively that the telegraphic service, as managed by the companies, (1) maintained excessive charges, (2) occasioned frequent and vexatious delays in the transmission of messages, and inaccuracies in the rendering of them, (3) left a large number of important towns and districts wholly unprovided for, and (4) placed special difficulties in the way of that newspaper press which had, in the interest of the public, a claim so just and so obvious to special facilities. The committee also proved that, great as were the just causes of public complaint at the date of its inquiry, they would have been greater still but for a considerable reduction of charge effected by, and in consequence of, the establishment in 1861 of the United Kingdom Company—a company opposed by a formidable combination of its competitors, which forced it to abandon the uniform shilling rate, [24 cents,] irrespective of distance, with which it started.[4] The Edinburgh chamber was unanimous in supporting the plan of a uniform sixpenny rate, [12 cents], and that proposal was speedily endorsed by the other chambers of commerce throughout the kingdom. When the inquiry of 1865 was instituted the total number of places supplied with telegraphic communication by all the companies collectively was about 1000, whereas the number of places having postal communication at the same date was 10,685. The telegraphic offices were placed most inconveniently for the service of the population generally, and especially for that of the suburbs of large towns; and under the then existing telegraphic tariff the charge in Great Britain was a shilling [24 cents] for a twenty-word message over distances not exceeding 100 miles; 1s. 6d. [36 cents.] for a like message over distances from 100 to 200 miles; 2s. [49 cents] when exceeding 200 miles. For a message between Great Britain and Ireland the charge ranged from 3s. [73 cents] to 6s. [$1.46]; to Jersey or Guernsey it was 7s. 8d [$1.86]. There were also innumerable extra charges, under contingent regulations of great complexity, which commonly added 50 per cent. to the primary charge, and frequently doubled it.

The Edinburgh committee considered in turn the respective merits of three several remedial measures: (1) a regulated amalgamation of the existing companies; (2) the establishment of entire free-trade in public telegraphy; (3) the transfer of the service to the post-office. It tended towards a preference of the last, but agreed to recommend the appointment of a royal commission of inquiry prior to legislation. In the result the needful preliminary inquiries, and also the preparation of the Bills for parliament to which those inquiries led, came to be made by the direct authority of the postmaster-general, and were mainly entrusted to Mr. Frank Ives Scudamore, second secretary of the post-office.

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[1] Prior to the year 1875 the payments consisted of purchase money returned only, no annuities being payable till after the lapse of ten years.

[2] On immediate and deferred annuity contracts, the charges on monthly allowances being included in the premium.

[3] Claims on surrender value of life insurance contracts commenced in this year.

[4] *Papers on Electric Telegraphs*, 1868, pp. 53, 55, 202 *sq.*

Electric Telegraph Acts of 1868-69.

The Electric Telegraph Act of 1868 (31 and 32 Vict. c. 110) authorized the postmaster-general, with consent of the treasury, to purchase for the purposes of the Act the whole, or such parts as he should think fit, of any existing telegraphic company, "provided always that no such purchase be made . . . until the proposed agreement, and a treasury minute thereupon, shall have lain for one month upon the table of both Houses of Parliament without disapproval." The Bill in its original form gave to the post-office the exclusive right of public telegraphy. But the committee of the House of Commons to which the Bill was referred made a special report of their opinion "that it is not desirable that the transmission of messages for the public should become a legal monopoly in the post-office." They also recommended that it should be left to the discretion of the postmaster-general, with the consent of the treasury, to make special agreements for the transmission of certain classes of messages at reduced rates; that security should be taken for ensuring the secrecy of messages, by making its violation punishable as a misdemeanor; and, finally, that submarine cables acquired by the postmaster-general should at first be leased to companies, although ultimately it might become expedient that the post-office should work them.[1] The Act of 1869 (32 and 33 Vict. c. 73), entitled "An Act to alter and amend the Telegraph Act, 1869," gives to the post-office the exclusive privilege of transmission—withheld in the previous Act—empowers the purchase of telegraphic undertakings other than those included in that Act and enables certain companies to require the postmaster-general to make such purchase. It also directs the raising by the treasury of a sum of £7,000,000, [$34,020,000] for the purposes of the Acts. The Act 33 and 34 Vict. c. 88 (1870) extended the post-office telegraphic system to the Channel Islands and to the Isle of Man; and that of the 34 and 35 Vict. c. 75 (1871) authorized the raising of an additional million. These sums collectively proved to be quite insufficient, and eventually the capital sum so raised exceeded £10,000,000, [$48,600,000]. This large excess led to very blameable irregularities, during two or three years, in the post-office accounts by the temporary application of savings banks' balances, and the like, to telegraphic expenditure—irregularities which attracted the express censure both of the treasury and of the House of Commons. Probably no more arduous task was ever thrown upon a public department than that imposed on the post-office by this transfer of 1868–70. The reforms which it was to bring about were eagerly and impatiently demanded by the public. The utmost ingenuity that some of the old companies could exert, employ, or indirectly incite was used at first to prevent or impede the transfer and then to make it as difficult and as costly as possible.[2]

This great operation had to be effected without for one hour interrupting the public service. Thereupon the department had immediately to reduce and to simplify the charges of transmission throughout the kingdom. It had to extend the hours of business at all the offices. It had to extend the wires from railway stations lying outside of town populations to post-offices in the centre of those populations and throughout their suburbs. It had also to extend the wires from towns into rural districts theretofore wholly devoid of telegraphic communication. It had to effect a complete severance of commercial and domestic telegraphy from that of merely railway traffic; and in order to this severance it had to provide the railways with some 6000 miles of wires in substitution of those of which theretofore they had been joint users. It had, further, to provide at low charges, by all sorts of agencies, an effective "free trade" (so to speak) in the collection of news for the newspaper press, of which collection hitherto the old telegraph companies had possessed a virtual monopoly. It had to facilitate the transmission of money orders by telegram.[3] Finally, it had to amalgamate into one staff bodies of men who had formerly worked as rivals, upon opposite plans and with different instruments, and to combine the amalgamated telegraph staff with that of the postal service.

When under examination by the Commons' committee of 1868 Mr. Scudamore had very modestly disclaimed[4] the honor of originating anything with respect to the proposed transfer. Every part of the scheme had, he said been borrowed from somebody else, and tried successfully elsewhere: the amalgamation of the telegraphic and postal administration in Victoria, New South Wales, Belgium, Switzerland, and to a certain extent in France; the institution of places of deposit for messages, in addition to the offices of transmission, in Belgium, as well as the gratuitous grant of postal facilities for telegraphic messages; telegraphic stamps in Belgium and France; a telegraphic money-order office in Switzerland and Prussia. But it is quite certain that Mr. Scudamore, had he been put under examination at a later date, could have pointed to no precedent for labors like those imposed upon him and his able assistants by the Telegraph Acts of 1868–69.

So zealously was the work of improvement pursued that within little more than six years of the transfer (viz., in 1876) the aggregate extent of road wires in the United Kingdom was already 63,000 miles, that of railway wires 45,000,—in all 108,000 miles. The number of instruments in the telegraphic offices was 12,000. At that date the superintending and managing staffs of the post-office comprised 590 persons, the staff of the old companies with the relatively insignificant traffic of 1867—less than 6,000,000 messages as compared with 20,000,000—having been 534 persons.[5] For supervision exclusively the number of officers was 88 against 86, and the relative cost £16,900 to the post-office as against £15,000 [$72,900] to the companies.[6] At this date there were still no less than 1720 miles of the road wires carried over houses and across streets. In 1882 more than 1300 miles of these had been gradually removed and underground wires substituted.

The following table (XV.) shows the gross and net revenue derived by the post-office from the telegraph service since the date of the actual transfer Jan. and Feb. (1870).[7]

In the year 1882 a large increase in the working expenses became necessary for the further improvement and extension of the service, and for a very just increase in the remuneration of the telegraphists. In the report of that year the postmaster-general writes as follows: "The annual interest on the capital sum of £10,880,571, [$52,879,795.02] raised by the Government for the purchase of the telegraphs, has

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[1] *Report of Commons' Committee on Electric Telegraph Bill* (Session Papers of 1868, No. 435).

[2] Two instances out of more than twenty may suffice. The Northeastern Railway Company claimed in compensation for its telegraphic department £540,292, [$2,625,819.12], besides a very large sum for interest; it was awarded, in all, £168,696, [$819,862.56]. The metropolitan railway companies claimed, in all, £433,000, [$2,104,380] and were awarded £51,907 [$252,268.02]. (*Twenty-fifth Report of Postmaster-General*, 1879, p. 21).

[3] Enumerated (Scudamore, *Supplementary Report*, p. 142) as amongst the objects aimed at by the post-office in accepting the transfer.

[4] *Minutes of Evidence taken by Commons' Committee on proposed Transfer*, etc., passim.

[5] *Report of the Select Committee on Telegraphs*, 1876 (Commons' Session Papers, No. 357), p. iii. *sq.*

[6] Lord John Manners to the treasury; see *Papers relating to Post-Office Telegraphs*, 1876 (Session Papers, No. 34), p. 2.

[7] *Thirtieth Report of Postmaster-General*, 1884, p. 58.

Year ended 31st March.	Total Telegraph Receipts (payments to Cable Companies and for Porterage deducted.)	Working Expenses Charged to Telegraph Vote.[1]	Net Revenue (irrespective of interest on Capital Account).
1870 (two months)	£100,760	£62,273	£38,487
1871..................	697,934[2]	394,477	303,457
1873..................	989,921	874,946	114,975
1875..................	1,137,079	1,077,347	59,732
1877..................	1,313,107	1,123,790	189,317
1879..................	1,346,892	1,089,392	257,500
1881..................	1,610,907	1,242,092	368,815
1882..................	1,630,443	1,365,633	264,810
1883..................	1,740,063	1,504,204	235,859
1884..................	1,760,899	1,709,506	51,393

not previously been included in the postmaster-generals' accounts, because the amount is not provided for out of post-office votes ; but in estimating the financial position it ought to be borne in mind that the chancellor of the exchequer has to meet a charge of £326,417 [$1,586,386.62] for this service out of the consolidated fund."[3]

Progress of telegraph service.

The reduction of the unit of charge from a shilling [24c.] to sixpence [12c.] is a reform yet to come, but it is a reform expressly promised (*Thirtieth Report*, 1884, p. 5). It was originally proposed, in the Edinburgh chamber of commerce, at the outset of the public movement which led to the transfer of 1870. It has been repeatedly urged upon successive postmasters-general by the council of the London Society of Arts. On one of those occasions it was admitted by the postmaster-general that even at a sixpenny [12 cent] rate the telegraphs would eventually more than pay all expenses, including the current rate of interest upon the capital expended.[4] Two years later the urgent necessity of this reform was expressly stated by the same high authority in answer to a question put to him in the House of Commons. But he calculated that to effect it would involve a loss to the revenue for the first three years, which would probably amount to nearly £420,000 [$2,041,200] in the aggregate.

The chief dates in the history of the electric-telegraph service may be stated briefly thus. The first public line to work the patent of Wheatstone and Cooke was laid from Paddington to Slough on the Great Western line[5] in 1843. The charge for a message up to fifty words was 1s. [24c]. Before the end of the year 1845 lines exceeding in the aggregate 500 miles were at work in England on the same patent. In the following year the Electric Telegraph Company was established with a tariff of 1s. [24c.] for 20 words within a radius of 50 miles, 1s. 6d. [36c.] within 100 miles, 5s. [$1.22] if exceeding 100 miles. Remittance messages or telegraphic money-orders were established in 1850. In October of that year the first oceanic telegraph was worked for the Submarine Telegraph Company. In June, 1854, a writer in the *Quarterly Review*[6] put the question : "Is not telegraphic communication as much a function of Government as the conveyance of letters ?" In January, 1870, the telegraphs became, in pursuance of the Acts of 1868 and 1869, practically a branch of the post-office. In 1881 telephone exchanges were established, both by the post-office and by private companies under its license, for terms of years, upon payment of a royalty. In 1884 (August and September) definitive arrangements were made between the post-office and the telephonic companies, thus terminating a long controversy and removing many mercantile heart-burnings.

Telephonic communication.

When the telegraphs were taken over by the Government telephonic communication had not yet come into practical use. But the principle and base of both methods are the same; and the Acts were framed to give the state a right to profit by improvements. In the course of the year 1880 several telephone companies established telephone exchanges in various parts of the kingdom. Means were immediately used by the postmaster-general to vindicate the law. On the 20th December of that year the question was brought to an issue in the Exchequer Division of the High Court of Justice. It was contended by the companies that "the telephone differed essentially from the telegraph,—the one transmitting electric signals, the other carrying the human voice by means altogether unknown when the post-office monopoly was granted." In the course of his judgment Mr. Justice Stephen observed that, "if the telephone really transmitted the human voice, then communication by it could not be more rapid than the velocity of sound, whereas in fact it was instantaneous. In both the communication is by electric signals." The Exchequer decision of December, 1880, establishes once for all, not only that the telephone companies are quite outside of "the terms of the exceptions in section 5 of the Act of 1869," but also that "the Government monopoly is not limited to the property it acquired. It extends to all improvements in telegraphic communication."[7] The postmaster-general used his victory with generous moderation. As the companies, he wrote, "were apparently under the belief that they had infringed no law, I held myself ready to meet them with liberal terms. The system of telephonic intercommunication is therefore now being extended partly through the agencies of companies and partly by the post-office."[8] In the next annual report (1882) he added : "Licences were granted to the United Telephone Company,[9] as representing the companies defendants to the suit, and to other private agencies to carry on the business of a telephone exchange in London and in various provincial towns, the department at the same time itself establishing exchanges in other places. The principle which underlay this arrangement was that only one telephone system should be established in any one town. Ultimately he came to the conclusion that it was undesirable . . . to create a monopoly in the matter of telephonic communication ; and in future applications will be favorably entertained from responsible persons for licences to establish exchanges under conditions which may be regarded as giving adequate protection to the public and to the department."[10]

According to the *Situation des Réseaux Téléphoniques* for 1883, published by the International Telephonic Company at Paris, the contract between the British post-office and the London and Globe Telephone and Maintenance Company is for a term of twenty-nine years. The license granted to the Telephone Company of Ireland provides that no exchange to be established thereunder by that company shall be within less than 4 miles of any post-office exchange. But, liberal as they were, the concessions made by Mr. Fawcett in 1883 failed to satisfy the large and constantly-increasing claims of the telephonic interest. They claimed (1) entire practical freedom of control for their respective enterprises, (2) the reduction of the subsisting state royalty by one-half, (3) the extension of the commercial telephonic radius to 15 miles. As an alternative, they offered to continue the subsisting royalty if every sort of restriction and control were removed. Mr. Fawcett firmly maintained the right of Her Majesty's post-office to continue the existing royalty, to establish at its discretion its own telephone exchanges throughout the realm, and to grant new licenses irrespective of the old ones; he consented to abolish all limitations of radius or area, to subject trunk wires and exchange wires to like conditions, to withdraw the claim heretofore made by the department for an unlimited supply of the patented instruments used by the companies, and to permit the establishment by them of call-offices for local messages. But no company was to be licensed to receive and deliver written messages at any point. By this restriction telegraphic and telephonic messages were practically divaricated in service, although identical in law.

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[1] This return is taken from the *Reports* of the postmaster-general, and is drawn up according to the appropriation account of each financial year. There are certain additional expenses (for buildings, stationery, manufacture of stamps, and rates) on account of the telegraph service which that account does not include. They raise the total cost of the telegraph service for 1881 to £1,308,454 [$6,359,086.44] for 1882 to £1,440,728 [$7,001,938.08].

[2] Mr. Scudamore's original estimate of yearly revenue was put at £608,000 [$2,954,880] (*Supplementary Report to Postmaster-General*, 1868. p. 147).

[3] *Twenty-eighth Report of Postmaster-General*, 1882, p. 10.

[4] *Journal of the Society of Arts*, 1880, vol. xxviii. p. 739.

[5] The preliminary experiments of Wheatstone and Cooke had been successfully made on the Northwestern line, between Euston station and Camden Town station, but at that date the Northwestern Company declined to give facilities for working out the new enterprise.

[6] Vol. xcv. p. 151.

[7] See *Law Journal Reports* of January, 1881.

[8] *Twenty-seventh Report of Postmaster-General*, p. 5.

[9] Upon on average this company paid to the post-office, under the arrangement so initiated, a sum of £15,150 [$2121] a year. Its aggregate payments up to 31st December, 1883 were only £35,500 [$172,530] (*Postal Gazette*, 1884, p. 490). In other countries the telephonic companies pay much more for their privilege. In Italy, for instance, there are fixed annual payments to the state over and above the royalty of 10 per cent., as in Britain.

[10] *Twenty-eighth Report*, 1882, pp. 5, 6.

Telegraph statistics.

The subjoined table (XVI.) shows the total number[1] of telegraphic messages forwarded in England and Wales, Scotland, and Ireland, severally, at different years, since the transfer.

Year.	England and Wales.			Scotland.	Ireland.	Total of United Kingdom.
	Provinces.	London.	Total.			
1870-71	5,299,882	2,863,821	8,163,703	1,080,189	606,285	9,850,177
1871-72	6,594,590	3,612,772	10,207,362	1,388,434	878,000	12,473,796
1876-77	11,232,704	6,561,930	17,794,634	2,402,847	1,529,162	21,726,143
1881-82[2]	14,204,479	12,071,034	26,275,513	3,207,994	1,862,354	31,345,861
1882-83	14,554,015	12,374,707	26,928,722	3,244,202	1,919,102	32,092,026
1883-84	14,920,413	12,686,433	27,606,846	3,299,428	1,936,846	32,843,120

The number of telegrams sent in proportion to population is now much greater in England than it is in the countries which were cited in the evidence of 1868 as in that particular outstripping others. The old companies, "by maintaining high charges as long as they could, by reducing those charges . . . only under pressure, by the confinement of their operations to important towns, and by planting their offices mainly in the business-centres of those towns, had brought speculative men, and speculative men only, to a free use of the telegraph."[3] The development of the service will be apparent when it is stated that at the date of transfer to the state (1870) the number of telegraph offices did not exceed 3700. The number of messages in a year was 8,606,000. In 1884 there were respectively 5873 and (as above) 32,843,120. The yearly increment has lately averaged nearly 700,000. More striking still is the contrast of cost. In 1851 twenty words sent from London to Edinburgh cost 10s. [$2.43]; as late as 1862 they cost 4s. [97c.]; since 1880 the cost has been reduced to 1s. [24.3]; in August of the present year (1885) it will be reduced to 6d. [12c.]. Among the latest minor improvements of detail in the telegraph service is that which was effected in November, 1882, by the abolition of the distinctive telegraph stamp, and the adoption of ordinary postage stamps for the payment of messages. Telegrams thus posted are conveyed, without extra charge, at the next collection of letters to the nearest telegraph office, whence they are transmitted by the wires at the earliest possible moment.[4]

During 1883 and 1884 great improvements were made in the telegraphic service of Scotland and also in the communication between Great Britain and Ireland. An additional cable was established between Fishguard and Blackwater. Four new land-lines were laid in connection therewith, namely, from London to Fishguard, and from Blackwater to Dublin, Cork, and Limerick. There are now twenty-four wires available for use between Britain and Ireland contained in six cables. A new cable depôt has been erected at Woolwich, and a cable-ship constructed (1883) expressly for post-office service. But the marvellous growth of telegraphy and telephony is best seen when we compare their statistics in individual towns. The daily average of messages in London, for example, was 450 in 1870 and nearly 6000 in 1883; in Derby 218 in 1870 and 898 in 1883. The staff at Derby in the former year was fourteen, in the latter year forty-six, and the instruments employed in the same years were respectively seven and twenty-seven.

Government, Organization, Staff, and Regulations.[5]

Administrative position.

Originally and essentially the post-office is part of the domain of the crown of England. Practically its administration is controlled and regulated by statute. There were in 1883 no less than twenty-one several Acts of Parliament, or parts of Acts, which affected the postal administration, although at the commencement of the reign of Victoria the existing Post-Office Acts and parts of Acts (somewhat more numerous still) were consolidated into a single statute,—a measure which had been previously resolved upon and in part prepared under the administration of the duke of Wellington.[6] The responsibilities of common carriers do not extend to the postmaster-general or to any of his deputies. But a sub-postmaster is answerable in the ordinary courts of law for individual acts of negligence. And all subordinates of the postal service are, of course, responsible to the postmaster-general, who may, and upon due cause will, besides other and official punishment, require them to make good to the sufferers losses which have been inflicted by proven breach of duty.[7]

Staff.

The staff of the post-office department was composed as follows on 31st March, 1884 (Table XVII.):

	Males.	Females	Total.
1. Chief officers, secrétariat, and surveyors	63	1	64
2. Head-postmasters	789	130	919
3. Sub-postmasters and letter-receivers	12,038	2,790	14,828
4. Clerks and superintending officers.	2,293	616	2,909
5. Supervisors, countermen, sorters, telegraphists, etc	10,074	2,115	12,189
6. Postmen, porters, etc	15,269	8	15,277
7. Assistants and servants of various grades (unestablished)	28,829	16,139	44,968
8. Colonial postmasters and foreign agents	29	1	30
Grand total	69,384	21,800	91,184

The general post-office, London, is organized in seven principal departments, viz., (1) secretary's, (2) solicitor's, (3) receiver- and accountant-general's, (4) money-order, (5) savings banks, (6) telegraphs, (7) circulation. The secretary's office has a general control over all the others.

At the beginning of 1858 the total number of post-offices in the United Kingdom was 11,101; at the beginning of 1884 it was 15,951. Of the former number 810 were head post-offices, of the latter number 921. In 1858 the number of street and road receiving-boxes was 703, in 1884, 15,749.

Letter rates, etc.

The quarterly *Post-Office Guide* is now so widely known that we need say very little about rates of postage. Whilst a letter not exceeding 1 oz. passes for 1d. [2 cents], and one not exceeding 2 oz. for 1½d. [3 cents], one not exceeding 12 oz. is charged 4d. [8 cents], but for every weight *exceeding* 12 oz. a penny for each ounce, beginning with the first, is charged. There is no express limit to weight, but no letter, unless it be from or to a Government office, must exceed the dimensions of 18 × 9 × 6 inches. The uniform rate for a registered newspaper is ½d. [1 cent], unregistered newspapers pay the book-rate of ½d. [1 cent] for every 2 oz.

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[1] Compiled from *Reports* of postmaster-general.

[2] Including certain press messages, which previous to 1878-79 were not included in the returns.

[3] Scudamore, *Report on the Reorganization*, etc., p. 17.

[4] *Twenty-eighth Report of Postmaster-General*, 1882, p. 5.

[5] The details are given at length in the *Law Journal Reports* for 1884. A good summary may be found in *The Postal and Telegraphic Gazette*, 1884, pp. 660-662.

[6] Hansard, *Parliamentary Debates*, series iii., vol. i. pp. 706, 779. We cannot here enumerate the subsisting Acts otherwise than in briefest form. (1) The general administration and working of the department, the rates of postage, and the appropriation of the revenue thence accruing are governed by—7 William IV. and 1 Vict. c. 33 (July, 1837), 3 and 4 Vict. c. 96; 10 and 11 Vict. c. 85 (1847); 33 and 34 Vict. c. 79 (1870), and *ibid.* c. 98, §§ 9-12; 34 and 35 Vict. c. 30 (1871); 38 and 39 Vict. c. 22 (June, 1875); 44 and 45 Vict. c. 19 (1881), and *ibid.* c. 12, § 47. (The Act 33 and 34 Vict., amongst other valuable improvements, extends the book-parcel post, and contains an express clause empowering the treasury to regulate by warrant postage rates from time to time. Yet there is a whole series of subsequent Acts regulating such rates. The Act 38 and 39 Vict. arose out of the provisions of the international postal treaty at Bern of 9th October, 1874 (see below, p. 601), and empowers the treasury to regulate foreign and international rates of postage in accordance with these provisions.) (2) The money-order branch is regulated by 3 and 4 Vict. c. 96, § 38 (1840), and by 43 and 44 Vict. c. 33. (3) The savings banks branch is regulated by 22 and 23 Vict. c. 53 (1859); 24 and 25 Vict. c. 14 (1861); and 37 and 38 Vict. c. 73 (1874). (4) The annuities and life insurance branch is governed by 27 and 28 Vict. c. 43 (1864); this statute applies also to savings banks managed by trustees (see SAVINGS BANKS). (5) The telegraphs branch is regulated by 31 and 32 Vict. c. 110 (1867-68); 32 and 33 Vict. c. 73 (1868-69); 34 and 35 Vict. c. 75 (1871); and 41 and 42 Vict. c. 76 (1878). (6) The acquisition of lands for post-office purposes is facilitated by 44 and 45 Vict. c. 20 (1881). Finally, (7) the parcel-post branch is provided for by 46 and 47 Vict. c. 58 (1883).

[7] Compare the judgment given in Lane v. Cotton, in Lord Raymond's *Reports*, i. 646, with that in Whitfield v. Lord Le Despencer (postmaster-general, 1766-1781), in Cowper's *Reports*, 754, and with that in Browning v. Goodchild, in Wilson's *Reports*, iii. 443.

in weight no book-packet must exceed 5 ℔, nor must it exceed in dimensions those prescribed for letters. The official post-card is impressed with a ½d. [1 cent] stamp; cards for reply, bearing two stamps, may be transmitted not only between places within the United Kingdom but between such places and many foreign countries (see *Post-Office Guide*). Petitions and addresses to Her Majesty and to the Houses of Parliament are exempt from charge up to a weight of 2 ℔. Parliamentary proceedings are charged at the book-rate, but are unlimited as to weight or size, and prepayment is optional, without entailing any increased rate of charge. The rates of the parcel post (1st August, 1883) are—for 1 ℔ or part thereof, 3d. [6 cents]; not exceeding 3 ℔, 6d. [12 cents]; not exceeding 5 ℔, 9d. [18 cents]; not exceeding 7 ℔, 1s. The limits of size are 3 feet 6 inches in greatest length, and in length and girth combined 6 feet. In all cases parcels must be prepaid in adhesive stamps. The rule as to registration is held to be inapplicable to postal parcels; but in January, 1885, a useful system of stamped certificates of the postage of parcels was introduced. For foreign rates of postage and for all like details we necessarily refer to the *Post-Office Guide* above-mentioned.

In social importance no branch of postal administration exceeds its savings banks system and the dependencies attached to it. At every post-office forms can be obtained on which twelve penny postage stamps can be fixed, which will be received as a postal savings bank deposit for a shilling, provided a due declaration be made that the depositor has no account with any other savings bank. When the deposit reaches £1 [$4.86] interest at the rate of 6d. [12 cents] a year on each pound is given. The depositor can withdraw his money (which may accrue to the limit of £30 [$145.80] in any one year) from any one of the 7475 post-office banks. At any such office a person who wishes to invest £10 [$48.60], or any larger sum up to £100 [$486], in Government stock can do so at the current price of the day.

Résumé.

In conclusion we add a brief retrospective survey of the more salient incidents, in chronological order, of the British post-office. (1533) First appointment of a postmaster-general for England; (1591) partial organization of rudimentary English post-office; (1619) appointment of a special postmaster-general for "foreign parts"; (1635) reorganization of English post-office under Thomas Witherings; (1665) settlement of post-office revenue on James, duke of York, and his heirs-male; (1680) establishment of a metropolitan penny post by William Dockwra; (1711) consolidation of Postal Acts by statute 9 Queen Anne, c. x.; (1720) organization of cross-road and rural posts under Ralph Allen; (1753) organization of post-office of American colonies under Benjamin Franklin; (1784) establishment of improved mail-coaches and of well-organized mail-routes, under John Palmer of Bath; (1821) first conveyance of mails by steam-packet; (1830) first mail-coach by railway; (1834, August) postage stamp invented at Dundee by James Chalmers; (1835) establishment of the overland route to India, mainly by exertions of Lieutenant Waghorn; (1837) Sir R. Hill's postal reform *initiated;* (1838) establishment of postal money-order office; (1840, January) general and uniform penny post (per half ounce) established; (1855, March) first street letter-box put up in London; (1855, June) book-post organized; (1856) metropolitan postal districts established and *Postal Guide* issued; (1861) postal savings banks instituted; (1870) transfer of telegraphs to the state; (1870) postal cards introduced; (1870) improved postal treaty with Napoleon III. concluded; (1871) postal unit of charge reduced to one penny per ounce; (1874) International Postal Union established at Bern; (1875) further consolidation of the post-office statutes; (1881, January) postal orders issued; (1883, August) parcel post established; (1884, October) entrance of the Australian colonies into the Postal Union.

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BRITISH COLONIES AND DEPENDENCIES.

Australia and New Zealand.

Australia and New Zealand.—In 1873 there were 2668 post-offices open; 38,930,852 letters (including South Australian and New Zealand packets) and 22,018,483 newspapers and packets were transmitted; 303,741 money orders, amounting to £754,847 [$3,668,556.42], were issued; there were 185,202 depositors in the post-office savings banks, whose deposits amounted to £2,081,288 [$10,115,059.68]; over 20,559 miles of telegraph lines were open; 2,100,272 messages were transmitted, from which an income of £211,276 [$1,026,801.36] was derived, while the expenditure (exclusive of South Australia) amounted to £186,681 [$907,269.66]. Western Australia is omitted from these figures owing to the inadequacy of the Government returns. These figures, compared with the population of 1873, show that over 18 letters and over 10 newspapers and packets per head were transmitted; that money orders were issued to 1 in about every 7 persons, at an average value of nearly £2, 10s. [$12.15] per order; that deposits in the post-office savings banks averaged a little over 1 in 11 of the entire population, at an average value of £11, 4s. [$54.43] per deposit; that of telegraph messages there was about one to each person.

In 1883 there were 4410 post-offices open; 123,614,387 letters and post-cards, 10,434,461 packets, and 60,869,570 newspapers (including South Australian packets) were transmitted; the revenue of the postal department amounted to £1,057,100 [$5,137.506], and the expenditure to £1,246,679 [$6,058,119.94]; 783,701 money orders were issued amounting to £2,608,915 [$12,679,326.90]; there were 254,510 depositors in the post-office savings banks, and their deposits amounted to £4,537,706 [$22,053,251.16]; there were over 57,174 miles of telegraph, and 7,083,163 messages were transmitted, the value of which was estimated at £476,683 [$2,316,679.38]; the expenditure of the telegraph departments amounted to £345,590 [$1,679,567.40], but it must be explained that the Victorian, South Australian, and West Australian expenditures were included in those of the postal departments. These figures, compared with the population of 1883, show that there were transmitted per head nearly 40 letters and post-cards, and over 23 newspapers and packets; to every third person a money order was issued, at an average value of about £3, 6s. 6d. [$16.16] per order; the number of deposits in the post-office savings banks averaged about 1 in every 12 of the population, and their average value was over £17, 6s. [$84.08] per deposit; the telegraph messages were transmitted at the rate of rather more than two messages to each person.

Canada.

Canada.—During the year which ended on 30th June, 1844, the number of letters conveyed by the mails throughout the Dominion of Canada was 66,100,000 as against 62,800,000 in the corresponding year 1883; that of post-cards was 13,580,000 as against 12,940,000. The number of letters registered was 3,000,000 against 2,650,000. The number of money orders issued was 463,502, their aggregate value being £2,068,726 [$10,054,008.36]. Of this amount £1,638,060 [$7,960,971.60] was for inland orders, £430,666 [$2,093,036.76] for foreign orders. The number of Canadian post-offices was 6837 against 6395 in 1883; the length of postal routes open was 47,131 miles, showing an increase over the previous year of 2488 miles. The distance traversed thereon by the mails in 1884 was 20,836,316 miles. Of the 6837 post-offices 866 were also money-order offices. In 1884 international money orders were extended to the principal countries of the Postal Union and to all British possessions abroad. In 1884 the amount of foreign money orders paid in Canada was £252,600 [$1,227,636]. In 1884 the number of post-office savings banks was 343, the number of depositors' accounts 66,682 (an increase of 5623 over 1883), and total amount in deposit £2,650,000 [$12,879,000].

India.

India.—In order to illustrate the growth of the post-office in India we give the salient statistics for 1873 and 1883. In British India and the native states the total number of post-offices in 1883 was 5310, showing an increase of 2304 since 1873. In 1883 the number of letters of all descriptions that passed through the post-office was 135,709,147, in 1873 it was 83,127,098. Post-cards were not issued until 1880, when they numbered 7,471,834, which number had increased to 29,844,347 in 1883. In the last-quoted year 18,501,171 newspapers, parcels, and packets passed through the post and 10,030,216 in 1873. In 1883 2,565,904 postal money orders, representing a value of £6,468,418 [$31,436,511.48], were issued. Adding the number of money orders to the total of letters, newspapers, etc., for the year 1883 we obtain an aggregate of 186,620,569, equal to 0.73 per head of population. Post-office savings banks were opened in India on 1st April, 1882; during the first year the deposits reached a total of £435,356 [$2,115,830.16], or including interest (£4902 [$23,823.72]) £440,258 [$2,139,653,88]. Deposits amounting to £160,578 [$780,409.08] were withdrawn during the year, leaving a balance of £279,680 [$1,359,244.80] on 31st March, 1883. The total length of Government telegraph lines increased from 46,386 miles in 1873 to 84,700 miles in 1883. The expenditure in both years under consideration exceeded the receipts: whilst in 1873 the figures were respectively £704,193 [$3,422,377.98] and £677,047 [$2,290,448.42]; in 1883 they were £983,779 [$4,781,165.94] and £971,639 [$4,722,165.54]. (E. ED.)

UNITED STATES.

Early history.

The early history[1] of the post-office in the British colonies in North America has been briefly referred to above (pp. 580, 582). Benjamin Franklin was removed by the home department from his office of postmaster-general in America in 1774. On 26th July, 1775, the American Congress assumed direction of the post-offices, re-appointing Franklin to his former post. Shortly afterwards, when Franklin was sent as ambassador to France, his son-in-law, Richard Bache, was made postmaster-general in November, 1775.

Growth.

In 1789 the number of post-offices was 75, in 1800 903, in 1825 5677, in 1875 35,734, and in 1884 50,017. In 1789 the gross revenues of the postal service were $30,000, in 1800 $280,804. In 1860 the gross revenues had increased to $8,518,067 and in 1875 to $26,671,218. In 1884 they amounted to $43,338,127.08. In 1860 there was a deficit in the postal income of $10,652,542.59, occasioned through lavish expenditures and then existing abuses. Annual deficiencies had occurred for nine years previous to 1860, and continued for twenty-one years thereafter. In 1882 a surplus of $1,394,388.92 was shown, and in 1883 a profit of $1,001,281.83. The percentage of deficit continued steadily to decrease after 1860, and in 1882, for the first time in thirty-one years, the postal service ceased to be a burden upon the treasury. It is not to be doubted that adverse natural conditions operated for many years to prevent or to postpone this favorable result, among them the vast extent of territory embraced within the confines of the republic, entailing costly service over long routes, and the extraordinarily rapid development of the western States and Territories, conditions which militate against the United States in a comparison of the statistics of its postal service during that period with those of the service of countries having more limited areas.

Until 1863 the rates of postage were based upon the distances over which the mails were conveyed. In 1846 these rates were—not exceeding 300 miles, three cents; exceeding 300 miles, ten cents. In 1851 the rates were reduced to three cents for distances not exceeding 3000 miles and ten cents for distances exceeding 3000 miles. The use of adhesive postage stamps was first authorized by Act of Congress, approved 3d March, 1847, and on 1st June, 1856, prepayment by stamps was made compulsory. In 1863 a uniform rate of postage without regard to distance was fixed at three cents, and on 1st October, 1883, after satisfactory evidence had been given of the surplus income from the operations of the post-office establishment for the two preceding fiscal years, the rate was further reduced to two cents, the equivalent of the British penny postage. It will be seen that no time was lost in giving to the public the benefit of the change for the better in the condition of the postal finances, and to this liberality is undoubtedly due in great measure the deficit of $5,204,484.12 for the year 1884, a deficiency which, however, it is reasonable to expect, will decrease from year to year under the stimulus given to correspondence by the cheapened rate. It is hardly remarkable, in view of the great area of the United States, that for a long time distance should have formed a very material element in the calculations for levying postal tribute.

Conveyance of mails.

The franking privilege, which had grown to be an intolerable abuse, was finally abolished in 1873, and the post-office now carries free under official "penalty" labels or envelopes (*i.e.*, envelopes containing a notice of the legal penalty for their unauthorized use) nothing but matter which is of a strictly official character, with the single exception of newspapers circulated within the county of publication. As late as 1860 the mails conveyed nothing but written and printed matter. They now admit nearly every known substance which does not exceed four pounds in weight (this restriction does not apply to single books), and which from its nature is not liable to injure the mails or the persons of postal employés.

The railway mail service, including the "fast mail," the character of which is from the necessity of the case peculiar, and which, in its methods and results, has reached a perfection attainable only in a country of great extent, was inaugurated in 1864 after a successful experiment upon a few of the large railroad lines with important termini. In 1865 one thousand and forty-one miles of railway post-office service were in operation, employing sixty-four clerks. The service was reorganized in 1874 with eight territorial divisions, each in charge of a superintendent subordinate to a general superintendent at the seat of government. This service was one of the earliest exponents of a classified civil service in the more recent acceptation of that term in the United States, appointment of railway postal clerks having always been made for a probationary period, permanent appointment conditioned upon satisfactory conduct and service, and removal based upon good cause only. On 1st July, 1884, there were about four thousand clerks in the railway mail service, and the length of the routes was 117,160 miles. The annual transportation (aggregate distance over which the mails were conveyed) was 142,541,392 miles. At the same date the length of the "star service" routes (*i.e.*, mail service other than by railway or steamboat) was 226,779 miles and the annual transportation 81,109,052 miles, while the length of the steamboat routes was 15,591 miles with an annual transportation of 3,882,288 miles, which does not include conveyance of mails by sea to foreign countries.

The penny post existed in a number of cities of the Union in 1862, the carriers remunerating themselves by the collection of a voluntary fee of from one to two cents on each piece of mail delivered. A uniform free delivery system was first authorized by law on 3d March, 1863, and was established on the succeeding 1st of July in forty-nine cities. The number of carriers employed the first year was 685. On 1st July, 1884, there were 3890 letter-carriers in one hundred and fifty-nine "free delivery cities." To the European reader this number will doubtless appear to be remarkably small in a country whose population, according to the census of 1880, was over 50,000,000, but it should be observed that, outside of the larger cities and towns, the people as a rule reside on detached farms of greater or less size, at considerable distances from each other, and not, as in many of the European states, congregated in small towns or villages, separated from their farms; from this circumstance it happens that rural factors or carriers have never been, and could not well be, employed as in European countries.

The registry system, in which great improvements have been made within the last few years, did not attain any degree of excellence until after 1860; and the money-order system was first established in 1864.

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[1] For early statistics (1790-1856) of the United States post-office, see *Ency. Brit.*, 8th ed., vol. xviii. pp. 419, 420.

The aggregate number of money orders, domestic and foreign, issued during the fiscal year 1883–84 was 8,314,963, of the value of $129,810,038.51. Postal notes for small sums, payable to bearer, and resembling the British postal orders except in that they are not drawn for fixed amounts, were first issued to the public in September, 1883, and during the first ten months there were 3,689,237 notes sold of the aggregate value of $7,411,992.48. Money orders are exchanged, in pursuance of postal conventions for the purpose, with most of the important countries of the world which have money-order systems of their own.

Late statistics.

The total staff of the post-office in 1884 numbered 71,671, of whom 50,017 were postmasters. For the same year the total number of letters delivered in 159 cities was 524,431,327. The number of post-cards delivered in the same cities was 166,652,429, and the number of newspapers 231,645,185. The number of registered letters and parcels sent through the mails was 11,246,545, and the total ascertained losses numbered 516, or in the ratio of 1 to 21,795. During the same year the total number of pieces of mail handled or distributed *en route* on the cars by railway postal clerks was 4,519,661,900, of which number 2,795,447,000 were letters,—a total increase over the previous year of 13½ per cent., the transactions of that year having themselves exceeded those of the year 1882 by nearly 16 per cent. The sales of stamps, etc., for the year amounted to $40,745,853.66, showing that almost the entire revenues of the service are derived from postages. The total estimated number of letters sent to foreign countries was 33,328,014, of post-cards, 1,672,458, of packets of newspapers, etc., 20,712,464, and of packages of samples of merchandise 297,048. There were received from foreign countries 28,404,035 letters, 1,288,673 post-cards, 21,747,784 packets of newspapers, etc., and 519,561 packets of samples of merchandise. The total number of articles of undelivered mail received in the dead-letter office was 4,843,099, of which number 4,752,483 were letters, being nearly a million less than the number which reached the British returned-letter office. Useful printed matter which cannot be returned is distributed amongst the inmates of various hospitals, asylums, and charitable and reformatory institutions in the District of Columbia, and in 1884 23,152 magazines, pamphlets, etc., were thus disposed of.

Telegraphs.

Three years after the passage by the British parliament of the Electric Telegraph Act (1868–69) the subject of a similar transfer of the rights of the telegraph companies to the post-office of the United States was strongly urged by the postmaster-general of that country, Mr. Creswell, and he renewed his recommendations the succeeding year; the subject also recurred at intervals in the annual reports of the post-office department for subsequent years. In 1882 Mr. Howe admitted that he had been "forced to the conclusion that the time has fully come when the telegraph and postal service should be embraced under one management"; a year later, however, Mr. Gresham states that he "should hesitate to sanction a measure providing that the United States shall become the proprietor of telegraph lines and operate them by its officers and agents." Mr. Hatton in his first report as postmaster-general, that for 1884, is silent upon this subject.

Savings banks.

Mr. Creswell took occasion in 1871 to recommend also the establishment of postal savings banks in the United States, and this subject he made of peculiar interest at the time by the suggestion that the money needed to purchase existing telegraph lines could be raised through the postal savings banks, certainly a timely suggestion to accompany the two simultaneous recommendations. The establishment of postal savings banks has also been the frequent subject of departmental and congressional discussion without decisive action. The utility and expediency of the measure have not been doubted, but singularly enough what has seemed to be an insuperable obstacle to the inauguration of the system has been encountered. The policy of the Government, with its vast surplus revenue of late years, has been to gradually and surely reduce the national debt, which, it would seem from the progress already made in that direction, is certain of ultimate extinction in the course of a few years. It is plain, however, although the difficulty does not seem to have occurred to many of the advocates in the United States of a savings banks system, that to be lasting it must be founded upon a permanent Government debt, a condition which does not and is not likely to exist in that country. Interest cannot be paid to depositors for funds which are not needed and which cannot be profitably employed. Until this problem is solved, it is not probable that this feature will be added to the postal system of the United States, where, however, the practice of careful economy has not yet become a common habit of the masses of the people, and where the security for small savings afforded by Government institutions would tend to foster habits of thrift. A Bill to establish a postal savings depository as a branch of the post-office department was introduced in the House of Representatives on 8th February, 1882, and an elaborate report was made thereon, 21st February, 1882, by the committee on the post-office and post-roads, to whom the Bill had been referred. The measure was never acted upon and has not since been revived. (W. B. C*.)

FRANCE.

Early history

The French postal system was founded by Louis XI. (19th June, 1464), was largely extended by Charles IX. (1565), and received considerable improvements at various periods under the respective Governments of Henry IV. and Louis XIII. (1603, 1622, 1627 *sq.*).[1] In the year last-named (1627) France, so often during long ages pre-eminent in "teaching the nations how to live," originated a postal money-transmission system, expressly prefaced by those cautions about transmission of coin in ordinary letters which are now familiar to all eyes in the windows of English post-offices (but which no eyes saw there a dozen years ago), and in the same year it established a system of cheap registration for letters. The postmaster who thus anticipated 19th-century improvements was Pierre d'Alméras, a man of high birth, who gave about £20,000 [$97,200] (of modern money) for the privilege of serving the public. The turmoils of the Fronde wrecked much that he had achieved. The first farm of postal income was made in 1672, and by farmers it was administered until June, 1790. To increase the income postmasterships for a long time were not only sold but made hereditary. Many administrative improvements of detail were introduced, indeed, by Mazarin (1643), by Louvois (*c.* 1680 *sq.*), and by Cardinal de Fleury (1728); but many formidable abuses also continued to subsist. The revolutionary Government transferred rather than removed them. Characteristically, it put a board of postmasters in room of a farming postmaster-general and a controlling one. The keen and far-seeing mind of Napoleon (during the consulate[2]) abolished the board, recommitted the business to a postmaster-general as it had been under Louis XIII., and greatly improved the details of the service: Napoleon's organization of 1802 is, in substance, that which obtains in 1885, although, of course, large modifications and developments have been made from time to time.[3]

The university of Paris, as early as the 13th century, possessed a special postal system, for the abolition of which in the 18th it received a large compensation. But it continued to possess certain minor postal privileges until the Revolution.[4]

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[1] For the details, see *Ency. Brit.*, 8th ed., vol. xviii. pp. 420–424, and Maxime Du Camp, "L'Administration des Postes," in *Revue des Deux Mondes* (1865), ser. 2, lxvii. 169 *sq.*

[2] 28 Pluviose, an XII.—18th February, 1804.

[3] Le Quien de la Neufville, *Usages des Postes*, 1730, pp. 59–67, 80, 121–123, 147–149, 286–291; Maxime Du Camp, *op. cit.*, passim; Pierre Clément, *Appréciation des Conséquences de la Réforme postale*, passim; Loret, *Gazette rimée*, 16th August, 1653; Furetière, *Le Roman Bourgois* (in Du Camp, *ut supra*); "Die ersten Posteinrichtungen, u.s.w.," in *L'Union Postale*, viii. 188; *Ordonnances des Rois de France*, as cited by A. de Rothschild, *Histoire de la Poste-aux-Lettres*, i. 171, 216, 269 (3d ed., 1876). We quote M. de Rothschild's clever book with some misgivings. It is eminently sparkling in style, and most readable; but its citations are so given that one is constantly in doubt lest they be given at second or even at third hand instead of from the sources. The essay of M. Du Camp is, up to its date, far more trustworthy. He approaches his subject as a publicist, M. de Rothschild as a stamp-collector.

[4] There are several charters confirmatory of this original privilege. The earliest of these is of 1296 (Philip "the Fair").

Growth.

Mazarin's edict of 3d December, 1643, shows that France at that date had a parcel post as well as a letter post. That edict creates for each head post-office throughout the kingdom three several officers styled respectively (1) comptroller, (2) weigher, (3) assessor; and, instead of remunerating them by salary, it directs the addition of one-fourth to the existing letter rate and parcel rate, and the division of the surcharge between the three. Fleury's edicts of 1728 make sub-postmasters directly responsible for the loss of letters or parcels; they also make it necessary that senders should post their letters at an office, and not give them to the carriers, and regulate the book-post by directing that book parcels (whether MS. or printed) shall be open at the ends.[1] In 1758, almost eighty years after Dockwra's establishment of a penny post in London, an historian of that city published an account of it, which in Paris came under the eye of a man of similar spirit and enterprise to Dockwra. Claude Piarron de Chamousset[2] obtained letters-patent to do the like, and, before setting to work or seeking profit for himself, he issued a tract with the title, *Mémoire sur la petite-poste établie à Londres, sur la modèle de laquelle on pourrait en établir de semblables dans les plus grandes villes d'Europe.* The reform so worthily begun was successfully carried out.

By this time the general post-office of France was producing a considerable and growing revenue. In 1676 the farmers had paid to the king £48,000 [$233,280] in the money of that day. A century later they paid a fixed rent of £352,000 [$1,710,720], and covenanted to pay in addition one-fifth of their net profits. In 1788—the date of the last letting to farm of the postal revenue—the fixed and the variable payments were commuted for one settled sum of £480,000 [$2,332,800] a year. The result of the devastations of the Revolution and of the wars of the empire together is shown strikingly by the fact that in 1814 the *gross* income of the post-office was but little more than three-fifths of the *net* income in 1788. Six years of the peaceful government of Louis XVIII. raised the gross annual revenue to £928,000 [$4,510,080]. On the eve of the revolution of 1830 it reached £1,348,000 [$6,551,280]. Towards the close of the next reign the post-office yielded £2,100,000 [$10,206,000] (gross). Under the revolutionary Government of 1848–49 it declined again (falling in 1850 to £1,744,000 [$8,475,840]); under that of Napoleon III. it rose steadily and uniformly with every year. In 1858 the gross revenue was £2,296,000 [$11,158, 560], in 1868 £3,596,000 [$17,476,560].

The most important postal reforms in France (other than those which we have already noticed) are briefly these: (1) the extension of postal facilities to all the communes of the country,—effected under Charles X., placing the France of 1829 in certain postal particulars in advance of the United States of 1879; (2) the adoption of postage stamps,—effected under the presidency of Louis Napoleon (1849); (3) the organization of an excellent system of not only transmitting but insuring articles of declared value, whatever their nature,—effected under Napoleon III. (1859); (4) the issue of postal notes payable to bearer (1860); (5) the establishment of a post-office library (1878); (6) the creation of postal savings banks (1880.)

Money orders.

France, as we have seen, possessed a postal money-transmission service as early as 1627. But for almost two centuries the thing the remitter delivered at the post-office was the thing given to the payee, whether it were coin or paper money. In 1817 the money-transmission service became a money-order service. In that year the aggregate value of inland money orders was £364,000 [$1,769,040], in 1830 £528,000 [$2,566,080], in 1845 £844,000 [$4,101,840], in 1864 £4,520,000 [$21,967,200], in 1868 £6,280,000 [$3,052,080], in 1877 £9,238,644 [$44,899,809.84], in 1878 £11,036,712 [$53,638,420.32], in 1881 £18,793,188 [$91,334,893.68], in 1882 £19,655,117 [$95,523,868.62], in 1883 £20,770,078 [$100,942,579.08]. The average amount of each order varied very little during the fifty-eight years 1821 to 1878, ranging only between 28 francs 62 centimes and 30 francs (twenty-four shillings) [$5.83]. The number of orders was in the first-named year only 317,642. In 1868 the number was (in round figures) 5,320,000; in 1878 it had grown to 9,304,840, in 1881 to 14,626,117, in 1882 to 15,791,774, and in 1883 to 16,808,627.[3] The average amount of each order has been, since 1878, somewhat upon the increase.[4] France may also fairly claim to have been in advance of the United Kingdom not only in facilities for the safe transmission of money and other precious commodities but also in the facilities of book post and parcel post.

Letter tariff, etc.

In the tariff for ordinary correspondence, however, it has always contrasted unfavorably. Whilst under the regulations of January, 1849, and of July, 1854, respectively, the letter tariff was double that of Great Britain, it has come to be treble since the adoption by the latter country of the one-ounce unit of charge; 1½d. [3 cents] is the French rate under the regulation (M. Cochery's) of 1st May, 1878, for a half-ounce letter; 1d. [2 cents] is the English rate for an ounce letter. Post-cards are charged double the English rate.[5] The growth of postal correspondence in France prior to the great check inflicted by the calamities of 1870–71 may, very briefly, be shown thus:

TABLE XVIII.—*Comparative Numbers of Letters, Newspapers, and Books conveyed.*

	Ordinary Letters.[6]	Registered Letters.	Newspapers and Book-Parcels.
1848	126,480,000	176,000	c. 4,500,000
1857	252,921,942	...	...
{ 1867	...	...	c. 15,000,000
{ 1868	349,885,000	4,850,000	...

Pigeon and balloon posts.

The ingenuity of the French postal authorities was severely tried by the exigencies of the German War of 1870–71; but they proved themselves singularly successful in maintaining a correspondence, inland and foreign, under difficulties which were probably greater than any postal staff had ever before had to encounter since posts were known. The first contrivance was to organize a pigeon service,[7] carrying microscopic despatches prepared by the aid of photographic appliances.[8] The number of postal pigeons employed was

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[1] *Ordonnances*, etc., as above.

[2] There is an interesting biographical notice of Piarron de Chamousset in *Le Journal Officiel* of 5th July, 1875.

[3] These figures apply only to inland orders issued.

[4] Bernard, "Notice sur le Service postal en France," in *Journal des Economistes*, ser. 3, xv. 366–385; *Statistique générale du Service postal*, 1881, v. *sq.*

[5] *Recueil de Renseignements sur le Régime postal*, 5; *Annuaire des Postes*, for various years, to 1883 inclusive, *passim*. Comp. *Reports of Secretaries of Embassy*, etc., France (1879), 5.

[6] During the years from 1849 to 1857 ordinary letters in France increased at the annual rate of 12½ per cent. (under Napoleon III. as president and as emperor); during the rest of his rule the yearly rate of increase is calculated (to 1869 inclusive) at 3½ per cent. only.

[7] The employment of pigeons as carriers of despatches dates from a very early period, the curious annals of which are given in *Die Taubenpost* (Berlin). It was not, however, until the commencement of the present century that they were systematically utilized as bearers of messages to the sporting and other papers. Before the organization of the electric telegraph pigeons were regularly employed by the members of the stock exchange for conveying early intelligence of the state of the money markets in Paris, etc., the entire journey being broken up into short relays, so that transmission of messages might be secured even during unfavorable weather.

At the present time all the important fortresses in France and Germany have their staff of voyageur or homing pigeons that are well trained for 50 to 100 miles, so that they could be relied on for holding communication with the fortress in case it should be surrounded with hostile troops. The utility of these birds in conveying messages from the sea in case of war has not yet been recognized in Britain.

[8] The despatches carried by the pigeons were in the first instance photographed on a reduced scale on thin sheets of paper, the original writing being preserved, but after the ascent of the twenty-fifth balloon leaving the city an improved system was organized. The communications, whether public despatches or private letters, were printed in ordinary type, and micro-photographed on to thin films of collodion. Each pellicle measured less

363, of which number fifty-seven returned with despatches. During the height of the siege the English postal authorities received letters for transmission by pigeon post into Paris by way of Tours, subject to the regulations that no information concerning the war was given, that the number of words did not exceed twenty, that the letters were delivered open, and that 5d. [10 cents] a word, with a registration fee of 6d. [12 cents],[1] was prepaid as postage. At this rate the postage of the 200 letters on each folio was £40 [$194.40], that on the eighteen pellicles of sixteen folios each, carried by one pigeon, £11,520 [$55,987.20]. Each despatch was repeated until its arrival had been acknowledged by balloon post; consequently many were sent off twenty and some even more than thirty times. The second step was to establish a regular system of postal balloons, fifty-one being employed for letter service and six for telegraphic service. To M. Durnouf belongs very much of the honor of making the balloon service successful. On the basis of experiments carried out by him a decree of 26th September, 1870, regulated the new postal system. Out of sixty-four several ascents, each costing on the average about £200 [$972], fifty-seven achieved their purpose, notwithstanding the building by Krupp of twenty guns, supplied with telescopic apparatus, expressly for the destruction of the postal balloons. Only five were captured, and two others were lost at sea. The aggregate weight of the letters and newspapers thus aerially mailed by the French post-office amounted to about eight tons and a half, including upwards of 3,000,000 letters; and, besides the aeronauts, ninety-one passengers were conveyed. The heroism displayed by French balloon postmen was equalled by that of many of the ordinary letter-carriers in the conveyance of letters through the catacombs and quarries of Paris and its suburbs, and, under various disguises, often through the midst of the Prussian army. Several lost their lives in the discharge of their duty, in some cases saving their despatches by the sacrifice. No less than eighty-five faced the extremity of danger.[2] During the war the Marseilles route for the Anglo-Indian mails was, of course, abandoned. They were sent through Belgium and Germany, by the Brenner Pass to Brindisi, and thence by Italian packets to Alexandria. The French route was resumed in 1872.[3]

Latest statistics.

Before dealing with the latest statistics of the French postal system, it may be of interest to cite from *L'Union Postale* of Bern (ii. 87 *sq.*) a brief comparison of the mail matter within the limits of Paris with that of the state at large in the year 1874 (Table XIX.).

	Paris.	France,
1. Ordinary chargeable letters.	95,791,000	343,808,000
2. Registered chargeable letters.	1,730,000	6,786,000
3. Franked letters....................	8,985,000	56,534,000
4. Newspapers, books, mercantile patterns......................	242,613,000	368,782,000
5. Money orders.........................	647,400	4,793,680
Grand total of mailed articles.	349,716,400	780,703,680[4]

The reader will observe on glancing from this table to Table XVIII. that in 1874 the ordinary correspondence of France had not recovered its former extent, as it stood in 1868, although a large relative increase is shown in the number of registered letters during 1874 as compared with those of 1868. Taken as a whole, the postal traffic did not fully recover itself until 1878; and even then, although the mailed articles exceeded those of the year immediately preceding by 124,310,199, the gross revenue accruing from letters, newspapers, and parcels showed a diminution of £788,150 [$3,830,409] as compared with the gross revenue of 1877. Thenceforward the progress is rapid. The chief postal laws now in force are of 6th May, 1827, 4th June, 1859, 25th January, 1873, 3d May, 1876, 6th April, 1878, 5th February, 1879, and 9th April, 1881.

The comparative postal statistics for all France during the years 1881, 1882, and 1883 stand thus:

TABLE XX.—*Number of Letters and Post-Cards.*

	1881.	1882.	1883.	Tunis and Algiers 1883.
Inland letters............	535,541,378	544,198,588	568,524,119	8,550,266
Inland post-cards......	29,589,094	30,710,500	31,394,427	69,068
" reply post-cards.	37,326	48,430	50,000	3,492
Foreign letters sent ..	34,868,965	35,377,335	36,777,164	331,288
Foreign post-cards sent..........................	1,216,948	1,390,950	1,462,815	10,755
Foreign reply post-cards........................	30,005	41,184	58,323	308
Total..................	600,783,731	611,761,982	638,261,848	8,965,172

In 1882 the gross revenue of the entire French postal service was £6,170,146 [$29,986,909.56], the total expenditure £5,338,273 [$25,944,006.78], and the net revenue £831,873 [$4,042,902.78]. In 1883[5] the gross revenue amounted to £6,429,101 [$31,245,430.86], the expenditure to £5,678,851 [$27,599,215.86], and the net revenue to £750,250 [$3,646,215]. In 1881 the number of post-offices throughout France was 6158 plus 53,182 letter-boxes, making the total number of postal receptacles 59,340. In 1884 the number of post-offices proper had increased to 6565.[6] The aggregate of the postal and telegraphic staff was 49,121 persons in 1881, 50,268 in 1882, and 52,636 in 1883.[7] The relative number of letters (including post-cards) to each inhabitant was 16 in 1881 as compared with 27 to each inhabitant in the United States, and with 38 to each in the United Kingdom. In 1882 the proportion was 16$\frac{2}{10}$ as compared with 40$\frac{4}{10}$ in Great Britain, in 1883 16$\frac{4}{10}$ and 41$\frac{5}{10}$ respectively. Were it possible to deduct in each case the useless, the merely undesired advertising communications, France would contrast with Britain, and still more with America, far less disadvantageously than, on the mere face of the figures, it seems to do.

The savings bank system of France, so far as it is connected with the postal service, dates only from 1875, and began then (at first) simply by the use of post-offices as agencies and feeders for the pre-existing banks. Prior to the postal connection the aggregate of the deposits stood at £22,920,000 [$111,391,200]. In 1877 it reached £32,000,000 [$155,520,000]. Postal savings banks, strictly so called, began only during the year 1881. At the close of 1882 they had 210,712 depositors, with an aggregate deposit of £1,872,938 sterling [$9,102,478.68]; and on 31st December, 1883, 375,838 depositors, with an annual deposit of £3,097,765 [$15,055,137.90]. A convention lately made between France and Belgium enables depositors in either country to transfer their accounts to the other free of charge.[8] M. Auguste de Malarce has greatly distinguished himself in the promotion of savings banks of all kinds, and most especially in urging the formation of penny banks and school banks. These, however, are not directly connected with the postal service.

The union of the telegraph with the post-office dates only from 1878. Prior to the amalgamation the number of telegraph offices was 4561; in 1883 it was already increased to 6448. At the former date (1878) the lineal extent of the telegraph was 57,090 kilometres (35,453 miles); it is now (1885) upwards of 87,000 (54,027 miles). The postal administration having begun its new work by obtaining a credit for further extensions and for plant, amounting to nearly £100,000 [$486,000], the tariff was reduced (21st March, 1878) to one-half-penny for each word, with a minimum charge of 5d. [10 cents.][9] In April, 1884, France had 5535 subscribers to postal telephonic exchanges (against about 4000 in all Germany at the same date, according to the *Revue des Postes*), working under post-office licenses of five years' duration, and paying (as in Great Britain) a royalty of 10 per cent. The postal tele-

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than 2 inches by 1, and the reproduction of sixteen folio pages of type contained above 3000 private letters. These pellicles were so light that 50,000 despatches, weighing less than 1 gramme, were regarded as the weight for one pigeon. In order to insure their safety during transit the films were rolled up tightly and placed in a small quill which was attached longitudinally to one of the tail feathers of the bird. On their arrival in Paris they were flattened out and thrown by means of the electric lantern on to a screen, copied by clerks, and despatched to their destination. This method was afterwards improved upon, sensitive paper being substituted for the screen, so that the letters were printed at once and distributed.

[1] *Seventeenth Report of the Postmaster-General*, p. 7.

[2] Boissay, "La Poste et la Télégraphie pendant le Siége de Paris," in *Journal des Économistes*, ser. 3, xxii. 117–129 and 278–282. Compare *Postal Gazette*, i. 7 (1883).

[3] *Sixteenth Report of the Postmaster-General*, p. 8.

[4] *Statistique Générale du Service postal* (Bern, 1882–83), *passim.*

[5] *Stat. gén. d. Serv. post.*, 1883.

[6] *Archiv für Post und Telegraphie*, 1884, p. 570.

[7] Postal Union return for 1883. The figures quoted are exclusive of the boy messengers attached to the telegraphic service.

[8] Auguste de Malarce, in *Journal des Économistes*, various years: *Twenty-ninth Report of the Postmaster-General*, 1883, App. 46.

[9] *Archiv für Post und Telegraphie*, 1882, 570, 571; *Journal des Économistes*, ser. 4, ii. 136, 137.

phonic system began in 1879. Up to the close of 1883 the royalties had produced £17,324 [$84,194.64]. At Rheims, Troyes, Roubaix, Tourcoing, and St. Quentin the post-office has its own exchanges. The aggregate number of inland postal money orders issued in France in 1881 was 14,626,117. In 1882 the number of inland orders increased to 15,791,774 (value £19,655,117 [$95,523,868.62]), in 1883 to 16,808,627 (value £20,770,078 [$100,942,579.08]). As compared with the population, the figures for 1883 show an average of 45$\frac{5}{10}$ to every 100 inhabitants, the corresponding figure for England being 70$\frac{4}{10}$, for the United States 17$\frac{5}{10}$, and for Italy 14$\frac{4}{10}$. The French parcel post forwarded in 1883 11,494,072 inland parcels, and 944,795 parcels abroad. A word must be added upon a special feature of the French post-office. Many years ago it began to collect books upon postal subjects; but up to 1878 it had less than 900 volumes, and less than 200 visits to consult them were made in a year. In 1884 there were about 8000 volumes—postal, telegraphic, statistical—and the annual visits for consulting them averaged 2500. These books are made accessible to the general public as well as to the postal staff, five rooms being set apart for the books, periodicals, and readers.

On the whole, it may be said that the recent record of the French postal service is a very honorable record, giving good augury of further improvements to come. Nor is it one of the least honorable items in that record to observe that, when the minister proposed to the chamber of deputies[1] in 1877 an increased vote of £18,200 [$88,452] for the better remuneration of the rural letter-carriers, the chamber voted £69,600 [$338,256] instead.

Bibliography.—P. d'Alméras, *Réglement sur le Porte des Lettres*, 1627; Le Quien de la Neufville, *Usages des postes*, 1730; Rowland Hill, *Report to the Chancellor of the Exchequer on the French Post-Office*, 1837; *Annuaire des postes*, 1850–84; M. Du Camp, "De l'Administration . . . et de l'Hôtel des Postes," in *Revue des Deux Mondes*, ser. 3, 1865; *Revue des Postes et Télégraphes*, 1870–84; A. de Rothschild, *Histoire de la Poste-aux-Lettres*, 1875; "Entwickelung des Post- u. Telegraphenweseus in Frankreich," in *Archiv f. Post u. Telegraphie*, 1882; "Die französischen Postsparkhassen," and other articles, in *L'Union Postale*, Bern, vols. viii., ix.

AUSTRIA-HUNGARY, GERMANY, AND ITALY.

1. *Austria-Hungary.*—The Austrian postal system is amongst the oldest on record. Vienna, too, possessed a local letter post and a parcel post, on the plan of prepayment, as early as May, 1772, at which date no city in Germany possessed the like. Curiously enough, this local post was established by a Frenchman (M. Hardy) and managed by a Dutchman (Schooten).[2] Thirteen years after its organization it became merged in the imperial post. The separate postal organizations of the empire (Austria) and of the kingdom (Hungary) date from 1867. In Austria the post-office and the telegraph-office are placed under the control of the minister of commerce, in Hungary under that of the minister of public works. In Austria the department has twenty-one travelling post-offices; in Hungary it has ten such.[3] Within the limits of the whole Austrian empire the lineal extent of the postal telegraph lines was 20,875 English miles in 1877, and in 1883 32,380 miles. The total number of telegraph stations was 3958. The aggregate number of telegraphic messages in 1877 (Austria-Hungary) was 5,358,544, in 1883 9,974,993. The aggregate of mailed articles in Austria[4] was 357,352,270 in 1877, and in 1878 358,427,000. Deducting from these figures the number of newspapers, book-packets, and parcels, there remains for letters and cards, jointly, an aggregate of 233,801,870 in 1877, and of 232,867,000 in 1878. In 1880 the letters and cards were 245,660,700, in 1881 255,618,100. In Hungary[5] the aggregate of letters and post-cards was 61,064,856 in 1877, in 1878 59,612,000, in 1880 78,080,804, in 1881 82,592,040. The gross revenue from posts and telegraphs stood thus in 1882 (according to the financial estimates of that year): Austria £2,307,300 [$11,213,478], Hungary £2,128,065 [$10,342,395.90], total £4,435,365 [$21,555,873.90], of which sum the postal revenue proper (*i. e.*, letter and parcel services) supplied about two and a half millions. In 1883 the gross revenue of Austria was £2,002,073 [$9,730,074.78]; that of Hungary was £790,839 [$3,843,477.54]; in the same year the respective expenditures were £1,647,373 [$8,006,232.78] and £605,185 [$2,841,199.10]. In November, 1881, a collecting service for bills and invoices was organised. In January, 1883, the unit of weight for inland letters was increased from half an ounce to two-thirds of an ounce, the rate being 1½d.; and in June of the same year the collection service above named was made international between Austria-Hungary and the German empire, on the basis of the country of origin retaining all fees, and the country of payment remitting all sums collected by money orders at the usual rate of commission.[6] In 1882 and 1883 the chief postal statistics of both divisions of the empire were as follows[7] (Table XXI.):

Austria-Hungary.

	Austria.		Hungary.	
	1882.	1883.	1882.	1883.
Inland letters..........	190,787,600	203,865,600	69,894,598	72,522,335
Inland post-cards.....	43,826,800	48,618,700	16,478,170	18,037,872
Foreign letters sent.	31,084,900	33,357,800	1,406,574	1,580,094[8]
Foreign post-cards sent..........................	4,113,100	4,536,400	153,206	149,742[8]
Totals..............	269,762.400	290,378,000	87,932,548	92,290,043

2. *German Empire.*[9]—The Prussian postal system—now developed (mainly by the ability and energy of Dr. Stephan, to whom the organization of the International Postal Union is so largely indebted) into the admirably organized post and telegraph office of the empire—began with the Great Elector, and with the establishment in 1646 of a Government post from Cleves to Memel. Frederick II. largely extended it, and by his successor the laws relating to it were consolidated. In Strasburg a messenger code existed as early as 1443. A postal service was organized at Nuremburg in 1570. In 1803 the rights in the indemnity-lands (*Entschädigungsländer*) of the counts of Taxis as hereditary imperial postmasters were abolished. The first mail steam-packet was built in 1821; the first transmission of mails by railway was in 1847; the beginning of the postal administration of the telegraphs was in 1849; and, by the treaty of postal union with Austria, not only was the basis of the existing system of the posts and telegraphs of Germany fully laid but the germ was virtually set of that International Postal Union which is now become so widely fruitful. That pregnant treaty was made for ten years on 6th April, 1850, and was immediately accepted by Bavaria. It came into full operation on the 1st July following, and then included Saxony, Mecklenburg-Strelitz, and Holstein. Other German states followed; and the treaty was renewed in August, 1860.

Germany.

Between 1850 and 1860 the number of post-offices in Prussia increased by 20½ per cent., that of letters conveyed by 115 per cent. The postal staff during that term increased from 9029 to 15,471. In 1860 the aggregate number of letters was 135,377,086, that of ordinary parcels 13,765,336, that of registered parcels, with value declared (£178,937,360 [$869,635,569.60]), 10,807,293.[10] In 1872 the post-offices of the empire, exclusive of those in Bavaria and Würtemberg (each of which countries retains in postal and telegraphic matters its own organization), numbered 5784, in 1883 11,646. Adding the number of letter-boxes, the total of postal receptacles in those years respectively was 33,362 and 65,175.[11] The aggregate postal staff was 49,945 persons in 1872, in 1883 74,393.[12] These figures include large numbers of persons who are connected with the transit of travellers, as well as with that of letters, parcels, and telegraphic messages. In 1872 the aggregate number of letters, cards, book-packets, and newspapers conveyed was 718,233,000, in 1883 1,468,315,000, or, with the addition of Bavaria and Würtemberg, 1,649,845,000.

For Berlin itself a private letter and parcel post was established by the commercial guild of the grocers and druggists in September, 1800, and continued to work under their rule until 1806, when it was abolished. A regular delivery by letter-carriers, attached to the state postal organization, existed in Berlin as early as 1712.[1] In 1876 the Berlin office employed a special staff of 3705 persons, which in 1883 had increased to 6120. It delivered in 1883 postal articles amounting to 199,500,000 in number. It received an annual income for postage of £796,517 [$3,871,072.62] in 1883.

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[1] *L'Union Postale*, ii. 83 *sq.*

[2] Loeper, "Organisation des Postes de Ville," in *L'Union Postale*, vii. 1 *sq.*

[3] Priewe, "Le Service des Bureaux ambulants," in *L'Union Postale*, vii. 25 *sq.*

[4] With a population of 21,944,336 (1877).

[5] With a population of 15,564,583 (end of 1876).

[6] *L'Union Postale*, vii. 285, viii. 190.

[7] *Statistique générale du Service Postal*, 1883, pp. 2–16.

[8] Exclusive of 3,406,184 letters and 797,066 post-cards which passed between the two countries of Hungary and Germany.

[9] The figures in this section have been kindly revised by the Reichspostamt in Berlin.

[10] *Aemtliches preussisches Handelsarchiv*, Nos. 15–17 (1863), as quoted in Hildebrand's *Jahrbücher für Nationalökonomie*, i. 396-398; K. A. H. Schmid, "Zur Geschichte der Briefporto-Reform in Deutschland," in Hildebrand's *Jahrbücher*, iii. 1-51 (1866); *Journal des Economistes*, ser. 4, ii. 68-71.

[11] *Statistisches Jahrbuch für das deutsche Reich*, 1884, 97 *sq.*

[12] These, like the other figures, are exclusive of Bavaria and Würtemberg.

The net revenue accruing from the whole of the imperial postal and telegraphic service in 1874 was only £349,301 sterling [$1,697,602.86];[2] in 1881 it was £1,060,310 sterling [$5,153,106.60], in 1882 £1,066,860 [$5,184,939.60], and in 1883 £1,172,343 [$5,697,586,98]. The lineal extent of telegraphic lines in the whole of Germany was 74,313 kilometres (46,148 miles) at the close of 1882 as compared with 72,577 kilometres (45,070 miles) in the preceding year. There were 10,803 telegraphic offices (10,308 in preceding year). The aggregate number of messages transmitted in 1883 was 15,300,816 as against 12,721,290 in 1879. Collectively, the total number of money orders issued by the postal service throughout the German empire in 1882 was 52,537,440, showing an annual average a little exceeding one to each inhabitant; in 1883 53,935,556 money orders, worth a total of £161,622,221 [$785,483,994.06] were issued. In 1883 the aggregate number of ordinary inland parcels forwarded by the German parcel post was 79,245,700, that of registered parcels with declared value was 5,410,800, the aggregate declared value being £201,469,460 [$979,141,575.60.] The parcels sent abroad were—ordinary 3,231,970, registered with declaration of value 262,620.

Bibliography.—Von Beust, *Versuch einer ausführlichen Erklärung des Postregals, . . . insbesondere in Anschauung d. h. röm. Reichs Teutscher Nation*, 3 vols., Jena, 1747-48; *Avis instructif au Public . . . pour la petite Poste* [*de Vienne*], 1772; *Ueber die kleine post in Wein*, 1780; A. Flegler, *Zur Gesch. d. Posten*, 1858; Stephan, *Hein. Gesch. d. preuss. Post*, 1859; Fischer, *Die Verkehrsanstalten des deutschen Reichs*, 1878; Von Linde, *Haftverbindlichkeit d. Postanstalt*; W. Kompe, *Das Handelsgesetzbuch u. das Postrecht*; Gad, *Die Haftpflicht d. d. Postanstalten*, 1863; Eug. Hartmann, *Entwickelungsgesch d. Posten*, 1868; P. D. Fischer, *Die d. Post- und Telegraphie-Gesetzebung*, 1876; O. Dambach, *Das Gesetz über das Postwesen des deutschen Reichs*, 1881; *Archiv f. Post u. Telegraphie*, 1878-85; F. X. von Neumann-Spallart, *Uebersichten über Verkehr in d. Weltwirthschaft*, 1885; *Deutsche Verkehrszeitung*, 1881-85; W. Lenz, *Katechismus d. d. Reichspost*, 1882.

Italy.

3. *Italy.*—The history of the Italian post-office is in many respects one of special interest. But the limits of this article admit only of a very brief statement of results. Its origin may be traced virtually to Venice and to the establishment of the "Corrieri di Venezia" early in the 16th century. As early as 1818 the Sardinian post-office issued stamped letter-paper. The total number of letters, newspapers, and book-packets conveyed in 1862 was but 111,733,319. Ten years later there was an aggregate of 232,242,677, and in 1882 one of 333,242,148. The comparative growth of postal traffic in letters and post-cards may be shown thus: in 1869 the aggregate number was 87,613,348, in 1870 89,430,261, in 1880 189,207,627, in 1881 194,587,021; in 1882 204,644,355,[3] in 1883 216,944,382.

The growth of postal savings banks in Italy is on the whole satisfactory, as will be seen by a glance at the following table (XXII.):

	No. of Banks.	No. of Accounts (31st Dec.)	Amount of Deposits (31st Dec.)
1876	1989	57,354	£97,736
1879	3259	238,869	1,049,291
1881	3406	471,094	2,679,876
1882	3488	592,018	3,398,049
1883	3584	805,988	4,485,135

In the year 1881 the accounts opened were 143,410 and 249,741 in 1883; those closed were 12,161 in 1881 and 35,771 in 1883. The average of each deposit increased (omitting fractions) from £1, 4s. 3d. [$5.89] in 1876 to £3, 16s. 1d. [$18.49] in 1881, and decreased to £3, 4s. 8d. [$15.71] in 1883. The average sum standing to the credit of each depositor was £5, 12s. 11d. [$27.44] in 1881, and in 1883 £5, 11s. 3d. [$27.04.] The number of accounts opened in 1883 was 249,741 as against 144,485 opened in 1882. This rapid increase, and the corresponding diminution in the average amount of each deposit and of the average sum standing to the credit of each depositor, are due to the regulation of 18th February, 1883, which came into operation on 1st May following, and by which post-office savings banks were authorized to accept as deposits cards bearing sufficient ten-centime [nearly 2 cents] postage stamps to make up the sum of one lira (9½d.) [19 cents]. Between 1st May and 31st December 193,763 such cards were deposited. The financial results of the post-office savings banks service for 1883 show a net gain of £29,768 [$144,672.48]; the total gain from 1876 to 1883 was £90,345 [$439,076.70.] It is the purpose of the postal administration to make by degrees the number of the postal savings banks identical with that of the post-offices.[4] That administration is now (1885) a dependency upon the ministry of public works. There were issued in 1883 for Italy itself 4,207,544 money orders, valued at £21,706,968 [$105,495,864], and for countries abroad 17,087, valued at £164,174 [$797,885.64].

The Italian parcel post despatched in the first three months of 1882 489,687 articles, in the corresponding period of 1883 869,280; it received respectively 486,814 (1882) and 978,559 (1883).[5] The number of parcels, both inland and foreign, conveyed in 1882 was 2,877,201. In 1883 3,747,182 inland and 180,828 foreign parcels were despatched by parcel post. The net postal revenue in 1882 was £197,257 [$958,669.02] (against £152,676 [$742,005.36] in 1881), to which sum the parcel post contributed £27,078 [$131,599.08.][6] The net postal revenue in 1883 was £213,537 [$1,037,789.82]. The parcel post of Italy dates only from 1881 (October), since which time it has carried more than nine millions of parcels, which it registers, paying for loss or damage during transit. But the service is so excellently organized that the administration has hitherto (1885) had to pay but a very insignificant sum as compensation.

POSTAL CONGRESSES AND INTERNATIONAL POSTAL UNION AT BERN.

Conference of 1863.

Substantially, the first step towards an effectual postal union was taken at Paris in June, 1863, when delegates from France, Great Britain, Austria, Prussia, Italy, Spain, Belgium, Holland, Portugal, Switzerland, Denmark, the Hanseatic towns, the United States of America, and Costa Rica met in Congress, under the presidency of M. Vandal, the then postmaster-general of France. The conference recommended (1) an optional prepayment of foreign letters, with a reduction of the differential charge between paid and unpaid; (2) a readjustment of the regulations concerning the international weighing and taxing of letters; (3) a reduction of the transit tariff;[7] (4) an improved regulation as to the choice of routes of transit for letters addressed to remote parts of the world; and (5) great improvements in the international money-order system, and in the postal transmission of articles of special value.[8] Thus a basis was practically laid for the treaty of Bern of 1874. What was achieved in 1874 and extended in 1878 had also been largely promoted by the proceedings and example of several local conferences on postal affairs held at various dates in Germany. Certain intermediate international conferences, more or less largely constituted, also helped to prepare the way for the great results of 1874. Though here necessarily limited to brief notices of the treaty of Bern and of the congress at Paris (four years later), a word or two must be afforded to a curious anticipation by an enterprising Swiss of a social reform destined to be realized at a distance of almost two centuries. Amongst the many political schemes which the dread of the advance of France towards a predominating sway in Europe gave rise in the 17th century, was that of Beatus Fischer, who strove zealously to seat at Bern a postal union—representing Austria, the empire, the electorate of Brandenburg, Great Britain, the Netherlands, Italy, Spain, and Switzerland—which should organize and administer a great network of postal routes, independently of France.[9] But France was still too strong, and the incidental difficulties too great. The attempt, however, led to minor postal reforms in various places.

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[1] *Archiv. für Post und Telegraphie*, 1884, p. 97.

[2] Hildebrand, *Jahrbücher*, xxvii. 207 *sq.* (1876).

[3] *Statistique générale*, 1882.

[4] *Ann. di. Statist.*, ii. 263.

[5] *L'Union Postale*, viii. 164.

[6] "Le Service des Colis postaux en Italie," in *L'Union Postale*, November, 1884, ix. 229 *sq.*

[7] All the envoys, the Italian envoy excepted, advocated such a tariff as should leave some surplus, by way of reserve fund, for improvements in the services. And in 1863 adherence to a distance-scale, albeit a liberal one, obtained favor universally.

[8] Various contemporary reports in periodicals; Schmid, "Der deutsche Briefporto-Tarif," etc., in *Jahrbücher*, ii. 187-205.

[9] The details are given in *L'Union Postale* (of August, 1883), viii. 190.

Treaty of Bern.

At Bern in 1874 postal delegates of twenty-two states assembled, representing an aggregate population of 350 millions. An eminent Frenchman had given a great impulse to the initiatory movement in 1863; a Belgian (M. Vinchent) and a Prussian (Dr. Stephan) were the principal leaders of its development in 1874.[1] Both had already rendered distinguished service to their respective countries. A half-ounce unit of weight for ordinary letters; a uniform charge, wholly irrespective of distance, of 2½ d. [5 cents] for a letter from any one country within the Union to any other; uniform rates for newspapers (1d. [2 cents] for 4 oz.) and for book-parcels, law-papers, mercantile samples (1d. [2 cents] for every 2 oz.); a transit rate greatly reduced; a regulation (very fruitful in good results) that "each post-office shall retain its own collections, and that payments due for transit shall be estimated only from accounts taken twice in each year," were among the chief improvements effected. M. Vinchent (17th September, 1874)[2] suggested the creation of an international board; and the proposal met with the zealous suppport of Dr. Stephan, of Dr. William Günther (whose death in December, 1882, was a great loss to the post-office of Germany), and of other leaders of the conference. The office so established is supported by contributions, graduated roughly—not merely according to extent of postal traffic but in part according to national rank—from the several administrations. There are six classes of such contributories. Each country in the first class contributes 25 parts of the total expense, each of the second class 20 parts, of the third 15, of the fourth 10, of the fifth 5, and of the sixth 3 parts. It is covenanted that the total expense shall not exceed £3000 [$14,580] a year. No rule was laid down as to the composition of the board. But the persons entrusted wisely determined that "it should be international in composition as in attributions." All its proceedings are reported in its official organ, *L'Union Postale*, which is trilingual (German, French, English) and appears monthly. Dr. Stephan did nor err by over-enthusiasm when he said at the close of the proceedings, "You enter upon one of the most important fields of action in the intercourse of nations; . . . you are promoting an eminent work for their peace and their prosperity." The work so successfully begun at Bern was extended at Paris, when from representing twenty-two states the Union came to represent thirty-three, and the 350 millions of (in a certain sense) its "constituents" had grown to 653 millions.

Convention at Paris, 1878.

The work before the convention at Paris in June, 1878, consisted mainly in the application of four years' experience, in the postal administrations of the constituent states, to the improvement of details. It made improved regulations with respect to transit between countries within the Union and those which still remained outside of it. It guaranteed rights of transit throughout the entire Union. It extended stipulations, made at Bern, to postal exchanges between members of the Union and extraneous countries, in cases wherein the postal service of two at least of the contracting countries were employed. It provided that expenses of transit should be borne by the country of origin. In some cases it slightly enhanced the unit of charge whilst considerably extending the unit of weight. It made valuable improvements in the regulations concerning compensations for loss during transit. Finally, it made provision for a postal congress to revise and to improve all pending rules and matters at least once in every five years.[3] The last congress was held at Lisbon in February, 1885. One of the matters which claimed its attention calls imperatively for some notice here. Whilst the growing action of the Postal Union tends constantly to simplification and identity of postal sysems, there still exists great diversity of national practice and of national law on the important point of the ownership of a letter whilst in transit. In Great Britain it lies, for the time being, in the queen, as represented by her postmaster-general and her secretary of state. Neither sender nor addressee can claim to interfere with a letter whilst in the post-office. Only the warrant of a secretary of state can stay its delivery. In Her Majesty's Indian Empire, however, the sender has virtually a property in the letter until delivery, and may (under regulations) recall it. So is it in Belgium, in Austria and Hungary, in Portugal, in Russia, and in the Scandinavian States, whilst in Canada the letter belongs to its addressee as soon as it is posted. In the Netherlands there is no precise law, but the sender may claim return prior to actual postal despatch; the case is virtually similar in France. In Italy, in Spain, and in Greece the addressee (as in Canada) has an absolute property in the letter when once posted.[4] A very recent decision of the French council of state extends the French provision,[5] practically, in favor of the sender up to actual delivery, leaving it to the postal administration to regulate the forms.

Congress at Lisbon, 1885.

Subjoined is a tabular view (Table XXIII.) of postal statistics of the principal countries comprised within the Postal Union for the year 1883.

TABLE XXIII.—*Comparative Table of the position of the Postal Service in the principal Countries belonging to the Postal Union, for the year* 1883.[6]

	Estimated No. of Letters and Post-cards (inland and despatched abroad).	No. of English Sq. Miles to each Post-office.	No. of Letters and Post-cards to each Inhabitant.	No. of Persons employed.	Gross Revenue.	Net Revenue or Deficit.
Argentine Republic	11,995,478	2487	4	958	£110,448	£191 [*deficit*]
Austria....	290,873,000	29	13	15,768	2,002,078	854,700
Hungary..	92,290,048	89	10	6,447	790,839	185,654
Belgium.....	107,662,590	13	19	4,802	585,819	202,271
Canada......	78,840,000	501	18	7,225[7]	452,876	84,602 [*deficit*]
Chili..........	11,772,884	658	5	828	71,113	8,448 [*deficit*]
Denmark....	30,022,899	24	15	3,167	282,615	24,521
Egypt.........	5,002,000	1501	1	570	94,678	14,982
France.......	633,261,848	82	17	52,686	6,429,101	750.250
Germany....	848,897,870	15	19	79,884	8,897,608	1,172,848
Great Britain.....	1,525,007,500	8	41	91,002	7,764,855	2,610,028
Greece........	4,148,447	115	2	407	36,217	12,582
Holland......	79,828,859	10	19	4,713	432,284	118,571
India[8].........	165,439,644	142	1	36,948	1,008,798	15,906 [*deficit*]
Italy...........	216,944,882	82	7	18,790	1,418,469	213,537
Japan..........	86,435,182	27	2	19,028	......	......
Norway......	18,977,444	119	7	1,491	112,879	2,595
Portugal.....	18,247,577	84	4	2,457	126,821	10,908 [*deficit*]
Roumania..	9,491,214	261	2	1,410	168,245	50,080
Russia........	124,555,076	1829	1	15,865	2,508,828	280,600 [*deficit*]
Spain.........	101,111,070	74	6	7,112	685,706	386,269
Sweden......	87,500,044	90	8	8,905	387,852	89,468
Switzerland	71,980,625	5	25	5,986	679,476	49,833
United States......	......	83	...	69,020	9,610,896	448,569

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[1] Full and able reports of the proceedings will be found in the preliminary numbers of *L'Union Postale*, October to December, 1875, and additional particulars in later numbers. A good summary is given by M. Bonnaud, "Le Congrès Postal," etc., in *Journal des Economistes*, ser. 4, ii. 419 *sq.*

[2] Treaty of Bern, 9th October, 1874 (Sessional Papers of House of Commons, "presented by command").

[3] *Convention of Paris* (Commons' Papers of 1879, No. 2309); Bonnaud, "Le Congrès Postal," in *Journal des Economistes*, ser. 4, ii. 418 *sq.*

[4] "Das Eigenthumsrecht an die Postsendungen," in *Archiv für Post und Telegraphie*, 1882, p. 239 *sq.*

[5] "Bulletin mensuel des Postes," August, 1884, in *L'Union Postale*, September, 1884 (ix. 208).

[6] *Statistique générale du Service postal*, Bern, 1884.

[7] The number on 1st November, 1882.

[8] Exclusive of French and Portuguese possessions.

The crowning improvement in postal matters, that of an international transit entirely free, is merely a question of time. It is the logical, the necessary complement of the work initiated at Paris in 1863, organized at Bern in 1874, revised and methodized again at Paris in 1878. One postal territory, one code of postal regulations, one uniform postal tariff, free conveyance between nation and nation, will be the outcome of this important movement.

Comparing the postal traffic of the various quarters of the globe for the year 1882 we find that out of a total of 8,280,000,000 articles mailed European countries claimed nearly two-thirds, while America had considerably more than one-fourth. The total was distributed as follows:

Europe	5,624,000,000	Australia	73,000,000
America	2,366,000,000	Africa	12,000,000
Asia	205,000,000		

Bibliography.—In adition to books already quoted the reader may consult K. Loeper, *Stammbuch der neueren Verkehrsmittel*, 1881; "Die Post in d. Weltliteratur," in *L'Union Postale*, ix. 12-161, 1884; and "Die Disinfection der Postentsendungen als Schützmassregel gegen die Einschleppung der Cholera," in *Archiv f. Post*, April, 1884. See also J. G. Borel, *L'Europe synoptique des Postes et des Télégraphes*, 1882; *Recueil de Renseignements sur le Régime postale en vigueur dans le Service interne des Pays de l'Union Postale Universelle.*

POSTAGE STAMPS.

Invention of adhesive stamps.

For all practical purposes the history of postage stamps begins in the United Kingdom, and with the great reform of its postal system in 1839–40. A postpaid envelope was in common use in Paris in the year 1653. Stamped postal letter-paper (*carta postale bollata*) was issued to the public by the Government of the Sardinian states in November, 1818 (above, p. 600), and stamped postal envelopes were issued by the same Government from 1820 until 1836.[1] Stamped wrappers for newspapers were made experimentally in London by Mr. Charles Whiting, under the name of "go-frees," in 1830. Four years later (June, 1834), and in ignorance of what Mr. Whiting had already done, the stamp-office authorities, in a letter addressed to Lord Althorp, then chancellor of the exchequer, by Mr. Charles Knight, recommended similar wrappers for adoption. Finally, and in its results most important of all, the adhesive stamp was made experimentally by Mr. James Chalmers in his printing-office at Dundee in August, 1834.[2] These experimental stamps were printed from ordinary type, and were made adhesive by a wash of gum. Their inventor had already won local distinction in matters of postal reform by his strenuous and successful efforts, made as early as the year 1822, for the acceleration of the Scottish mails from London. Those efforts resulted in a saving of forty-eight hours on the double mail journey, and were highly appreciated in Scotland. There is evidence that from 1822 onwards his attention was much directed towards postal questions, and that he held correspondence with the postal reformers of his day, both in and out of parliament. It is also plain that he was far more intent upon aiding public improvements than upon winning credit for them. He made adhesive stamps in 1834, and showed them to his neighbors, but took no step for publicly recommending their adoption by the post-office until long after such a recommendation had been published—although very hesitatingly—by the author of the now famous pamphlet, entitled *Post-Office Reform.*[3] Mr. Hill brought the adhesive stamp under the notice of the commissioners of post-office inquiry on 13th February, 1837. Mr. Chalmers made no *public* mention of his stamp of 1834 until December, 1837.

Only a fortnight before his examination by the above-named commissioners Mr. Hill, in his letter to Lord Monteagle (then Mr. Spring Rice and chancellor of the exchequer), seemed to have no thought of the *adhesive* stamp. He recommended to the treasury that "stamped covers and sheets of paper be supplied to the public from the stamp-office, or post-office, . . . and sold at such a price as to include the postage. . . . Covers at various prices would be required for packets of various weights. Each should have the weight it is entitled to carry legibly printed with the stamp. . . . Should experience warrant the Government in making the use of stamped covers universal,[4] most important advantages would be secured. The post-office would be relieved altogether from the collection of the revenue."[5] Then, upon suggestion, it would seem, of some possible difficulty that might arise from the occasional bringing of unstamped letters to a post-office by persons unable to write, he added: "Perhaps this difficulty might be obviated by using a bit of paper just large enough to bear the stamp, and covered at the back with a glutinous wash." It is a quite fair inference that this alternative had been suggested from without. In reviewing the subject, long afterwards, in his *History of Penny Postage*, Sir R. Hill says: "The post-office opinions as to the use of stamps for . . . prepayment were, on the whole, favorable." In a paper of 1839, entitled *On the Collection of Postage by means of Stamps*, the author continued to look upon "stamped covers or envelopes as the means which the public would most commonly employ; still believing that the adhesive stamp would be reserved for exceptional cases."[6] Mulready's well-remembered allegorical cover came into use on 1st May, 1840, together with the first form of the stamped letter-paper, and the adhesive labels.[7] They all met at first, but only for a few days, with a large sale. That of the first day yielded £2500 [$12,150]. Soon afterwards the public rejection of the "Mulready envelope," writes Rowland Hill, "was so complete as to necessitate the destruction of nearly all the vast number prepared for issue. Whilst, on the other hand, the presses of the stamp-office were producing more than half a million of [adhesive] labels, by working both night and day, they yet failed to meet the demand."[8] It was only after many weeks, and after the introduction of a series of mechanical improvements and new processes, due to the skill and ingenuity, in part of Mr. Edwin Hill of the stamp-office, in part of Mr. Perkins, an engraver, that the demand could be effectually answered. To find an obliterating ink which worked effectually, without damaging the letters, was also a special difficulty.

Manufacture of stamps.

In the production of the stamps both cheapness and security against forgery had to be combined. "The queen's head was first engraved on a single matrix, the effigy being encompassed with lines too fine for any . . . but the most delicate machinery to engrave. The matrix, being subsequently hardened was employed to produce impressions on a soft steel roller of sufficient circumference to receive twelve, and this, being hardened in turn, was used under very heavy pressure, to produce and repeat its counterpart on a steel plate,"[1] capable of working off at each impression 240 stamps. Engravers, printers, chemists and artificers of several kinds had to combine their efforts before the desired results could be secured. Long afterwards (June, 1856) a question was raised in the House of Commons as to an alleged preference of one manufacturing firm over all its virtual competitors without preliminary inquiry or actual competition. The operation, it was replied, was confided to Messrs. De La Rue & Co., because they "had the best means of accomplishing it (*i. e.*, the production of the adhesive stamp) within the time required. No public notice calling for tenders for printing and gumming was given to the trade, nor is there any trade to which such notice could have been given, the operation being the making of the stamps, as well as the printing and gumming, and that operation being to a great extent experimental."[2] The total cost of the manufacture of each million of stamps was £30 0s. 11d. [$146.02] (viz., paper, £5 14s. 5d. [$27.80]; printing and gumming, £22 1s. 9d. [$107.34]; perforating,[3] £1 8s. 1d. [$6.82]; salaries, £16 8d. [$4.05]). To this is to be added a sum of £45 2s. 4d. [$219.27] for poundage and commission upon the sale, making in all £75 3s. 3d. [$365.29]; the whole of which forms a deduction from the produce of sale. In the event about three thousand millions of stamps were produced from the original matrix. At the end of fifteen years a second matrix was obtained, after the deepening of the lines by hand, from the first. From 1st May, 1840, up to the end of the year 1884 more than thirty-one thousand three hundred millions of postage stamps had been printed, varying in value from £5 [$24.30] to a half-penny [one cent]. The details are as follows (Table XXIV.):

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[1] *Stamp-Collector's Magazine*, v. 161 *sq.*; J. E. Gray, *Illustrated Catalogue of Postage Stamps*, 6th ed., 167.

[2] Patrick Chalmers, *Sir Rowland Hill and James Chalmers, Inventor of the Adhesive Stamp* (London, 1882), *passim*. See also the same writer's pamphlet, entitled *The Position of Sir Rowland Hill made plain* (1882), and his *The Adhesive Stamp; a Fresh Chapter in the History of Post Office Reform* (1881). Compare Mr. Pearson Hill's tract, *A Paper on Postage Stamps*, in reply to Mr. Chalmers, reprinted from the *Philatelic Record* of November, 1881. Mr. Hill has therein shown conclusively the priority of *publication* by Sir Rowland Hill. He has also given proof of Mr. James Chalmers's express acknowledgment of that priority. But he has not weakened the evidence of the priority of *invention* by Mr. Chalmers.

[3] *Ninth Report of Commissioners of Post-Office Inquiry*, 1837, pp. 32, 33, reprinted in Sir R. Hill's "History of Penny Postage" (*Life*, etc., ii. 270).

[4] *I. e.*, by prohibiting the prepayment of letters in money.

[5] *Ninth Report*, as above.

[6] "History of Penny Postage" (*Life*, i. 345, 346).

[7] "Considerable diversion was created in the city to-day [1st May, 1840] by the appearance of the new penny-post devices for envelopes, half-sheet letters, and bits of sticking-plaster for dabbing on to letters. . . . [The elephants on the Mulready cover] are symbolic of the lightness and rapidity with which Mr. Rowland Hill's penny-post is to be carried on. . . . Withal the citizens are rude enough to believe that these graphic embellishments will not go down at the price of 1s. 3d. per dozen for the envelopes, . . . and of 1s. 1d. per dozen for the . . . sticking-plaster." This good-humored banter is from the money article of an eminent daily paper.

[8] Hill, *ut supra*, p. 398.

Adhesive stamps at £5	84,000
" £1	285,054
" 10s	461,438
" 5s	6,413,686
" 2s. 6d	789,884
" 2s	6,715,820
" 1s	225,378,060
" 10d	5,963,476
" 9d	11,235,080
" 8d	4,608,720
" 6d	217,048,960
" 5d	26,413,680
" 4d	175,221,180
" 3d	223,381,000
" 2½d	284,475,696
" 2d	385,171,080
" 1½d	105,603,360
" 1d	26,651,930,040
" ½d	2,970,705,120
Total number	31,301,885,334

Stamped envelopes.

The first contract for the ordinary stamped envelope, with the embossed queen's head, was entered into with Messrs. Dickinson & Longman on 22d May, 1840. The average cost of each million of this envelope was £376 [$1827.36]; of which sum £359 6s. [$1746.20] was repaid by the produce of its sale, over and above the value of the stamp, leaving a net deduction from the aggregate value of £16 14s. [$81.16] upon each million sold.[4] In November, 1850, a second contract was entered into with Messrs. De La Rue & Co., the contractors for the adhesive stamp. In the ten years, 1847 to 1856 inclusive, the aggregate number of envelopes manufactured and sold was 186,124,000. Under both these contracts the outside of the envelope was impressed with a colored embossed device in the place of a seal.[5] And this small device—the cost of which was infinitesimal—whilst it obviously improved the appearance of the envelope, added still more to its security. Of late years the device has been omitted and the security of letters impaired for a very contemptible saving.

Introduction of postage stamps.

The little canton of Zurich was the first foreign state to adopt postage stamps, in 1843. The stamps reached America in the same year, being introduced by the government of Brazil. That of the United States did not adopt them until 1847, but a tentative issue was made by the post-office of New York in 1845. An adhesive stamp was also issued at St. Louis in the same year and in Rhode Island in the next. In Europe the Swiss cantons of Geneva (1844) and of Basel (1845) soon followed the example set by Zurich.[6] In the Russian empire the use of postage stamps became general in 1848 (after preliminary issues at St. Petersburg and in Finland in 1845). France issued them in 1849.[7] The same year witnessed their introduction into Tuscany, Belgium and Bavaria and also into New South Wales. Austria, Prussia, Saxony, Spain, Italy, followed in 1850. The use of postage stamps seems to have extended to the Sandwich Islands (1851?) a year before it reached the Dutch Netherlands (1852). Within twenty-five years of the first issue of a postage stamp in London the known varieties, issued in all parts of the world, amounted to 1391. Of these 841 were of European origin, 333 were American, 59 Asiatic, 55 African. The varieties of stamp issued in the several countries of Oceanica were 103. Of the whole 1391 stamps no less than 811 were already obsolete in 1865, leaving 580 still in currency.

Defacement marks.

It was not until 1853 that the admirable improvement of perforating the stamp-sheets was introduced by the purchase for £4000 [$19,440] (pursuant to the recommendation of a select committee of the House of Commons of 1852) of a perforating machine invented by Mr. Henry Archer. Other improvements of value have also been made in the obliterating process. The defacement mark now serves to show the official consecutive numbers of the town in which each particular letter was posted. For England that number appears within circular lines; for Scotland, between parallel lines; for Ireland, it appears diamond-wise. The general post-office mark also denotes the hour of posting. The metropolitan district marks indicate the office number within oval lines under the initials of each district. Paper for the embossed stamps of all the recognized values is received by the Board of Inland Revenue from all persons who offer it, under favorable regulations.

The collection and sale of specimen postage stamps as a branch of commerce has already attained dimensions little anticipated by those who watched the origin of the new pursuit, as a sort of toy for children, some quarter of a century ago. Before stamp-collection became conspicuous commercially, it came to have a recognized educational value, in its degree, as an amusing aid to the early knowledge of geography, more especially in the political aspect.

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[1] Sir R. Hill, *op. cit.* p. 407.

[2] *Returns relating to Stamped Postal Envelopes*, etc., 24th July, 1856, House of Commons' Papers, No. 392.

[3] This item only after the year 1858.

[4] This great difference of the *deduction* from the postal revenue accruing from the net produce of stamped envelopes of only £16 14s. [$81.16] upon each million sold, as against £75 3s. [$365.23] upon each million of the labels, may well have weighed much with Sir Rowland Hill in his long preference for stamped covers to adhesive labels. If the 23,415 millions of adhesives sold up to 1879 could have been sold in the form of envelopes the gain to the revenue would have been more than £1,358,070 [$6,600,220.20]. Besides, the security of the cover is greater.

[5] *Return*, etc., as above (Sessional Paper of 1856, No. 392, p. 8).

[6] On the whole, within the course of seven years the postage stamp was adopted in three Swiss cantons, throughout the United States, in Russia, and in Brazil. So curiously inexact is the statement which appears in Mr. Lewin's volume—one in many respects of eminent ability—entitled *Her Majesty's Mails*, p. 261: "*For eight long years* the English people may be said to have enjoyed a complete monopoly in postage stamps." It is still more curious to observe in Sir Rowland Hill's own "History of Penny Postage" (*Life*, etc., ii. 13) this passage: "It is remarkable . . . that the first countries to adopt the improvement—Spain and Russia—should be two so far from taking a general lead in civilization."

[7] The date of the law authorizing the introduction is 30th August, 1848. It became operative on 1st January, 1849.

Postage stamps in France.

When the legislation of August, 1848, directed the introduction of postage stamps into France the first endeavor of the postal administration was to make a contract for their manufacture in England. But the terms proposed were thought to be too high. A contract was then made with M. Hulot of the Paris mint, and the die approved of was engraved by M. Barre, also of that establishment. M. Hulot became "director of the manufacture of postage stamps," and under the early contracts was allowed, in lieu of salary, one franc (10d.) on each thousand stamps for the first two hundred millions, 9d. per thousand for the next two hundred millions, and 8d. per thousand for all above. In 1869 these terms were reduced to 6d. per thousand upon the first five hundred millions, and 5d. upon all above.[1] The cost of mere manufacture was slightly below that of the stamps of the United Kingdom, each million being estimated to cost about £25 10s. [$123.93], of which sum paper, printing, and gumming absorbed somewhat more than £20[2] [$97.20].

During the war, in November, 1870, a contract was entered into between the Provisional Government and a M. Delebecque and others for the manufacture of postage stamps at Bordeaux. The contractor bound himself to deliver, after a day determined, 4000 sheets of stamps daily, each containing 300 stamps, at the price of 3d. for each sheet. The stamps were to be of the several values of 8d., 4d., 3d., 2d., 1d., ½d., and of one, two, three, and four centimes respectively, in such proportions as the post-office should direct. The first plate which was sent to the press was made from a matrix drawn with the pen; afterwards lithographic processes were employed. The post-office suspended the contract by notice in March, 1871, but was immediately obliged by the communal insurrection to license its continuance, and the manufacture was resumed at Bordeaux until June. On the whole, 125,387,075 postage stamps were produced from the presses at Bordeaux.[3]

In Germany.

The first postage stamp used in Germany was issued in the kingdom of Bavaria in 1849. It is of quite inartistic character, though originating in a state so famous for its cultivation of the plastic arts. The earliest type shows with the name of the country only the postal tariff. None of the many subsequent varieties displays the royal effigy; even the embossed royal arms were not used until 1866. Stamps made specially for the use of the army bear the figure sometimes of a Bavarian trooper, sometimes of an infantryman or artilleryman. The earliest Prussian stamp is of November, 1850, and bears the effigy—laureated—of King William, in filigree, to which in 1861 succeeded the Prussian eagle. The duchy of Anhalt and several petty principalities placed themselves under its wing by adopting almost from the outset the Prussian stamp. Three weeks after its first appearance in Prussia, Hanover (December, 1850) issued a stamp bearing the name of the kingdom with the royal arms. The first stamp having the royal effigy is an envelope of 1857. The effigy appears first upon adhesive stamps in 1859. The earliest Saxon type (1850) shows merely the postal tariff, but the second, of the same year, bears the king's head. The first Baden stamp resembles that of Saxony. The head of the grandduke appears upon an envelope of October, 1858. From 1860 the adhesives bear the arms of the duchy. Within the Thurn and Taxis district stamps were first used in 1852, and they continued until 1866. The earliest stamp of Schleswig-Holstein is that of an insurrectional Government patronized by Prussia and bears the national arms. The insignia of Denmark take their place in 1852 and continue until 1864. In that year separate stamps appear for Schleswig and for Holstein, to be succeeded for a short time by a common one in 1865.

In January, 1868, the postage stamps of Prussia, Hanover, Saxony, Oldenburg, of the two Mecklenburgs, of Brunswick, of Schleswig-Holstein, and of the free cities of Bremen, Hamburg, and Lübeck virtually disappear and are replaced by the new stamp of the North German Confederation. For a while the postage envelopes of such of those states as had issued any continued to appear, but with the significant super-addition of the confederation stamp. That, in its turn, after a currency of nearly four years, made room (15th December, 1871) for the imperial stamp of the new Germany. The grand-duke of Baden presently adopted it. Only Bavaria and Würtemberg retain their special postage stamps and their separate administration. Certain tariff stamps, however, for merely fiscal purposes continued to be used in Saxony, Saxe-Coburg-Gotha, Brunswick, Oldenburg, Hesse, Mecklenburg-Schwerin, Schaumburg-Lippe, Schwarzburg-Sondershausen, and in the city of Bremen.[4]

This brief review of atelic phenomena in Germany alone—the limits of this article make it impossible to give similar details for the rest of Europe—may suffice to show that the pretension of stamp-collectors to illustrate, in degree, the course and currents of political geography has its justification in fact.

In Austria-Hungary.

The earliest postage stamps of Austria-Hungary date from 1850, and display the imperial arms. It is only in 1858 that the emperor's head takes their place. In 1863 and 1864 the armorial eagle reappears, followed again and continuously, as regards adhesive stamps, by the imperial effigy. The stamped wrappers for newspapers and books bear sometimes a figure of Mercury, sometimes the double-headed eagle. Stamped envelopes were first issued in 1861; they bear, indifferently, the imperial effigy or the armorial eagle. The imperial stamps are adopted in the principality of Liechtenstein. The special stamps for Hungary bear date from 1868. The postal card is of Austrian origin, and was first issued in August, 1869. Taking all kinds of postal stamps together, the aggregate number of types (39) and of varieties (123) issued throughout the empire from 1850 amounted in 1883 to 162.[5]

In Russia.

In the Russian empire the province of Finland takes the initiative. As early as 1845 its lion within a crowned escutcheon appears upon a postal envelope. Its adhesive stamps (1856) date a few months earlier than the earliest formalized issue for the empire generally (1857). These Finnish stamps are of a similar type to the envelopes, but they continue to bear the arms of the province only until 1860. The Russian stamps bear the imperial eagle and the imperial crown; but none of them bears the head of the emperor. For a short time (1858-1864) unhappy Poland has the appearance—it is little more—of a certain differentiation in the stamps issued at Warsaw from those of the empire at large. But early in 1865 these slight peculiarities disappear, along with the local postal administration of Warsaw. All the Polish stamps are now obsolete, and have been superseded by those of the Russian empire.[6] Many other local posts, however, survive in all parts of the empire; and their stamps have peculiarities which are eminently curious. Some bear the arms, as in the case of Finland, of a province or of a great town. Others, and the greater part, bear symbolic and curious emblems: at Kherson, a wheatsheaf, a scythe, and a rake; at Elizabethgrad, an open book, sheaves, a scythe, and a plume of feathers interlaced; at Tamboff, a beehive; at Bogorodsk, Saint George on horseback. The varieties of Russian local stamps are so great, and some of them so scarce, as to cause to the ardent collector many a heartache. M. Koprowski has of late come to his solace by devoting a volume to their history. Stamp-collecting has for some years past possessed a literature large enough to fill a respectable bookcase; it bids fair ere long to need a large library for its storage. Of Russian stamps, general and local together, the total number of types exceeded 135 up to the year 1875.

The table (XXV.) which follows will give the reader the chronological sequence of postage-stamps in all parts of the world.

Year.	Countries.	Year.	Countries.
1840	United Kingdom.	1847	United States, Mauritius(?).[8]
1843	Zurich, Brazil.	1848	Russia (envelopes).[9]
1844	Geneva.	1849	France, Belgium, Bavaria, Vaud, Winterthur, Tuscany,[10] New South Wales.
1845	Basel, St. Petersburg (experimental), Finland (envelopes), New York[7] (tentatively), St. Louis.	1850	Austrian empire, Italy, Prussia, Saxony, Schleswig-Holstein, Spain, Switzer-
1846	Rhode Island.		

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[1] Ordinances of the minister of finance, 30th January, 1860, and 30th January, 1869, respectively, as cited in Rothschild, *Hist. de la Poste-aux-Lettres*, ii. 130-138.

[2] Rothschild, ii. 125.

[3] *Ibid.*, ii. 202.

[4] *Bulletin de la Société francaise de Timbrologie*, 1875, No. 1; Rothschild, *op. cit.*, pp. 251-266.

[5] Gray, *Illustrated Catalogue of Postage Stamps*, 6th ed., pp. 1-8 and 79-82; Rothschild, *ut supra*.

[6] Gray, *Illustrated Catalogue*, 6th ed., p. 167.

[7] A provisional issue by the post-office prior to legislation.

[8] According to Gray, 1852; according to Earle (*Stamp Collector's Mag.*, xi. 168 *sq.*) 1850.

[9] Embossed arms, crown, and post-horns on a circular disk.

[10] According to Gray, 1849 (*Cat.* 6th ed.); according to both Earle (*Stamp Collector's Mag.*, xi. 168) and A. de Rothschild (*Hist. de la Poste*, ii. 208), 1876.

Year.	Countries.
	land, Hanover, Baden (?), British Guiana (?), Victoria (?).[1]
1851	Baden, Wurtemberg, Denmark, Oldenburg, Canada, Trinidad, Chili,[2] Sind (tentatively),[3] Sandwich Islands (?).
1852	Roman States, Parma, Modena, Brunswick, Thurn and Taxis post-district, Netherlands, Luxemburg, Isle of Réunion.
1853	Portugal, Cape of Good Hope, Tasmania.
1854	Norway, British India, Philippines, West Australia.
1855	Sweden, Bremen, Cuba, Porto Rico, South Australia, New Zealand.
1856	Mecklenburg-Schwerin, Finland (adhesives), Uruguay.
1857	Lübeck (?),[4] Ionian Isles, Roumania, Russia (adhesive stamps), Mexico, New Brunswick, Newfoundland, Ceylon, St. Helena, Natal.
1858	Naples, Poland, Moldavia, Nova Scotia, Buenos Ayres, Argentine, Peru.[5]
1859	Sicily, Romagna, Hamburg, St. Lucia, Bahamas, New Granada, Venezuela.
1860	Poland, Malta, Jamaica, Prince Edward Island, Dutch West Indies, Liberia, New Caledonia.
1861	Greece, Bergedorf, British Columbia, St. Vincent, Nevis, Sierra Leone, Queensland.
1862	Roumania, Livonia, San Domingo, Antigua, Nicaragua, Costa Rica, United States of Colombia.
1863	Turkey, Turk's Islands.
1864	Mecklenburg-Strelitz, Dutch East Indies.
1865	Vancouver, Bermuda, Egypt.[6]
1866	Servia, Honduras, Virgin Islands, Shanghai, Kashmir, Deccan, Sarawak.
1867	Heligoland, St. Salvador, Guadalajara, Bolivia, Malacca, South African Republic.
1868	Azores, Madeira, Orange River, Fernando Po.
1869	Gambia, St. Thomas, Angola.
1870	St. Christopher, Paraguay.
1871	Guatemala, Japan.
1872	Portuguese Indies, Persia, Fiji.
1873	Iceland, Dutch Guiana, Curaçoa, Cabul.
1874	Montenegro, Dominica, Lagos (Gold Coast).
1875	Punjab

Stamp-collecting.

The extent of the commercial traffic which has so rapidly grown out of the increasing taste for collecting postage stamps is marked (sufficiently for our purposes) by a record of three facts: (1) the aggregate number of manuals, periodicals, and current catalogues relating thereto, in English, French, and German alone exceeds seventy; (2) for a collection of postage stamps, made by Sir Daniel Cooper (of Australia) between 1862 and 1878, £3000 [$14,580] sterling was given in the last-named year by M. Philippe de Ferrari; (3) the Galliera collection at Paris is said, upon credible authority, to have cost, up to 1883, in acquisition and arrangement together no less a sum than £57,600 [$279,936] (1,440,000 francs). Next to these two collections ranks that of M. A. de Rothschild.[7]

(E. ED.)

POTASSIUM METALS. Under this heading we treat of potassium, rubidium, and cæsium; SODIUM and LITHIUM, being less closely allied to potassium, have special articles devoted to them.

Potassium.—The three metals under consideration are all very widely diffused throughout nature; but only potassium is at all abundant, and therefore we begin with it. The richest natural store is in the ocean, which, according to Boguslawski's calculation (in his *Oceanographie*) of its total volume and the present writer's analysis of sea water, contains potassium equal to 1141 times 10^8 tons of sulphate, K_2SO_4. This inexhaustible store, however, is not much drawn upon at present; the "salt-gardens" on the coast of France have lost their industrial importance as potash-producers, if not otherwise, since the rich deposits at Stassfurt in Germany have come to be so largely worked. These deposits, in addition to common salt, include the following minerals: sylvine, KCl; carnallite, $KCl.MgCl_2+6H_2O$ (transparent deliquescent crystals, often red with diffused oxide of iron); kainite, $K_2SO_4.MgSO_4.MgCl_2+6H_2O$ (hard crystalline masses, permanent in the air); kieserite (a hydrated sulphate of magnesia which is only *very slowly* dissolved by water); besides boracite, anhydrite ($CaSO_4$), and other minor components lying outside the subject of this article. The potassium minerals named are not confined to Stassfurt; far larger quantities of sylvine and kainite are met with in the salt-mines of Kalusz in the eastern Carpathian Mountains, but they have not yet come to be worked so extensively. The Stassfurt potassiferous minerals owe their industrial importance to their solubility in water and consequent ready amenability to chemical operations. In point of absolute mass they are insignificant compared with the abundance and variety of potassiferous silicates, which occur everywhere in the earth's crust; orthoclase (potash felspar) and potash mica may be quoted as prominent examples. Such potassiferous silicates are found in almost all rocks, if not as normal at least as subsidiary components; and their disintegration furnishes, directly or indirectly, the soluble potassium salts which are found in all fertile soils. These salts are sucked up by the roots of plants, and by taking part in the process of nutrition are partly converted into oxalate, tartrate, and other organic salts, which, when the plants are burned, assume the form of carbonate, K_2CO_3. It is a remarkable fact that, although in a given soil the soda may predominate largely over the potash salts, the plants growing in the soil take up the latter by preference: in the ashes of most land plants the potash (calculated as K_2O) forms upwards of 90 per cent. of the total alkali (K_2O or Na_2O).[8] The proposition holds, in its general sense, for sea plants likewise. In ocean water the ratio of soda (Na_2O) to potash (K_2O) is 100 : 3.23 (Dittmar); in kelp it is, on the average, 100 : 5.26 (Richardson). Ashes particularly rich in potash are those of burning nettles, wormwood (*Artemisia Absinthium*), tansy (*Tanacetum vulgare*), fumitory (*Fumaria officinalis*), tobacco. In fact the ashes of herbs generally are richer in potash than those of the trunks and branches of trees; yet, for obvious reasons, the latter are of greater industrial importance as sources of carbonate of potash.

Carbonate of Potash (K_2CO_3) in former times used to be made exclusively from wood-ashes, and even now the industry survives in Canada, Russia, Hungary, and other countries, where wood is used as the general fuel. In some places—for instance, in certain districts of Hungary—wood is burned expressly for the purpose; as a rule, however, the ashes produced in households form the raw material. The ashes are lixiviated with water, which dissolves all the carbonate of potash along with more or less of chloride, sulphate, and a little silicate, while the earthy phosphates and carbonates and other insoluble matters remain as a residue. The clarified solution is evaporated to dryness in iron basins and the residue calcined to burn away particles of charcoal and half-burned organic matter. In former times this calcination used to be effected in iron pots, whence the name "potashes" was given to the product; at present it is generally conducted in reverberatory furnaces on soles of cast-iron. The calcined product goes into commerce as crude potashes. The composition of this substance is very variable,—the percentage of real K_2CO_3 varying from 40 to 80 per cent. The following analysis of an American "potashes" is quoted as an example.

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[1] According to De Rothschild (*Hist. de la Poste*, ii. 215), 1851.

[2] Rothschild's date is 1852 (p. 218).

[3] By Sir Bartle Frere.

[4] Both Gray and Rothschild date 1859. Earle (*ut supra*) describes a Lübeck stamp of 1847.

[5] Rothschild's date is 1857.

[6] Gray (6th ed., p. 258). Both Rothschild and Earle give the date as 1866.

[7] See *Stamp Collector's Magazine*, 1878.

[8] Compare the interesting paper by C. Bischoff in the *Journ. f. Pract. Chem.*, vol. xlvii. p. 193 (1849).

Carbonate of potash	71.4	Water	4.5
" soda	2.3	Insoluble matter	2.7
Sulphate of potash	14.4		
Chloride of Potassium	3.6		98.9

Crude potashes is used for the manufacture of glass, and after being causticized for the making of soft soap. For many other purposes it is too impure and must be refined, which is done by treating the crude product with the minimum of cold water required to dissolve the carbonate, removing the undissolved part (which consists chiefly of sulphate), and evaporating the clear liquor to dryness in an iron pan. The purified carbonate (which still contains most of the chloride of the raw material and other impurities) is known as "pearl ashes."

Large quantities of carbonate used to be manufactured from the aqueous residue left in the distillation of beetroot spirit, *i.e.*, indirectly from beetroot molasses. The liquors are evaporated to dryness and the residue is ignited to obtain a very impure carbonate, which is purified by methods founded on the different solubilities of the several components. Such potashes, however, is exceptionally rich in soda: Grandeau found in crude ashes from 16 to 21 per cent. of potash and from 23 to 50 of soda carbonate. This industry would have expired by this time were it not that the beetroot spirit residues are worked for trimethylamine (see METHYL, vol. xvi. p. 204), and the carbonate thus obtained incidentally. Most of the carbonate of potash which now occurs in commerce is made from Stassfurt chloride by means of an adaptation of the "Leblanc process" for the conversion of common salt into soda ash (see SODIUM).

Chemically pure carbonate of potash is best prepared by the ignition of pure bicarbonate (see below) in iron or (better) in silver or platinum vessels, or else by the calcination of pure bitartrate (see TARTARIC ACID). The latter operation furnishes an intimate mixture of the carbonate with charcoal, from which the carbonate is extracted by lixiviation with water and filtration; the filtrate is evaporated to dryness (in iron or platinum) and the residue fully dehydrated by gentle ignition. The salt is thus obtained as a white porous mass, fusible at a red heat (838° C., Carnelley) into a colorless liquid, which freezes into a white opaque mass. The dry salt is very hydroscopic; it deliquesces into an oily solution ("oleum tartari") in ordinary air. 100 parts of water dissolve—

at 0° C.	20° C.	185° C. (boiling point of saturated solution).
83	94	205

parts. Carbonate of potash, being insoluble in strong alcohol (and many other liquid organic compounds), is much used for the dehydration of the corresponding aqueous preparations. From its very concentrated solution in hot water the salt crystallizes on cooling with a certain proportion of water; but these crystals are little known even to chemists. Pure carbonate of potash is being constantly used in the laboratory, as a basic substance generally, for the disintegration of silicates, and as a precipitant. The industrial preparation serves for the making of flint-glass, of potash soap (soft soap), and of caustic potash. It is also used in medicine, where its old name of "sal tartari" is not yet quite obsolete.

Bicarbonate of Potash ($K_2OCO_2 + H_2OCO_2 = 2KHCO_3$) is obtained when carbonic acid is passed through a cold solution of the ordinary carbonate as long as it is absorbed. If silicate is present, it likewise is converted into bicarbonate with elimination of silica, which must be filtered off. The filtrate is evaporated at a temperature not exceeding 60° or at most 70° C.; after sufficient concentration it deposits on cooling anhydrous crystals of the salt, while the chloride of potassium, which may be present as an impurity, remains mostly in the mother-liquor; the rest is easily removed by repeated recrystallization. If an absolutely pure preparation is wanted, it is best to follow Wöhler and start with the "black flux" produced by the ignition of pure bitartrate. The flux is moistened with water and exposed to a current of carbonic acid, which, on account of the condensing action of the charcoal, is absorbed with great avidity. The rest explains itself. Bicarbonate of potash forms large monoclinic prisms, permanent in the air. 100 parts of water dissolve—

at 0°	10°	20°	60°	70°
19.61	23.23	26.91	41.35	45.24

parts of salt. At higher temperatures than 70° the solution loses carbonic acid quickly. The solution is far less violently alkaline to the taste and test-papers than that of the normal carbonate. Hence it is preferred in medicine as an anti-acid. When the dry salt is treated it breaks up below redness into normal carbonate, carbonic acid, and water.

Caustic Potash (*Hydrate of Potassium*), KHO.—It has been known for a long time that a solution of carbonate of potash becomes more intensely alkaline, acts more strongly on the epidermis, and dissolves fats more promptly after it has been treated with slaked lime. It used to be supposed that the latent fire in the quick-lime went into the "mild" alkali and made it "caustic," until Black, about the middle of last century, showed that the chemical difference between the two preparations is that the mild is a compound of carbonic acid and the caustic one of water with the same base (potash),—the causticizing action of the lime consisting in this, that it withdraws the carbonic acid from the alkali and substitutes its own water. Add to this that the exchange takes place only in the presence of a sufficient proportion of water, and that it is undone if the mixture is allowed to get concentrated by evaporation beyond a certain (uncertain) point, and you have a full theory of the process. A good concentration is twelve parts of water for one of carbonate of potash; the lime is best employed in the shape of a semi-fluid paste, made by slaking quicklime with three parts of water poured on at a time. The alkali solution is heated to boiling in a cast-iron vessel (industrially by means of steam-pipes) and the lime paste added in instalments until a sample of the filtered mixture no longer effervesces on addition of an excess of acid. The mixture is then allowed to settle in the iron vessel, access of air being prevented as much as practicable, and the clear liquor is drawn off by means of a syphon. The remaining mud of carbonate and hydrate of lime is washed, by decantation, with small instalments of hot water to recover at least part of the alkali diffused throughout it, but this process must not be continued too long or else some of the lime passes into solution. The united liquors are boiled down in an iron vessel until the desired degree of concentration is reached. In obedience to an old tradition, the concentration is habitually continued until the specific gravity of the cold lye is 1.333, which is a rather inconveniently high degree of strength for most purposes, but in the case of the ordinary commercial article offers this advantage, that any sulphate of potash which may be present as an impurity crystallizes out completely on standing (Liebig). If solid caustic potash is wanted, the lye (after removal of the deposit of sulphate, etc.) is transferred to a *silver* dish, and the evaporation continued until, instead of steam, the heavy vapor of KHO itself is seen to go off. The residual oily liquid is then poured out into a polished iron tray, or into an iron mould to produce the customary form of "sticks," and allowed to cool. The solidified preparation must be at once bottled up, because it attracts the moisture and carbonic acid of the air with great avidity and deliquesces. According to the present writer's experience (*Journ. Soc. Chem. Ind.*, May, 1884), nickel basins are far better adapted than iron basins for the concentration of potash lye. The latter begin to oxidize before the lye has come up to the traditional strength, while nickel is not attacked so long as the percentage of *real* KHO is short of 60.

For the fusion of the dry hydrate nickel vessels cannot be used; in fact, even silver is perceptibly attacked as soon as *all* the excess of water is away; absolutely pure KHO can be produced only in *gold* vessels. Regarding the action of potash on platinum, see PLATINUM (*supra*, p. 203). Glass and (to a less extent) porcelain are attacked by caustic potash lye, slowly in the cold, more readily on boiling.

Frosen caustic potash forms an opaque, white, stone-like mass of dense granular fracture; specific gravity =2.1. Is fuses considerably below and is perceptibly volatile at a red heat. It is extremely soluble in even cold water, and in any proportion of water on boiling. The solution is intensely "alkaline" to test-papers. It readily dissolves the epidermis of the skin and many other kinds of animal tissue,—hence the well-known application of the "sticks" in surgery. A dilute potash lye readily emulsionizes fats, and on boiling "saponifies" them with formation of a soap and of glycerin. Caustic potash is the very type of an energetic (mono-acid) basic hydrate (see CHEMISTRY, vol. pp. 421, 423).

According to Tünnermann's and Schiff's determinations, as calculated by Gerlach, the relation in pure potash lye between specific gravity at 15° C. and percentage strength is as follows:

Percentages of KHO or K_2O.	Specific Gravity, if percentage refers to		Percentages of KHO or K_2O.	Specific Gravity, if percentage refers to	
	K_2O.	KHO.		K_2O.	KHO.
0	1.000	1.000	25	1.285	1.230
1	1.010	1.009	30	1.355	1.288
10	1.099	1.083	40	1.504	1.411
15	1.154	1.128	50	1.660	1.539
20	1.215	1.177	60	1.810	1.667

All commercial caustic potash is contaminated with excess of water (over and above that in the KHO) and with carbonate and chloride of potassium; sulphate, as a rule, is absent. Absolutely pure potash has perhaps never been seen; a preparation sufficing for most purposes of the analyst is obtained by digesting the commercial article in strong (85 per cent. by weight) *pure* alcohol. The hydrate KHO dissolves in the alcohol of the solvent; the chloride and the carbonate unite with the water and form a lower layer or magma, from which the alcoholic solution of the KHO is decanted off, to be evaporated to dryness and fused in silver vessels ("potasse à l'alcool").

The metal (potassium) has been known to exist since Lavoisier, but was first obtained as a substance by Humphrey Davy in 1807. He prepared it from the hydrate by electrolysis. Gay-Lussac and Thénard subsequently found that this substance can be reduced to the metallic state more easily by passing its vapor over white hot metallic iron; but even their method as a mode of preparation was soon superseded by Brunner's, who, to the surprise of his contemporaries, produced the metal by simply distilling its carbonate with charcoal—applying an old-established principle of ordinary metallurgy. Brunner's process is used to the present day for the production of the metal.

One of those cylindrical, neckless, wrought-iron bottles which serve for the storing of quicksilver is made into a retort by taking out the screw-plug at the centre of one of the round ends and substituting for it a short ground-in, iron outlet pipe. This retort is charged with a black flux made from a mixture of pure and crude bitartrate so adjusted that the flux contains as nearly as possible the proportion of free carbon demanded by the equation $K_2C_2O + 2C = 2K + 3CO$. It is then suspended horizontally within a powerful wind-furnace, constructed for coke as fuel. At first a mixture of coke and charcoal is applied, to produce the right temperature for chasing away the moisture and enabling one to, so to say, varnish over the retort with borax and thus protect it against the subsequent intense heat. After these preliminaries coke alone is used and the fire urged on to, and maintained at, its maximum pitch, when potassium vapor soon begins to make its appearance. The condensation of this vapor, however, demands special methods, because even the cold metal would quickly oxidize in the air and act most violently on liquid water. Brunner used to condense the vapor by passing it into a small copper vessel charged with rock-oil (see PARAFFIN, vol. xviii. p. 241), in which liquid the condensed metal sinks to the bottom and thus escapes the air. Donné and Maresca dispense with rock-oil altogether; they receive the vapor in a dry condenser made of two flat rectangular trays of wrought iron which fit closely upon each other, enclosing a space such as might be used as a mould for casting a thin cake of any ordinary metal. This condenser has a short neck into which the outlet pipe of the retort fits; and the pipe must be as short as possible, because it is essential (Donné and Maresca) that the hot vapor pass abruptly from its original high to a low temperature, to evade a certain range of medium temperatures at which the metal combines with carbonic oxide into a black solid, which may obstruct the outlet pipe. The formation of this by-product cannot be altogether avoided; hence a long borer is inserted into the condenser from the first to enable one to clear the throat of the retort at a moment's notice. The condenser is kept as far as possible cold by the constant application to it of damp cloths. As soon as the distillation is finished the (still hot) condenser is plunged into a bucketful of rock-oil, to cool it down, the mould opened (under the oil), and the now solid metal taken out. The crude metal is always contaminated with some of the black solid and other mechanical impurities. To remove these the best method is to redistil it from out of a small iron retort and condense the vapor in rock-oil according to Brunner's original plan. The purified metal is soft enough to be moulded (under rock-oil) into globular pieces, which are preserved in bottles filled to the top with the protecting liquid. But even this does not prevent gradual oxidation; bright metallic potassium can be maintained in this condition only by preserving it in a sealed-up glass tube within a vacuum or in an atmosphere of hydrogen or some other inert gas. The black solid above referred to is a most dangerous substance. When exposed to the air it turns red and then explodes either spontaneously or on the slightest provocation by friction or pressure. Even if kept under rock-oil it gradually becomes explosive. The distillation of potassium, in fact, is a dangerous operation, which had better be left in the hands of specialists.

Pure potassium is a bluish-white metal; but on exposure to ordinary air it at once draws a film of oxide, and on prolonged exposure deliquesces into a solution of hydrate and carbonate. At temperatures below 0° C. it is pretty hard and brittle; at the ordinary temperature it is so soft that it can be kneaded between the fingers and cut with a blunt knife; specific gravity = 0.865. It fuses at 62.5° C. (Bunsen), and at 720° to 730° C. (Carnelley and Williams), *i.e.*, considerably below its boiling point, begins to distil with formation of an intensely green vapor. When heated in air it fuses and then takes fire and burns into a mixture of oxides. Most remarkable, and characteristic for the group it represents, is its action on water. A pellet of potassium when thrown on water at once bursts out into a violent flame and the burning metal fizzes about on the surface, its extremely high temperature precluding absolute contact with the liquid, except at the very end, when the last remnant, through loss of temperature, is wetted by the water and bursts with explosive violence. What really goes on chemically is that the metal decomposes the water thus, $K + H_2O = KHO + H$, and that the hydrogen catches fire, the violet color of the flame being due to the potassium vapor diffused throughout it. Similar to that on water is its action on alcohol: the alcohol is converted into ethylate, while hydrogen escapes, $K + C_2H_5.OH = C_2H_5.OK + H$, this time without inflammation. So strong is the basilous character of the element that, in opposition to it, even ammonia behaves like an acid. When the oxide-free metal is heated gently within the dry gas it is gradually transformed into a blue liquid, which on cooling freezes into a yellowish-brown or flesh-colored solid. This body is known as "potassamide," KNH_2. When heated by itself to redness the amide is decomposed into ammonia and nitride of potassium, $3_2NHK = NK_3 + 2NH_3$. The nitride is an almost black solid. Both it and the amide decompose water readily with formation of ammonia and caustic potash. Potassium at temperatures from 200° to 400° C. "occludes" hydrogen gas, as palladium does (see "Palladium," under PLATINUM, *supra*, p. 204). The highest degree of saturation corresponds approximately to the formula K_2H for the "alloy," or to about 126 volumes of gas (measured cold) for one volume of metal. In a vacuum or in sufficiently dilute hydrogen the compound from 200° upwards loses hydrogen, until the tension of the free gas has arrived at the maximum value characteristic of that temperature (Troost and Hautefeuille).

Potassium Oxides, singularly, can be produced only from the metal, and another remarkable fact is that the one with which all chemical students imagine they are so familiar—namely, "anhydrous potash," K_2O—is little more than a fiction. According to Vernon Harcourt, when the metal is heated cautiously, first in dry air and then in dry oxygen, it is transformed into a white mass (K_2O_2?), which, however, at once takes up more oxygen with formations ultimately of a yellow powdery tetroxide (K_2O_4), fusible at a red heat without decomposition. At a white heat it loses oxygen and leaves a residue of lower oxides (K_2O?). When heated in hydrogen it is reduced to ordinary potash, KHO. When dissolved in excess of dilute acid it yields a mixed solution of the respective potash salt and peroxide of hydrogen, with abundant evolution of oxygen gas.

Potassium Salts.—There is only one series of these known,—namely, the salts produced by the union of potash (KHO) with acids.

Chloride, KCl.—This salt (commercial name, "muriate of potash") is at present being produced in immense quantities at Stassfurt from the so-called "Abraumsalze." For the purpose of the manufacturer of muriate these are assorted into a raw material containing approximately in 100 parts—55-65 of carnallite (representing 16 parts of chloride of potassium); 20-25 of common salt; 15-20 of kieserite, a peculiar, very slowly soluble sulphate of magnesia, $MgSO_4 . H_2O$; 2-4 of tachhydrite ($CaCl_2 . 2MgCl_2 + 12H_2O$); and minor components. This mixture is now wrought mainly in two ways. (1) The salt is dissolved in water with the help of steam, and the solution is cooled down to from 60° to 70°, when a quantity of impure common salt crystallizes out, which is removed. The decanted lye deposits on cooling and standing a 70 per cent. muriate of potash, which is purified, if desired, by washing it by displacement with cold water. Common salt principally goes into solution, and the percentage may thus be brought up to from 80 to 95. The mother-liquor from the 70 per cent. muriate is evaporated down further, the common salt which separates out in the heat removed as it appears, and the sufficiently concentrated liquor allowed to crystallize, when almost pure carnallite separates out, which is easily decomposed into its components (see *infra*). (2) Ziervogel and Tuchen's method. The crude salt is ground up and then heated in concentrated solution of chloride of magnesium with mechanical agitation. The carnallite principally dissolves and crystallizes out relatively pure on cooling. The mother-liquor is used for a subsequent extraction of fresh raw salt. The carnallite produced is dissolved in hot water and the solution allowed to cool, when it deposits a coarse granular muriate of potash containing up to 99 per cent. of the pure substance. The undissolved residue produced in either process consists chiefly of kieserite and common salt. It is worked up either for Epsom salt and common salt, or for sulphate of soda and chloride of magnesium. The potassiferous by-products are utilized for the manufacture of manures.

Chemically pure chloride of potassium is most conveniently prepared from pure perchlorate (see *infra*) by dioxygenating it in a platinum basin at the lowest temperature and then fusing the residue in a well-covered platinum crucible. The fused product solidifies on cooling into a colorless glass. Chloride of potassium dissolves in water and crystallizes from the solution in anhydrous cubes. 100 parts of water dissolve—

at 0°	10°	20°	50°	100° C.
29.2	32.0	34.7	42.8	56.6

parts of the salt. When a sufficiency of hydrochloric-acid gas is passed into the solution the salt is completely precipitated as a fine powder. If the original solution contained chloride of magnesium or calcium or sulphate of potash, all impurities remain in the mother-liquor (the SO_3 as $KHSO_4$), and can be removed by washing the precipitate with strong hydrochloric acid. Chloride of potassium fuses at 738° C. (Carnelley), and at a red heat volatilizes rather abundantly.

Chlorate, $KClO_3$.—This industrially important salt wa discovered in 1786 by Berthollet, who correctly designated it as "peroxidized muriate." Chlorine gas is largely absorbed by cold caustic-potash lye with formation o chloride and hypochlorite, $2KHO + Cl_2 = KCl + KClO +$ H_2O. When the mixed solution is boiled it suffers, strictly speaking, a complicated decomposition, which, however, in the main comes to the same as if the hypochlorite broke u into chloride and chlorate, $3KClO = 2KCl + KClO_3$. Hence chlorate of potash is easily produced by passing chlorin into hot caustic-potash lye so as at once to realize the change, $6KHO + 3Cl_2 = 3H_2O + 5KCl + KClO_3$; and thi method used to be followed industrially until Liebig pointe out that five-sixths of the potash can be saved by first substituting milk of lime, $Ca(OH)_2 = 2caOH$, for the potash ly and from the mixed solution of lime-salts precipitating, s to say, the chloric acid as potash salt by adding 1KCl fo every $1caClO_3$ present, concentrating by evaporation, an allowing the $KClO_3$ to crystallize out. This is the presen industrial process. For the technical details we must refe to the handbooks of chemistry. Suffice it to say that i practice about 1.03 times KCl are used for every 1caClO and that the salt produced is almost chemically pure afte one recrystallization. By repeated recrystallization ever trace of impurities is easily removed. The crystals a colorless transparent monoclinic plates, which, unle formed very slowly, are very thin, so as often to exhibi the Newton's colors. 100 parts of water dissolve—

at 0°	15°	50°	104.8° (on boiling)
3.3	6	19	60

parts of the salt (Gay-Lussac). The salt is almost insolub in strong alcohol. It is permanent in the air. It fuses a 359° C. (Carnelley), and at about 18° above the temperature of its formation the liquid gives off oxygen *with evolution of heat*, and formation ultimately of chloride (a oxygen). The salt accordingly, in opposition to any combustible matter with which it may be mixed, behaves a the same time as a store of highly-condensed loosely-combined oxygen and of potential heat. Hence its manifol applications in artillery and pyrotechnics are easily understood. To give one example of the readiness with which i acts as a burning agent: a mixture of it and sulphur wh struck with a hammer explodes loudly, the mechanica blow sufficing to produce locally the temperature necessar for starting the reaction. When the salt was still a novelt it was tried as a substitute for the nitre in gunpowde Such powder, however, proved too good to be safe. Mor recently a mixture of 49 parts of the chlorate, 23 of suga and 28 of prussiate of potash was recommended by Pohl a a preferable substitute for gunpowder, but this powder h never come into actual use anywhere. We must not forge to point out that mixtures of chlorate of potash and combustible substances must on no account be made in mortar; this would be sure to lead to dangerous explosion The several ingredients must be powdered separately an only then be mixed together on a sheet of paper or on table, all unnecessary pressure or friction being carefully avoided.

The decomposition of chlorate of potash by heat is greatl facilitated by admixture of even small proportions of certain solid oxides, *e.g.*, oxide of copper, of iron, or of manganese. The oxygen, in the case of binoxide of manganese for instance, comes off below the fusing point of the salt Hence a salt contaminated with even a small proportion o heavy metallic chlorate cannot (in general) be fused without decomposition. The writer observed this anomaly with commercial chlorate which happened to contain about one half per cent. of chlorate of zinc. The aqueous solution of the salt is neutral and bears prolonged boiling without decomposition. On acidification with dilute sulphuric acid it assumes the reactions of a solution of chloric acid, *i.e.*, of a powerful but readily controllable oxydant. In thi capacity it is used in calico-printing as a "discharge." In the same industry it serves for making the chlorate of soda needed for the production of aniline black. In the chemical laboratory it is in constant requisition as a source of oxygen and as an oxidizing agent. In the hands of Marignac it served for the determination of the importan ratio KCl : 3O.

Perchlorate, $KClO_4$.—The decomposition of chlorate of potash by heat, if catalytic agents like MnO_2, etc., are absent, proceeds by two stages. In the first the salt break up thus, $2KClO_3 = KCl + O_2 + KClO_4$; in the second the perchlorate at a higher temperature is decomposed int chloride and oxygen. The termination of the first stage i marked by a slackening in the evolution of the oxygen and by the residual salt (which, at the beginning, is a thin fluid becoming pasty. From the mixture $KCl + KClO_4$ the chloride is extracted by lixiviation with successive instalments of cold water. The residual perchlorate is *very easily* purified by recrystallization (compare pure chloride of potassium, *supra*). Perchlorate of potash dissolves in 88 parts of water of 10° C., and in far less of boiling water. It is absolutely insoluble in absolute alcohol. It begins to give off its oxygen at about 400° C., which is below its fusing point. The salt has been recommended as a substitute for chlorate in pyrotechnic mixtures, because it contains more oxygen, and yet, on account of its greater stability, is a less dangerous ingredient.

Bromide, KBr.—This salt is formed when bromine is dissolved in caustic-potash lye. The reaction is quite analogous to that going on in the case of chlorine; only the hypobromite (KBrO) first produced is far less stable than hypochlorite, and vanishes after short heating. The addition of bromine is continued until the liquid is permanently yellow and retains its color after short heating. The solution is then evaporated to dryness and the bromate decomposed by cautious heating. A small portion of the bromate breaks up into $K_2O + Br_2 + 5O$; hence the residual bromide is contaminated with a little free alkali; but this is easily set right by neutralizing its solution with hydrobromic acid. The salt crystallizes in colorless transparent tubes, easily soluble in water. It is used in medicine for quieting the nerves,—to cure sleeplessness, for instance; also (internally) as a local anæsthetic preparatory to operations on the larynx or the eye. The dose of the pure (KI free) salt for adults can safely be raised to 2 grammes (about 30 grains). It is also used in photography.

Iodide, KI.—Of the very numerous methods which have been recommended for the preparation of this important salt the simplest (and probably the best) is to dissolve in a caustic-potash lye (which is dilute enough to hold the rather difficultly soluble iodate KIO_3 in solution) enough iodine to produce a permanent yellow color (the iodine passes at once into $5KI + KIO_3$; the hypo body KIO has no existence practically) and to deoxidize the iodate, which is done most conveniently by adding a sufficiency of powdered charcoal to the solution, evaporating to dryness in an iron vessel, and heating the residue. The oxygen goes off as CO_2 at a lower temperature than that which would be needed for its expulsion as oxygen gas. The residue is dissolved, and the solution filtered and evaporated to crystallization. The salt comes out in colorless transparent cubes, very easily soluble in even cold water. The commercial salt forms opaque milk-white crystals, which, as a matter of habit, are preferred to the clear salt, although they are produced by causing the salt to crystallize from a strongly alkaline solution and by drying the crystals (finally) in a stream of hot air, and although through the former operation they are at least liable to contain carbonate. Iodide of potassium acts far more powerfully on the human system than bromide, and therefore is administered in smaller doses. It is used against skin-diseases, and also for eliminating the mercury which settles in the system after long continued administration of mercurial medicines. It is also used, far more largely than the bromide, in photography. See PHOTOGRAPHY, *passim*.

Sulphate (K_2SO_4) used to be extracted from kainite, but the process is now given up because the salt can be produced cheaply enough from the muriate by decomposing it with its exact equivalent of oil of vitriol and calcining the residue. To purify the crude product it is dissolved in hot water and the solution filtered and allowed to cool, when the bulk of the dissolved salt crystallizes out with characteristic promptitude. The very beautiful (anhydrous) crystals have as a rule the habitus of a double six-sided pyramid, but really belong to the rhombic system. They are transparent, very hard, and absolutely permanent in the air. They have a bitter salty taste. 100 parts of water dissolve—

at 0°	12°	100° C
8.36	10	26

parts of the salt. Sulphate of potash fuses at a strong red heat, and at this temperature volatilizes, for an alkaline salt, rather slowly. The chloride, weight for weight, volatilizes at ten times the rate (Bunsen). Sulphate of potash used to be employed in medicine, but is now obsolete. The crude salt is used occasionally in the manufacture of glass.

Bisulphate ($KHSO_4$) is readily produced by fusing thirteen parts of the powdered normal salt with eight parts of oil of vitriol. It dissolves in three parts of water 0° C. The solution behaves pretty much as if its two congeners, K_2SO_4 and H_2SO_4 were present side by side of each other uncombined. An excess of alcohol, in fact, precipitates normal sulphate (with little bisulphate) and free acid remains in solution. Similar is the behavior of the fused dry salt at a dull red heat; it acts on silicates, titanates, etc., as if it were sulphuric acid raised beyond its natural boiling point. Hence its frequent application in analysis as a disintegrating agent.

For the following potash salts we refer to the articles named: *Chromates*, see CHROMIUM; *Cyanide* and *Ferrocyanide*, PRUSSIC ACID; *Chloroplatinate*, PLATINUM (*supra* p. 203); *Nitrate*, NITROGEN; (vol. xvii. p. 531); *Phosphates*, PHOSPHORUS (vol. xviii. pp. 830–832); *Oxalates*, OXALIC ACIC; *Sulphides* and *Sulphites*, SULPHUR; *Silicates*, GLASS (vol. x. p. 583 *sq.*) and SILICA; *Tartrates*, TARTARIC ACID. For potash salts not named, see the handbooks of chemistry.

Rubidium and Cæsium.—When Bunsen and Kirchhoff in 1860 applied their method of spectrum. analysis to the alkali salts which they had extracted analytically from Dürkheim mineral water, they obtained a spectrum which in addition to the lines characteristic for sodium, potassium, and lithium, exhibited two blue lines which were foreign to any other spectrum they had ever seen. They accordingly concluded that these lines must be owing to the presence of a new alkali metal, which they called "cæsium." Bunsen at once resumed the preparation of the mixed alkaline salt with 44,000 litres of Dürkheim water, with the view of isolating the cæsium in the form of a pure salt; and he was more than successful—for the new alkali salt, after elimination of all the ordinary alkali metals, proved to be the mixture of the salts of *two* new alkali metals, which he succeeded in separating from each other. For one he retained the name already chosen; the other he called "rubidium" on account of the presence in his spectrum of certain characteristic red lines. Since Bunsen's time these two metals have been discovered in a great many native potassifferous materials—minerals, mineral waters, plant ashes, etc.,—but in all cases they form only a small fraction of the alkali, the cæsium in general amounting to only a fraction of even the rubidium. One solitary exception to both rules is afforded by a rare mineral called "pollux" which is found only on the island of Elba. Plattner analyzed this mineral in 1846, and recognized it as a compound silicate of alumina, oxide of iron, soda, potash, and water; but his quantitative analysis came up to only 92.75 per cent., and he could not account for the 7.25 per cent. of loss. After Bunsen's discovery Pisani analyzed the mineral again, and he found that it contained no potash at all, but, instead of it, a large percentage (34.1) of *cuesia.* Recalculating Plattner's analysis on the assumption that the presumed chloroplatinate of potassium was really chloroplatinate of cæsium, he found that the corrected numbers did add up to near 100 and agreed with his own. Rubidium, singularly, is absent from this mineral.

That both rubidium and cæsium are contained in sea water might well be taken for granted; but it is worth while to state that Schmidt of Dorpat actually proved the presence of rubidium, and even determined it quantitatively.

For the preparation of rubidium compounds one of the best materials in a mixture of alkaline salts, which falls as a by-product in the industrial preparation of carbonate of lithia from lepidolite. A supply of this salt mixture which Bunsen worked up contained 20 per cent. of chloride of rubidium, 33 of chloride of potassium, and 36 of common salt, but very little cæsium; his supply came from the Saxon or Bohemian mineral. The lepidolite of Hebron, Maine, United States, on the other hand, is rich in cæsium. Another practically available source for cæsium is the mother-liquor salt of Nauheim in Germany. It yielded to Böttcher 1 per cent. of its weight of the chloroplatinate $PtCl_6Cs_2$.

Bunsen's method for the extraction of the two rare potassium metals from a given mixture of alkaline salts is founded upon the different solubility of the several alkaline chloroplatinates. According to him 100 parts of water dissolve—

	Potassium	*Rubidium*	*Cæsium*
at 0°C…………	0.74	0.13	0.024
" 20°C…………	1.12	0.14	0.079
" 100°C…………	5.13	0.63	0.377

parts of the several salts. The chloroplatinates of sodium and lithium are easily soluble even in cold water, so that chloride of platinum does not precipitate these two metals at all. Hence, supposing we boil a given mixture of chloroplatinates of potassium and (say) rubidium with a quantity of water insufficient to dissolve the whole, part of both salts will dissolve; but the residual chloroplatinate will be richer in rubidium than the dissolved part. And supposing, on the other hand, we add to a mixed solution of the two chlorides a quantity of chloroplatinic-acid solution insufficient to bring down the whole of both metals, the rubidium will accumulate in the precipitate and the potassium in the solution. It is also easily understood that, if the amount of reagent added falls short even of that which would be needed by the rubidium if present alone, a very nearly pure $PtCl_6Rb_2$ may be expected to come down. Any dry chloroplatinate is easily reduced to a mixture of metallic platinum and alkaline chloride by the simple operation of heating in hydrogen to about 300° C. The chloride can be dissolved out, and thus again made amenable to fractional precipitation by platinum solution, and the platinum be reconverted into reagent by means of aqua regia. Hence the process is not so expensive as it might at first sight appear.

Redtenbacher has worked out an analogous process to Bunsen's, founded upon the different solubility of the three atoms—$Al. R (SO_4)_2+12H_2O$. At 17° C. 100 parts of water dissolve of the alum of

Potassium	*Rubidium*	*Cæsium*
13.5	2.27	0.62

parts. Sodium and lithium alum are very easily soluble in water, and remain dissolved in the first mother-liquor when the mixed alum of K, Rb, and Cs crystallizes out. These three alums are parted by repeated crystallization, and the rare alkalis recovered from their respective alums by precipitation with chloride of platinum.

The separation of rubidium and cæsium offers great difficulties. According to Godeffroy an approximate separation may be effected by dissolving the mixed chlorides in strong hydrochloric acid, and adding a solution of terchloride of antimony in the same menstruum; the cæsium (chiefly) comes down as $SbCl_3+6CsCl$; the bulk of the rubidium remains dissolved. The two rare alkali metals are so closely similar to potassium that it will suffice to give a tabular statement of the principal points of difference. By way of introduction, however, we may state that rubidium metal was prepared by Bunsen from the black flux obtained by igniting the bitartrate, by Brunner's method for potassium. Metallic cæsium, it seems, cannot be thus obtained; but in 1883 Setterberg made it by the electrolysis of a fused mixture of the cyanides of cæsium and barium.

	Potassium.	*Rubidium.*	*Cæsium.*
Atomic weights O=16...	K=39.136	Rb=85.4	Cs=133.0
Free Metals—			
Specific gravity..........	0.865	1.52	1.88
Fusing point..............	62.5°	38.5°	26° to 27° C.
Volatility increases>⟶			
Hydrates, RHO—Very similar to one another; the basility increases>⟶			
Chlorides, RCl...	*Vide supra.* Almost insoluble in alcohol.	Permanent in air. More soluble than KCl. Soluble in alcohol.	Deliquescent.
Sulphates, R_2SO_4—			
100 parts of water dissolve............	At − 2° C. 8 " 70° C. 19.8	? 42	159 ?
Carbonates, R_2CO_3—All very soluble in water.			
100 parts of alcohol dissolve...............	At 19° C. 0	0.74	11.1
Alums *Chloroplatinates*	Solubility decreases>⟶ (*vide supra*).		

Analysis.—In this section we treat of the detection and determination of alkali metals generally. If the given substance is a solid, a good preliminary test is to heat about one centigramme of it at one end of a fine platinum wire in the flame-mantle of a Bunsen lamp, or in a blow-pipe flame just at the end of the inner cone. Most alkali salts are sufficiently volatile to impart to the flame the color characteristic of the respective metallic vapor. Certain native silicates and certain other compounds do not volatilize, but these can be rendered amenable to the test by mixing them with sulphate of lime and then applying the flame, whereupon alkaline sulphate is formed which volatilizes. The flame-colors are—

Potassium, Rubidium, Cæsium.	*Sodium.*	*Lithium.*
Violet.	Yellow.	Red.

These flame-reactions are very delicate but not conclusive, because in the case of mixtures several colors may be radiated out at the same time, and one may eclipse all the rest—this holds, for instance, for things containing sodium, whose flame-color is more intense than that of any other metal—or a mixed color may be produced which the eye is incompetent to analyze. The spectrum apparatus here comes in usefully; and by means of it it is in general possible to see the lines characteristic of the several metals in presence of, or at least after, one another, because as a rule the several metals are present as compounds of different volatility.

For a thorough analysis it is necessary to begin by bringing the substance into aqueous or acid solution, and next to eliminate all that is *not* alkali metal by suitable methods. A certain set of heavy metals can be precipitated as sulphides by means of sulphuretted hydrogen in the presence of acid, all the rest of these by means of sulphide of ammonium from an alkaline solution. From the filtrate, barium, strontium, and calcium are easily precipitated by means of carbonate of ammonia on boiling, so that, if the filtrate from these carbonates is evaporated to dryness and the residue kept at a dull red heat long enough to drive away the ammonia salts, nothing can be left but salts of alkali metals and magnesium. This residue is dissolved in a *small* quantity of water, and any residual basic salt of magnesium filtered off. The filtrate is then ready to be tested for alkali metals as follows: *if magnesia be absent*, potassium or rubidium (not cæsium) can be detected by addition (to a neutral or feebly acetic solution) of a saturated solution of bitartrate of soda. Potassium and rubidium come down as crystalline bitartrates. The reaction may take some time to become manifest, but can be accelerated by vigorous stirring. In a separate quantity of the solution lithium may be searched for by means of carbonate of soda or trisodic phosphate as explained under LITHIUM (vol. xiv. p. 703). For soda we have no characteristic precipitant. In any case the spectrum apparatus should be used for controlling and, if necessary, supplementing the wet-way tests. The case of *magnesia being present* need not be specially considered, because the qualitative method will easily be deduced from what is said in the following paragraph.

Quantitative Determination.—An exhaustive treatment of this subject would be out of place here. We confine ourselves to two cases. (1) A mixture of alkaline chlorides only. In this case the potassium (including Rb and Cs) is best separated out by adding a quantity of chloroplatinic-acid solution sufficient to convert *all the metals* into choloroplatinates, to evaporate to dryness over a water-bath, and from the residue to extract the lithium and sodium salts by lixiviation with alcohol of 70 per cent. (by weight). The residual chloroplatinate is collected on a filter, dried at 110° C., and, if Rb and Cs are absent, weighed as chloroplatinate of potassium, $PtCl_6K_x(PtCl_6K_2 \times 0.3071 = 2KCl)$. The chloride of sodium is determined by difference—if lithium be absent. The case of its presence cannot be here considered. (2) A mixture of alkalis combined with sulphuric acid, or such volatile acids as can be expelled by sulphuric. In this case it is best to begin by converting the whole into neutral sulphates, and then to apply the method of Finkener, which, amongst other advantages, offers the one that it does not demand the absence of magnesia. The mixed sulphate is dissolved in water and the solution mixed with a little more than the volume of chloroplatinic acid ("platinum solution") demanded by the potassium (Rb and Cs). The mixture is placed in a water bath and, if necessary, diluted with sufficient water to bring the whole of the precipitated chloroplatinate into hot solution. The solution is then evaporated very nearly to dryness (on the water bath, with continuous stirring towards the end to avoid formation of crusts), allowed to cool, and the residue mixed, first with twenty times its volume of absolute alcohol, then with ten volumes of absolute ether. The mixture is allowed to stand in a well-covered vessel for some hours, to enable the precipitate to settle completely. The precipitate contains all the potassium as chloroplatinate, and most of the sodium and magnesium, and also part of the lithium in the sulphate form. It is washed with ether-alcohol (to complete filtrate A), and then lixiviated as quickly as possible with cold concentrated solution of sal-ammoniac, which dissolves away the sulphates (filtrate B). The residual chloroplatinate is dried within the filter in a porcelain crucible, which is next heated so as to char the paper at the lowest temperature. The residue is then ignited gently in hydrogen, and from the resulting residue the chloride of potassium is extracted by water, to be determined as chloroplatinate, as shown in (1), or otherwise. From the undissolved residue the charcoal is burned away and the residual platinum weighed to check the potassium determination. After removal of the ether and alcohol from filtrate A by distillation, the two filtrates A and B are mixed, evaporated to dryness, the ammonia salts chased away by heating, and the residue is reduced (at about 300° C.) in hydrogen to bring the platinum into the form of metal, from which the magnesia and alkali salts are easily dissolved away by means of water or dilute acid. The whole of the salts are then made into neutral sulphate, which is weighed and then dissolved in a known weight of water. The lithium and the magnesium are determined in aliquot parts of the solution and calculated as sulphates. The soda is found by difference. A case intermediate between (1) and (2) often presents itself in practice. We refer to the commercial muriate from Stassfurt. In such an impure muriate the potassium can be determined promptly and accurately by adding to the very concentrated solution of the substance a large excess of a very concentrated solution of chloroplatinic acid,—"excess" meaning more platinum than necessary to make all the metals into chloroplatinates. The precipitate is allowed to settle, collected on a small filter, and washed, first with successive instalments of a platinum solution (containing 5 per cent. of metal), then with ordinary alcohol; it is next dried, and weighed as above (Tatlock's method slightly modified). In exact analyses the small quantity of potassium which passes into the filtrate is recovered—ultimately by Finkener's method—and allowed for. (W. D.)

POTATO. The potato (*Solanum tuberosum*) is too well known to need detailed description. It owes its value to the peculiar habit of developing underground slender leafless shoots or branches which differ in character and office from the true roots, and which gradually swell at the free end and thus produce the tubers with which we are so familiar. The nature of these tubers is further rendered evident by the presence of "eyes" or leaf-buds, which in due time lengthen into shoots and form the haulm or stems of the plant. Such buds are not, under ordinary circumstances, formed on roots. What the determining cause of the formation of the tubers may be is not known, the object evidently is to secure a method of propagation independently of the seed. Starch and other matters are stored up in the tubers, as in the perisperm of a seed, and in due season are rendered available for the nutrition of the young shoots when they begin to grow. The young shoots, in fact, derive their nourishment from the parent tuber until by the production of roots and leaves they are enabled to shift for themselves. When grown under natural circumstances (without being earthed up, as is usually done by the cultivator) the tubers are relatively small and close to the surface of the soil, or even lie upon it. In the latter case they become green and have an acrid taste, which would probably render them objectionable to predatory animals or insects, and which certainly renders them unpalatable to human beings, and, in consideration of the known poisonous qualities of many *Solanaceæ*, might probably cause them to be unwholesome. Hence the recommendation to keep the tubers in cellars or pits, not exposed to the light, for the green coloring matter is, in this case, developed in the tubers independently of the direct action of light on the leaves. Among the six hundred species of *Solanum* less than a dozen have this property of forming tubers, but similar growths are formed at the ends of the shoots of the common bramble, of the *Convolvulus sepium*, of the *Helianthus tuberosus*, the so-called Jerusalem artichoke, of *Sagittaria*, and other plants. Tubers are also sometimes formed on aerial branches, as in some Aroids, Begonias, etc. The production of small green tubers on the haulm, in the axils of the leaves of the potato, is not very unfrequent, and affords an interesting proof of the true morphological nature of the underground shoots and tubers. The so-called fir-cone potatoes, which are elongated and provided with scales at more or less regular intervals, show also very clearly that the tuber is only a thickened branch with "eyes" set in regular order, as in an ordinary shoot. The potato tuber consists mainly of a mass of cells filled with starch and encircled by a thin corky rind. A few vessels and woody fibres traverse the tubers.

The chief value of the potato as an article of diet consists in the starch it contains, and to a less extent in the potash and other salts. The quantity of nitrogen in its composition is small, and hence it should not be relied on to constitute the staple article of diet, unless in admixture with milk or some other substance containing nitrogen. Letheby gives the following as the average composition of the potato—

Nitrogenous matters	2.1	Saline matter	0.7
Starch, etc	18.8	Water	75.0
Sugar	3.2		
Fat	0.2		100.0

—a result which approximates closely to the average of nineteen analyses cited in *How Crops Grow* from Grouven. In some analyses, however, the starch is put as low as 13.30, and the nitrogenous matter as 0.92 (Dehérain, *Cours de Chimie Agricole*, p. 159). Boussingault gives 25.2 per cent. of starch and 3 per cent. of nitrogenous matter. Warington states that the proportion of nitrogenous to non-nitrogenous matter in the digestible part of potatoes is as 1 to 10.6. The composition of the tubers evidently varies according to season, soils, manuring, the variety grown, etc., but the figures cited will give a sufficiently accurate idea of it. The "ash" contains on the average of thirty-one analyses as much as 59.8 per cent. of potash, and 19.1 per cent. of phosphoric acid, the other ingredients being in very minute proportion. Where, as in some parts of northern Germany, the potato is grown for the purpose of manufacturing spirit, great attention is necessarily paid to the quantitative analysis of the starchy and saccharine matters, which are found to vary much in particular varieties, irrespective of the conditions under which they are grown.

The origin and history of the potato are better known than in the case of many long-cultivated plants. It is to the Spaniards that we owe this valuable esculent, "optimum benigni Numinis donum, dapes grata diviti, pauperi panis," as it has been called by an eminent botanist. The Spaniards met with it in the neighborhood of Quito, where it was cultivated by the natives. In the *Cronica de Peru* of Pedro Cieça, published at Seville in 1553, as well as in other Spanish books of about the same date, the potato is mentioned under the name "batata" or "papa." Hieronymus Cardan, a monk, is supposed to have been the first to introduce it from Peru into Spain, from which country it passed into Italy and thence into Belgium. Carl Sprengel, cited by Professor Edward Morren in his biographical sketch entitled *Charles de l'Escluse, sa Vie et ses Œuvres*, and to which we are indebted for some of the historical details given below, states that the potato was introduced from Santa Fé into England by John Hawkins in 1563 (*Garten Zeitung*, 1805, p. 346). If this be so, it is a question whether the English and not the Spaniards are not entitled to the credit of the first introduction; but, according to Sir Joseph Banks, the plant brought by Drake and Hawkins was not our potato but the SWEET POTATO (see below).

In 1587 or 1588 De l'Escluse, better known under the Latinized appellation of "Clusius," received the plant from Philippe de Sivry, lord of Waldheim and governor of Mons, who in his turn received it from some member of the suite of the papal legate. At the discovery of America, we are told by Humboldt, the plant was cultivated in all the temperate parts of the continent from Chili to New Granada, but not in Mexico. Nearly a hundred years afterwards, in 1585 or 1586, potato tubers were brought from North Carolina and Virginia to Ireland on the return of the colonists sent out by Sir Walter Raleigh, and were first cultivated on Sir Walter's estate near Cork. The tubers introduced under the auspices of Raleigh were thus imported a few years later than those mentioned by Clusius in 1588, which must have been in cultivation in Italy and Spain for some years prior to that time. Be this as it may, the earliest representation of the plant is to be found in Gerard's *Herbal*, published in 1597. The plant is mentioned under the name *Papus orbiculatus* in the first edition of the *Catalogus*, of the same author, published in 1596, and again in the second edition, which was dedicated to Sir Walter Raleigh (1599). It is, however, in the *Herbal* that we find the first description of the potato, accompanied by a woodcut sufficiently correct to leave no doubt whatever as to the identity of the plant. In this work (p. 781) it is called "Battata Virginiana sive Virginianorum, et Pappus, Potatoes of Virginia." Gerard says—

> "The roote is thicke, fat and tuberous; not much differing either in shape, colour or taste from the common Potatoes, saving that the rootes hereof are not so great nor long; some of them as round as a ball, some ouall or egge-fashion, some longer and others shorter; which knobbie rootes are fastened unto the stalks with an infinite number of threddie strings . . . It groweth naturally in America where it was first discovered, as reporteth C. Clusius, since which time I have received rootes hereof from Virginia otherwise called Norembega which growe and prosper in my garden, as in their owne native countrie."

The "common Potatoes" of which Gerard speaks are the tubers of *Convolvulus batatas*, the Sweet Potato, which nowadays would not in Great Britain be spoken of as common. Evidently the author attached great importance to the potato, for in the frontispiece to his volume he is represented with the flower and foliage of the plant in his hand. In his opinion it was, like the common potato, "a foode as also a meate for pleasure equall in goodnesse and wholesomenesse unto the same, being either rosted in the embers, or boiled and eaten with oile, vinegar and pepper, or dressed any other way by the hand of some cunning in cookerie." A second edition of the *Herbal* was published in 1636 by Thomas Johnson, with a different illustration from that given in the first edition, and one which in some respects, as in showing the true nature of the tuber, is superior to the first. The phenomenon of growing out or "super-tuberation" is shown in this cut.

Previous to this (in 1629) Parkinson, the friend and associate of Johnson, had published his *Paradisus*, in which (p. 517) he gives an indifferent figure of the potato under the name of *Papas seu Battatas Virginianorum*, and adds details as to the method of cooking the tubers which seem to indicate that they were still luxuries rather than necessaries. Chabræus, who wrote in 1666, tells us that the Peruvians made bread from the tubers, which they called "chunno." He further tells us that by the natives "*Virginiæ insulæ*" the plant was called "openauk," and that it is now known in European gardens, but he makes no mention of its use as an esculent vegetable, and, indeed, includes it among "plantæ malignæ et venenatæ." Heriot (De Bry's *Collection of Voyages*), in his report on Virginia, describes a plant under the same name "with roots as large as a walnut and others much larger; they grow in damp soil, many hanging together as if fixed on ropes; they are good food either boiled or roasted." The plant (which is not a native of Virginia) was probably introduced there in consequence of the intercourse of the early settlers with the Spaniards, who derived the plant from Peru or other parts of South America, and perhaps provisioned their ships with its tubers. In any case the cultivation of the potato in England made but little progress, even though it was strongly urged by the Royal Society in 1663; and not much more than a century has elapsed since its cultivation on a large scale became general.

The source of the potato being known, it is a matter of interest to determine the particular species from which the cultivated forms have descended and the exact part of the great American continent in which it is indigenous. As to the first point, botanists are agreed that the only species in general cultivation in Great Britain is the one which Bauhin, in his *Phytopinax*, p. 89 (1596), called *Solanum tuberosum esculentum*, a name adopted by Linnæus (omitting the last epithet), and employed by all botanical writers. This species is native in Chili, but it is very doubtful if it is truly wild farther north. Mr. Baker (*Journal* of the Linnean Society, vol. xx., 1884, p. 489) has reviewed the tuber-bearing species of *Solanum* from a systematic point of view as well as from that of geographical distribution. Out of twenty so-called species he considers six to be really distinct, while the others are merely synonymous or trifling variations. The six admitted tuber-bearing species are *S. tuberosum*, *S. Maglia*, *S. Commersoni*, *S. cardiophyllum*, *S. Jamesii*, and *S. oxycarpum*.

S. tuberosum is, according to Mr. Baker, a native not only of the Andes of Chili but also of those of Peru, Bolivia, Ecuador, and Colombia, also of the mountains of Costa Rica, Mexico, and the southwestern United States. It seems most probable, however, that some at least of the plants mentioned in the northern part of the American continent have no claim to be considered absolutely wild, but are the descendants of cultivated forms. *S. Maglia* is a native of the Chilian coast as far south as the Chonos Archipelago, and was cultivated in the garden of the Horticultural Society at Chiswick in 1822, being considered by Sabine, in his paper on the native country of the wild potato, to be the true *S. tuberosum* and the origin of the cultivated forms. This species was also found by Darwin in Chili, and was considered by him, as by Sabine before him, to be the wild potato. It is remarkable, says Darwin, that the same plant should be found in the sterile mountains of central Chili, where a drop of rain does not fall for more than six months, and within the damp forests of these southern (Chonos) islands. The explanation, according to Baker, is that the plant of the dry mountains is *S. tuberosum*, that of the coast is *S. Maglia*. It must, however, be stated that, although Mr. Baker refers to the plants figured by Sabine (*Trans. Hort. Soc. Lond.*, vol. v. p. 249) as being without doubt *S. Maglia*, A. de Candolle (*Origine des Plantes cultivées*, p. 40) is equally emphatic in the opinion, "ce qui saute aux yeux," that the plant grown from Chilian tubers and figured in the plate before cited is *S. tuberosum*. *S. Commersoni* occurs in Uruguay, Buenos Ayres, and the Argentine Republic, in rocky situations at a low level. Under the name of *S. Orondii* it has lately been introduced into western France, where it is not only hardy but produces abundance of tubers, which are palatable, but have a slightly acid taste. The tubers give promise of improvement under cultivation. *S. cardiophyllum*, described by Lindley in the *Journal* of the Horticultural Society, is a native of the mountains of central Mexico at elevations of 8000 to 9000 feet. *S. Jamesii* is a well-defined species occurring in the mountains of Colorado, New Mexico, and Arizona, and also in Mexico. In a wild state the tubers are not larger than marbles, but as the plant is now in cultivation in England it may be expected to improve in this particular. *S. oxycarpum* is stated by Mr. Baker to be a little known but very distinct tuberous species from central Mexico.[1]

Mr. Baker looks upon the forms enumerated not only with the eye of a systematic botanist but with the tendencies of one whose object is to assign varying forms to one common type from which they have, or may probably have, arisen. But from a practical point of view the forms in question require careful analysis rather than synthesis. Their morphological peculiarities and chemical constitution deserve attentive consideration as to their degree of constancy, and more particularly as to any relation that may be traced between them and the climatic circumstances under which they grow naturally, and their power of resistance to the attacks of disease. A review of the localities in which the presence of *S. tuberosum* and its tuber-bearing allies has been ascertained shows that, broadly, these varieties may be divided into mountainous and littoral. In either case they would not be subjected, at least in their growing season, to the same extremes of heat, cold, and drought as plants growing on inland plains. Again, those forms growing at a high elevation would probably start into growth later in the season than those near the coast. The significance of these facts from a cultural point of view is two-fold: for, while a late variety is desirable for culture in Great Britain, as ensuring more or less immunity from spring frost, which would injure the early sorts, it is, on the other hand, undesirable, because late varieties are more liable to be attacked by the potato disease, which as a rule makes its appearance at or about the time when the earliest varieties are ready for lifting, but before the late varieties are matured, and consequently while they are still exposed to the destructive influences of the fungus.

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[1] Although these six are the only species admitted as such by Mr. Baker, it is well to note some of the forms or varieties, because, although they may not be entitled to specific rank, which after all is a matter of opinion, they may yet be of importance in the future. First of all may be mentioned the *S. etuberosum* of Lindley, differing from the common *S. tuberosum* in not producing tubers. This was found in Chili, and is probably not specifically distinct, although exceptional, for it is by no means very unusual to find even cultivated plants produce no tubers. *S. Fernandezianum* is, according to Baker, a form of *S. tuberosum*, but if so its habitat in the mountain woods of Juan Fernandez is climatically different from that in the dry mountains of central Chili, where, as we have seen, the true *S. tuberosum* grows. *S. otites* was found recently by M. André on the summit of Quindiu in Colombia, at a height of 11,483 feet, in a rigorous climate, only about 3300 feet below the perpetual snows of Tolima. It produces tubers of the size of a nut. *S. Andreanum*, found by M. André at Cauca, at an elevation of 6234 feet, was considered by the traveller to be the true *S. tuberosum*, but this view is not shared by Mr. Baker, who named it after the discoverer. Its tubers, if it produces any, have not been seen. *S. immite* is probably only a slight variety of *S. tuberosum*, as are also the Venezuelan *S. colombianum*, *S. verrucosum*, *S. demissum*, and *S. utile*. *S. Fendleri*, a native of the mountains of New Mexico and Arizona, was considered by Asa Gray to be likewise a form of *S. tuberosum*.

In cultivation[1] the potato varies very greatly not only as to the season of its growth but also as to productiveness, the vigor and luxuriance of its foliage, the presence or relative absence of hairs, the form of the leaves, the size and color of the flowers, etc. It is probable that a more careful investigation of these peculiarities, and especially of those connected with the microscopical anatomy of the leaves, would give serviceable indications of the varieties most or least susceptible to the disease,—a point at present hardly if at all attended to. As to the tubers, they vary greatly in size, form, and color; gardeners divide them into rounded forms and long forms or "kidneys;" "lapstones" are more or less flattened; and "pebble" varieties are long potatoes broader at one end than at the other. The color of the rind, yellowish, brown, or purple, furnishes distinctions, as does the yellow or white color of the flesh. The color of the eyes and their prominence or depression are relatively very constant characteristics. These variations have originated chiefly by cross-breeding, but not invariably so, as some varieties rarely, if ever, produce flowers in Britain, and yet "sports" have been observed in their tubers and have become the parents of new varieties. Various methods have been proposed for the prevention or arrest of the ravages of the fungus which causes the "potato disease" (see below). In addition to different modes of cultivation, attempts have been made to secure varieties less liable than others to disease, and, although no great measure of success has been attained, still the matter is not without promise, seeing how the early varieties, as before stated, escape the full virulence of the malady. Other attempts have been made to infuse a hardier constitution by hybridizing the potato with hardy species such as *S. Dulcamara* and *S. nigrum*. Hybrids were accordingly raised by Mr. Maule, but they all suffered from the disease as much as the parents, and it is to be feared that the hybrids raised between the common potatoes and some of the six species mentioned by Mr. Baker may suffer a like fate. This, however, remains to be proved. Mr. Maule, disappointed with his hybridization experiments, then tried the effect of grafting. With this view he grafted *S. nigrum* on to a shoot of the potato. New tubers were formed, the foliage being wholly that of *S. nigrum*. In another experiment he grafted the potato on to *S. Dulcamara*. In one case tubers were produced on the graft (the potato), but none on the *Dulcamara* stock, either above or below ground, while in another case tubers were actually produced on the underground portions of *S. Dulcamara*. Mr. Maule's experiments were most ingenious, but the theory he gave in his *The Potato, what is it?* (Bristol, 1876) will not commend itself to physiologists, and there is no evidence to show whether the grafts he obtained were attacked by the parasite or even whether they had a chance of being so. Mr. Maule's experiments, especially the one last mentioned, afford confirmation of the possibility of graft hybridization being effected. Various experimenters, especially Mr. Fenn, have asserted that by engrafting an eye of one variety into the tuber of another, not only will adhesion take place but the new tubers will present great variety of character; and this indeed seems to be the case from the numerous specimens shown by Mr. Fenn at the Royal Horticultural Society, but it can hardly be considered as established that the variations in question were the result of any commingling of the essences of the two varieties. The wound may simply have set up that variation in the buds the occasional existence of which has been already noted. The last-cited experiment of Mr. Maule's, however, is much more conclusive. Mr. A. Dean also (*Gardeners' Chronicle*, 2d September, 1876, p. 304) succeeded in grafting the potato on to the tomato, with the result that, although no tubers were found on the root of the tomato, numerous tubers were produced on the sides of the branches of the potato. Another experiment may be here mentioned as throwing light on the formation of tubers, one wherein Mr. Burbidge observed the production of tubers at the portion of an ordinary cutting of *S. Commersoni* inserted in the soil. In this case no tubers were formed above ground. (M. T. M.)

POTATO DISEASE.

There are few agricultural subjects of greater importance than the culture of the potato and the losses entailed by potato disease. The number of acres in Great Britain alone under cultivation for potatoes is generally more than half a million (543,455 in 1883, 562,344 in 1884); the average weight of the produce per acre may be taken at five tons, the average price about £5 per ton, so that the commercial value of each year's crop commonly ranges between £13,000,000 [$63,180,000] and £15,000,000 [$72,900,000]. It is not unusual in bad seasons for a single grower to lose from £1000 [$4860] to £1500 [$7290] through disease; for the market grower sometimes not only loses the entire produce, or nearly so, but loses also the value of the seed, the guano, the farm-yard manure, the rent, and the labor. Growers sometimes lose £30 [$145.80] per acre in one season, for, exclusive of the diseased produce, £10 [$48.60] may be put down to guano and dung, £4, 10s. to rent, tithes, and taxes, £6, 10s. for seed, and £2 for digging; added to this there are ploughing, harrowing, overlooking, earthing up, sacks, carriage to and fro, and many minor expenses. The losses range in amount according to the virulence and general extent of the disease. In extreme cases every tuber is lost, as the produce will not even pay the cost of lifting. The year of the great potato famine in Britain was 1845, but the Rev. M. J. Berkeley, in his famous essay on the potato murrain published by the Royal Horticultural Society of England in 1846, stated that a very serious disease of the potato named the "curl" had at that time been known in Britain for more than half a century. We now know that the "curl" is a condition of the true potato murrain. As a rule, although there are a few exceptions, the disease occurs wherever the potato is grown. It is known in South America, in the home of the potato plant.

The disease of the potatoes is caused by the growth of a fungus named *Peronospora infestans*, Mont., within the tissues of the host plant, and this fungus has the peculiar property of piercing and breaking up the cellular tissues, and setting up putrescence in the course of its growth. The parasite, which has a somewhat restricted range of host plants, chiefly invades the potato, *Solanum tuberosum*, L.; the bittersweet, *S. Dulcamara*, L.; *S. demissum*, Lind.; and *S. cardiophyllum*, Lind. It is also very destructive to the tomato, *Lycopersicum esculentum*, Mill., and to all or nearly all the other species of *Lycopersicum*. At times it attacks petunias and even Scrophulariaceous plants, as *Anthocersis* and *Schizanthus*. A second species of *Peronospora* is known on Solanaceous plants, viz., *P. Hyoscyami*, D.By., a parasite of the common henbane.

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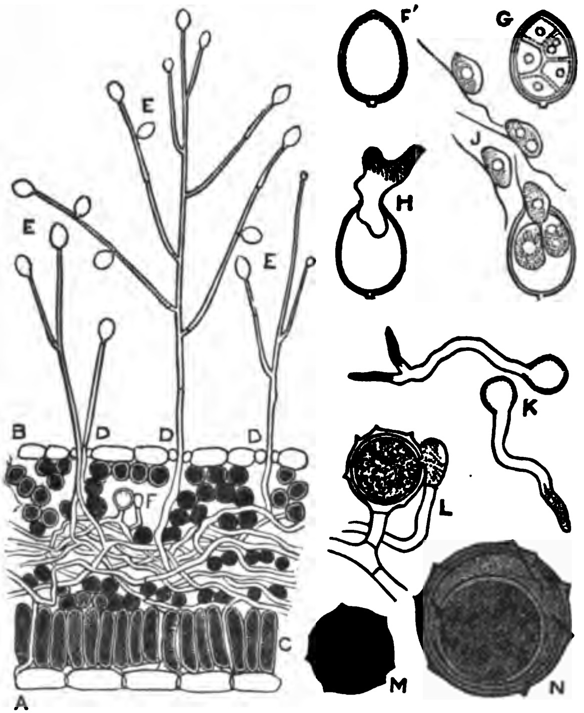
[1] See HORTICULTURE, vol. xii. p. 296.

In England the disease is generally first seen during the last ten days of July; its extension is greatly favored by the warm and showery weather peculiar to that period of the year, and according as the warm and humid weather of autumn is late or early the murrain varies a little in its time of appearance. To the unaided eye the disease is seen as purplish brown or blackish blotches of various sizes, at first on the tips and edges of the leaves, and ultimately upon the leaf-stalks and the larger stems. On gathering the foliage for examination, especially in humid weather, these dark blotches are seen to be putrid, and when the disease takes a bad form the dying leaves give out a highly offensive odor. The fungus, which is chiefly within the leaves and stems, seldom emerges through the firm upper surface of the leaf; it commonly appears as a white bloom or mildew on the circumference of the disease-patches on the under surface. It grows within the tissues from central spots towards an ever-extending circumference, carrying putrescence in its course. As the patches extend in size by the growth of the fungus they at length become confluent, and so the leaves are destroyed and an end is put to one of the chief vital functions of the host plant. On the destruction of the leaves the fungus either descends the stem by the interior or the spores are washed by the rain to the tubers in the ground. In either case the tubers are reached by the fungus or its spores, and so become diseased. The fungus which undoubtedly causes the mischief is very small in size, and under the microscope appears slightly whitish or colorless. The highest powers are required to see all parts of the parasite.

The accompanying illustration, drawn from nature, shows the habit and structure of the fungus, *Peronospora infestans*, Mont. The letters A B show a vertical section through a fragment of a potato leaf, enlarged 100 diameters; A is the upper surface line, and B the lower; the lower surface of the leaf is shown at the top, the better to exhibit the nature of the fungus growths. Between A and B the loose cellular tissue of which the leaf is partly built up is seen in section, and at C the vertical pallisade cells which give firmness to the upper surface of the leaf. Amongst the minute spherical cells within the substance of the leaf numerous transparent threads are shown; these are the mycelial threads or spawn of the fungus; wherever they touch the leaf-cells they pierce or break down the tissue, and so set up decomposition, as indicated by the darker shading. The lower surface of the potato leaf is furnished with numerous organs of transpiration or stomata, which are narrow orifices opening into the leaf and from which moisture is transpired in the form of fine vapor. Out of these small openings the fungus threads emerge, as shown at D, D, D. When the threads reach the air they branch in a tree-like manner, and each branch carries one or more ovate reproductive bodies termed "spores" or "conidia," bodies roughly comparable with seeds as shown at E, E, E. Sometimes other reproductive bodies roughly comparable with the anthers and pistils of flowering plants are borne inside the leaf, stem, or tuber, as at F; the larger body of these is female, and is termed an "oogonium," and the smaller, which at length pierces the oogonium, is male, and is termed an "antheridium." When the spores or conidia are magnified 400 diameters they are seen as at F′, and the contained protoplasm often breaks up into a definite number of parts, as at G. When a spore like F germinates it protrudes an amœba-like mass of protoplasm, as shown at H, which is capable of reproducing the potato fungus at once, and when a differentiated conidium as at G germinates it expels about eight minute mobile bodies called "zoospores," each zoospore being furnished with two extremely attenuated vibrating hairs termed "cilia," as shown at J. These zoospores swim about in any film of moisture, and on going to rest take a spherical form, germinate, and produce threads of mycelium as at K; the mycelium from the germinating conidia or zoospores soon finds its way into the tissues of the potato leaf by the organs of transpiration, and the process of growth already described is repeated over and over again till the entire potato leaf, or indeed the whole plant, is reduced to putridity.



Peronospora infestans, Mont.—Fungus of Potato Disease.

The oogonium and antheridium as seen at F are further enlarged to 400 diameters at L; it will here be seen that the smaller male organ or antheridium has projected a fine beak through the walls of the oogonium or female organism; through this beak some of the protoplasm from the antheridium passes into and mingles with the protoplasm of the oogonium; this is the act of fertilization, and an oospore or resting spore (M, N), a body roughly comparable with a seed, is the result. After fertilization the oospores quickly drop from their supporting threads and become free like most ripe fruits. As the potato fungus causes the potato to become putrid the mature oospores or resting spores are necessarily confined to the portions of the potato plant which have been destroyed by the fungus, *i.e.*, either to the decayed leaves or stems or to the diseased tubers; they are brown in color and generally more or less spinulose or warted. They will not germinate till after a rest of nine, ten, or twelve months, or in some instances even two years. They germinate by protruding threads, which speedily bear spores or conidia as at E, or more rarely zoospores as at J. The resting spores were seen by Dr. Rayer and Dr. Montague in 1845, and named (in ignorance of their true nature) *Artotrogus hydnosporus*. The Rev. M. J. Berkeley shortly afterwards identified them as the resting spores of the potato fungus; but they were not seen by any one between the years 1845 and 1875, when in the latter year they were discovered in great abundance and artificially produced from the potato fungus by the writer of this article. At first believed to be rare, they are now known to be amongst the commonest of vegetable productions. The potato fungus is easily made to produce resting spores, and their germination after a year's rest is an observation of no special difficulty. At one time these resting spores were confused by some botanists with a little fugitive transparent fungus, bearing oogonia not half the size of the oogonia of *Peronospora infestans*, and named *Pythium vexans*, D.By.; the latter plant perfects itself in twenty-four hours or at most a day or two, instead of taking a year or more as do the resting spores of the fungus of the potato disease. *Pythium vexans* has no connection whatever with the fungus or the potato disease.

The germinating conidia of the potato fungus, as at E, are not only able to pierce the leaves and stems of the potato plant, and so gain an entry to its interior through the epidermis, but they are also able to pierce the bark of the tuber, especially in young examples. It is therefore obvious that, if the tubers are exposed to the air where they are liable to become slightly cracked by the sun, wind, hail, and rain, and injured by small animals and insects, the spores from the leaves will drop on to the tubers, quickly germinate upon the slightly-injured places, and cause the potatoes to become diseased. Earthing up therefore prevents these injuries, but where practiced to an immoderate extent it materially reduces the produce of tubers. The labor entailed in repeated earthing up is also considered a serious objection to its general adoption.

All diseased potato material should be gathered together and either deeply buried or burnt, as the hibernating germs of the disease (oospores) rest in the decaying potato refuse, and the mycelium itself sometimes hibernates.

See Berkeley's essay, "On the Potato Disease," in *Journal of the Royal Horticultural Society*, vol. i., 1846; Professor A. de Bary, "On the nature of the Potato Fungus," in *Journal of Royal Agricultural Society*, vol. xii., 1876; Earl Cathcart, "The Cultivated Potato," in *Journal of Roy. Agr. Soc.*, 1884; J. G. Baker, "The Tuber-bearing Species of *Solanum*," in *Journal of the Linnean Society*, vol. xx., 1884; and Worthington G. Smith, *Diseases of Field and Garden Crops* (1884). In the latter work a full bibliography is given.

(W. G. SM.)

POTATO, SWEET. This plant (the *Convolvulus batatas*, or *Ipomœa batatas* of some authors) is generally cultivated in the West Indies and most tropical countries for the sake of its tuberous root, which is an article of diet greatly in request. It is a climbing perennial with cordate, entire, or palmately-lobed leaves borne on slender twining stems. The flowers are borne on long stalks in loose clusters or cymes, and have a white or rosy funnel-shaped corolla like that of the common bindweed of English hedges. The edible portion is the root, which dilates into large club-shaped masses filled with starch. It is ill suited to the climate of the United Kingdom, but in tropical countries it is as valuable as the potato is in higher latitudes. The plant is not known in a truly wild state, nor has its origin been ascertained. A. de Candolle concludes that it is in all probability of American origin, though dispersed in Japan, China, the South Sea Islands, Australia, etc. Its migrations are only explained by him on geological grounds of an entirely hypothetical character. It is mentioned by Gerard as the "potato," or "potatus," or "potades" in contradistinction to the "potatoes" of Virginia (*Solanum tuberosum*). He grew it in his garden, but the climate was not warm enough to allow it to flower, and in winter it perished and rotted. But as the appellation "common" is applied to them the roots must have been introduced commonly. Gerard tells us he bought those that he planted at "the Exchange in London," and he gives an interesting account of the uses to which they were put, the manner in which they were prepared as "sweetmeats," and the invigorating properties assigned to them. The allusions in the *Merry Wives of Windsor* and other of Shakespeare's plays in all probability refer to this plant, and not to what we now call the "potato."

POTATO BEETLE or **COLORADO BEETLE.** See COLEOPTERA (*Doryphora decemlineata*), vol. vi. p. 121.

POTEMKIN, GREGORY ALEXANDROVICH (1739–1791), Russian soldier and statesman, was born in 1739 in the village of Domnovo, in the government of Smolensk. His father was a poor nobleman of Polish extraction, but the family had been settled for some time in Russia. Owing to the slender means of his parents, Potemkin's first plan seems to have been to devote himself to the church; but he did not show much inclination for this profession, and eventually embraced the calling of a soldier. His fortunes rose from the time when he assisted the empress Catherine in her conspiracy against her husband on the memorable 10th of July, 1762. On this occasion, when Catherine rode through the ranks, Potemkin, perceiving that she had no plume in her hat, offered her his own. Soon afterwards he became one of the leading favorites and his rise was rapid. We first find him serving under Marshal Roumantzoff against the Turks, but, after having spent some time in the camp, he returned to St. Petersburg, where he became more influential than ever. From 1778 till his death the foreign policy of Russia was almost entirely in his hands. By his agency the Crimea was annexed in 1783, the khan being induced to put himself under Russian protection. In January, 1787, the empress set out with Potemkin to survey her new conquests. The description of this journey and of the fantastic luxury which accompanied it has been often given, and need not be recapitulated here. At Kherson Catherine was met by the emperor Joseph, who had travelled from Austria for that purpose. She there passed under a triumphal arch, on which was inscribed, in Greek letters, "The way to Byzantium." The empress went as far south as Bakhchisarai and Stari Krim, at which point she turned back, reaching St. Petersburg on the 22d of July. Soon afterwards war was declared against Turkey and the siege of Otchakoff commenced in July, 1788. Here Potemkin acted as commander-in-chief, with 150,000 men at his disposal, but it is difficult to say if he had any talent as a soldier, as many able men, among others Souwaroff, served under him, and he was able to appropriate the fruits of their labor and ability. According to some he showed military genius, according to others he was entirely destitute of it. He is said to have introduced some very useful changes in the dress and discipline of the Russion armies. Otchakoff was taken in December, 1788, with terrible slaughter on both sides, and was followed by the victories of Souwaroff at Bender and Ismail,* the latter of which was taken in 1790, when Souwaroff sent his celebrated couplet to Catherine:

"Slava Bogu! Slava Vam!
Krepost vsiata i ya tam."[1]

In March, 1791, Potemkin made his triumphal entry into St. Petersburg. The description of the banquet which he gave in honor of the empress at his Taurian palace rivals any scene of Oriental magnificence. But his constitution was now breaking; his body at a comparatively early age was worn out by his labors and excesses. Yet he refused to have recourse to medicine, lived upon salt meat and raw turnips, and drank strong wines and spirits. In the latter part of the year 1791 he went to the south of Russia, the scene of his former triumphs, and lay ill for some time at Jassy, whence he attempted to move to Otchakoff, but after travelling a few versts he could no longer endure the motion of the carriage. He accordingly was lifted out and a carpet was spread for him at the foot of a tree, upon which he soon expired in the arms of his niece, Countess Branicka, on the 15th of October, 1791. His body was interred at Kherson, but, from inquiries made on the spot by the traveller Edward Clarke at the commencement of the present century, it seems to have been disinterred and thrown into a ditch by order of the emperor Paul, who hated him.

During his lifetime Potemkin did not escape the censure of his countrymen, in proof of which may be cited the attacks of Derzhavin and Radistcheff. Strange stories are told of his extravagance and whimsicality, among others that he had in his library several volumes of bank notes bound together. He seems to have "sickened of a vague disease" in the midst of all his splendor. His wealth was boundless, as, besides his personal property, he had large landed estates and many thousands of serfs. He was arrogant and capricious, a thorough despot, and a man of grossly licentious life. That he was possessed of some ability cannot be doubted, but, taking him all in all, we must say that the prominence of a man of such character has left a deep stain upon the annals of Russia.

POTENZA, a city of Italy, the chief town of Potenza (Basilicata), lies in the heart of the country, on an isolated hill in the valley of the Basento or Busento (Casuentus or Masuentum), 69 miles by rail east of Salerno and 51 west-northwest of Metapontum, where the Basento reaches the Gulf of Taranto and the railway joins the line between Taranto and Reggio. It is much exposed to stormy winds, and has in general a far more northern climate than its astronomical position (40° 40′ N. lat.) implies. Along with Marsico Nuovo the city forms an episcopal diocese dependent on Acerenza, and under the Bourbon Government it was considered a fortified place of the fourth class. The buildings of chief note are the cathedral, the seminary, and the hospital of San Carlo (1869). The population was 18,295 in 1871 and 16,968 in 1881 (commune, 20,281).

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[1] Glory to God! glory to you!
The fortress is taken and I am there.

* [A writer in *Temple Bar* says the occasion was the capture of Tutukay, and gives the last line as originally "Tutukay vzala, I ya tam."—AM. ED.]

The hill on which Potenza now stands was originally occupied only by the citadel of the ancient Potentia, which spread out in the valley below, and must have been, to judge by its numerous inscriptions, a flourishing municipium during the Roman empire. The old town was destroyed by Frederick II., and again by earthquake in 1273; the erection of the new town on the hill probably dates from this latter event. By the Angevines Potenza was made a domain of the San Severino family; in the beginning of the 15th century it was held by Francesco Sforza, and in 1435 it passed to the Guevara family; the Loffredi, who succeeded by marriage, continued in possession till the abolition of the great fiefs. In 1694 there was a severe earthquake; and the more terrible earthquake which on 16th and 17th December, 1857, passed through southern Italy, and in the Basilicata alone killed 32,475 persons, proved particularly disastrous at Potenza, laying the greater part of the city in ruins.

POTI, a seaport town of Trans-Caucasia in the government of Kutais (Mingrelia), lies at the mouth of the Rhion (Phasis) on the coast of the Black Sea, 193 miles west-northwest of Tiflis, with which it is connected by a railway opened (except the tunnel of Suram) in 1872. The white walls of the fortress may be seen at a great distance contrasting with the green trees which surround them, and the lighthouse, 117 feet high, is visible 17 miles. Situated in a low and marshy delta not more than 2½ feet above the level of the river, Poti is extremely unhealthy, fever and ague prevailing in summer and autumn. Ever since the Russians obtained possession of the place, they have labored to improve the town and port, but with comparatively limited success. The houses are built of wood and supported on piles. After Batoum was transferred to Russia in 1878 it was thought that Poti would be abandoned as a port, but the Commission of Inquiry appointed in 1883 decided in its favor. Works estimated to cost 2,365,000 roubles [$1,821,050] and to be finished in four years were accordingly undertaken. The population of the town is given as 3112 in the Russian *Calendar* for 1882.

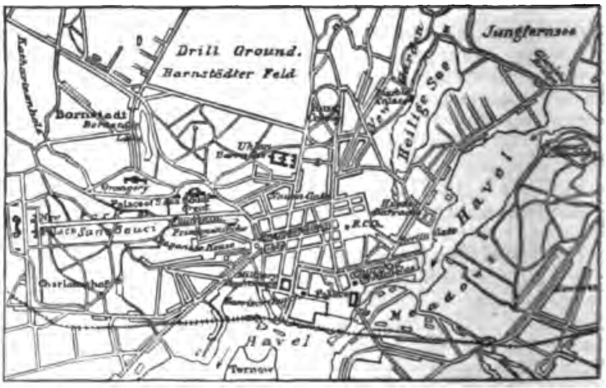
Poti represents the ancient Phasis, a commercial colony of the people of Miletus. The present fortress was built in 1578 by Amurath III. at the time of the war with Persia. In 1640 it was destroyed by the Imeritians, but it was again restored and enlarged, the ancient ruins in the neighborhood yielding the necessary material. The town was a great market for the trade in slaves. It was captured by the Russians in 1812, and again in 1829.

POTOMAC, a river of the United States, which joins Chesapeake Bay by a considerable estuary after a course of about 400 miles. The northern branch of the upper river rises in the Alleghanies, West Virginia, the southern in the Shenandoah Mountains. Affluents are received from Pennsylvania, Maryland, Virginia, and West Virginia,—the most important of all being the Shenandoah, which joins it at Harper's Ferry, below which the united stream breaks through the line of the Blue Ridge. Ships ascend for a short distance above Washington (the capital of the United States), or a total distance from the sea of 125 miles.

POTOSI (not to be confounded with San Luis Potosi, the state and state capital in Mexico) is a town of Bolivia, at the head of the department of Potosi, in 19° 36′ S. lat. and 65° 46′ W. long. It stands in a bleak and barren country not far from the sources of the Pilcomayo, and thus belongs to the great basin of the La Plata system. Situated at the height of about 13,280 feet above the sea, it is one of the highest inhabited places in the world, and the Cerro de Potosi,[1] at the foot of which it stands, reaches a height of 16,150 feet. The wealth of silver ore drawn from it up to 1846 is stated at upwards of £300,000,000 sterling [$1,458,000,000]; and, though the works had for a time to be discontinued as heavier machinery and greater capital were required, the store is far from being exhausted. The city is still the seat of the national mint. It consists of nine streets about 30 feet broad, running north and south and crossed at right angles by others of varying breadth. The houses (two-storied in the heart of the town, but only of one story in the outskirts) are built of adobe and whitewashed. Besides the cathedral (restored in 1858) there are a large number of churches, several convents, and other public buildings; but the city as a whole has that dilapidated and melancholy appearance which is the result of a greatly diminished population. In 1611 its inhabitants are said to have numbered 160,000; at present they are probably not more than 11,000, though Hugo Reck about 1867 gave 22,850 and Ondarza in 1882 repeated exactly the same figures.

The foundation of the town dates from 1547, two years after the first discovery of silver ore on Cerro de Potosi. In 1825 a monument to Bolivar was erected in the public square. The history of Potosi from its origin till 1702 will be found in Don Vicente Ballivian y Rojas's *Bolivian Archives*.

POTSDAM, the seat of government for the Prussian province of Brandenburg, and the summer residence of the emperor of Germany, lies 16 miles to the southwest of Berlin, on the river Havel, which here expands into a series of small lakes. The town is handsomely built, though with a monotonous regularity that betrays its artificial origin, and is situated amid the prettiest scenery of the Mark of Brandenburg, consisting of an oasis of wood and hill and lake in the centre of a sandy and unattractive plain. Except during the summer months, when its streets are enlivened by endless streams of excursionists from Berlin, Potsdam usually presents a somewhat dull and deserted scene, relieved only by the soldiers of its extensive garrison. The greater part of the town lies on the right bank of the Havel and is connected with the Teltow suburb on the opposite bank by a long bridge. At the north end of this bridge rises the royal palace, a large quadrangular building of the 17th century, with a colonnade, chiefly interesting for the numerous relics it contains of Frederick the Great, who made it his favorite residence. It also contains reminiscences of Voltaire, who also resided here for several years. The principal churches are the Nicolaikirche, a handsome edifice with a dome; the garrison church, containing the remains of Frederick the Great and his father; and the Friedenskirche or church of peace, erected by Frederick William IV. as a "positive and Christian counterpart to the worldly negative



Potsdam.

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[1] For a description of this mountain, see Bolivia (vol. iv. p. 13).

of Sans Souci." Among other conspicuous buildings are the large barracks, orphanages, and other military establishments; the town house; the district courts; the theatre; and the Brandenburg gate, in the style of a Roman triumphal arch. The Lustgarten, Wilhelmsplatz, and Plantage are open spaces laid out as pleasure-grounds and adorned with statues and busts. In spite of its somewhat sleepy appearance, Potsdam s the seat of a varied if not very extensive industry, of which sugar, cotton and woollen goods, chocolate, and tobacco are the chief products. Market-gardening affords occupation to many of the inhabitants, and the ultivation of winter violets is important enough to be mentioned as a specialty. The Havel is well stocked with fish. In 1880 Potsdam contained 48,447 inhabitants, mainly Protestant. The garrison consists of about 7000 men.

Potsdam is almost entirely surrounded by a fringe of royal palaces, parks, and pleasure-grounds, which fairly substantiate its claim to the title of a "German Versailles." Immediately to the west is the park of Sans Souci, laid out by Frederick the Great, and largely extended by Frederick William IV. It is in the formal French style of the period, and is profusely embelished with primly-cut hedges and alleys, terraces, fountains, statuary, and artificial ruins. Adjacent to he palace is the famous windmill (now royal property) which its owner refused to sell to the king, meetng threatened violence by an appeal to the judges of Berlin; the whole story, however, is now doubted. A ittle farther on is the so-called Orangery, an extensive edifice in the Italian style, containing numerous picures and other works of art. The park also includes he Charlottenhof, a reproduction of a Pompeian villa. At the west end of the park stands the New Palace, a huge brick edifice 375 feet in length, erected by Frederick the Great at enormous expense in 1763–69, and now occupied by the crown prince of Germany. It contains other reminiscences of Frederick and Volaire, a few pictures by ancient masters, a theatre, and a large hall gorgeously decorated with shells and minerals. The spacious buildings at the back are devoted o the "Lehrbataillon," a battalion of infantry composed of draughts from different regiments trained here to ensure uniformity of drill throughout the army. To the north of Potsdam lies a small Russian village, established in 1826 to accomodate the Russian singers attached to the Prussian guards. A little to the east of it is the New Garden, containing the Marble Palace. The list of Potsdam palaces may be closed with two situated on the left bank of the Havel—one at Glienicke and the other on the hill of Babelsberg. The atter, a picturesque building in the English Gothic style, in the midst of a park also in the English taste, s the summer residence of the present emperor of Germany.

Potsdam was originally a Slavonic fishing-village named Potsdupimi, and is first mentioned in a document of 993. It did not, however, attain any importance until the Great Elector established a park and palace here about 1660; and even at the close of his reign it only contained 3000 inhabitants. Frederick William I. (1688–1740) greatly enlarged Potsdam, and his stiff military tastes are reflected in the monotonous uniformity of the streets. Frederick the Great willingly continued his father's work, and is the real creator of the modern splendor of the town, of which his memory may be said to form the predominant interest. His successors have each contributed his quota towards the embellishment and extension of the town.

POTTER, JOHN (*c.* 1674–1747), archbishop of Canterbury, was the son of a linen-draper at Wakefield, Yorkshire, and was born about 1674. At the age of fourteen he entered University College, Oxford, and in 1693 he published, at the suggestion of the master of his college, various readings and notes on Plutarch's *De audiendis poetis* and Basil's *Oratio ad juvenes*. In 1694 he became a fellow of Lincoln College, and in 1697 his edition of Lycophron appeared. It was followed by his *Archæologia Græca* (2 vols. 8vo. 1697–99), once a very popular work. A reprint of his Lycophron in 1702 was dedicated to Græevius, and the *Antiquities* was afterwards published in Latin in the *Thesaurus* of Gronovius. In 1704 he became chaplain to Archbishop Tenison, and shortly afterwards was made chaplain-in-ordinary to Queen Anne. From 1708 he was regius professor of divinity and canon of Christ Church, Oxford; and from 1715 he was bishop of Oxford. In the latter year appeared his edition of Clemens Alexandrinus (frequently reprinted and still valued). In 1707 he published a *Discourse on Church Government*, and he took a prominent part in the controversy with Hoadly, bishop of Bangor, being complimented by that author as the antagonist of whom he was most afraid. In January, 1737, Potter was unexpectedly appointed to succeed Wake in the see of Canterbury. His primacy was in no way remarkable, but had the effect of checking the movement for revision of the formularies and confessions of the church and of the subscription to them. He died on 10th October, 1747. His *Theological Works*, consisting of sermons, charges, divinity lectures, and the *Discourse on Church Government*, were published in 3 vols. 8vo., in 1753.

POTTER, PAUL (1625–1654), animal painter, was born at Enkhuizen, Holland, in 1625. He was instructed in art by his father, Peter Potter, a landscape and figure painter of some merit, and by the time he had attained his fifteenth year his productions were already much esteemed. At the age of twenty he settled at The Hague, and there married in 1650. He was patronized by Maurice, prince of Orange, for whom he painted the life-size picture of the Young Bull, now one of the most celebrated works in the gallery of The Hague. In 1652 he was induced by Burgomaster Tulk of Amsterdam to remove to that city. The constitution of the painter seems to have been feeble, and his health suffered from the unremitting diligence with which he pursued his art. He died in 1654 at the early age of twenty-nine.

His paintings are generally on a small scale; his animals are designed with a careful accuracy which bears witness to the artist's close and constant study from nature; while the landscape backgrounds are introduced with spirit and appropriateness. His color is clear and transparent, his execution firm and finished without being labored. He executed a series of some twenty etchings, mainly of animals, which are simple and direct in method and handling. Here, as in painting, his precocity was remarkable; his large plate of the Herdsman, produced when he was only eighteen, and that of the Shepherd, which dates from the following year, show him at his best as an accomplished master of the point.

POTTERY AND PORCELAIN.

Plate V.

THE word "pottery" (Fr. *poterie*) in its widest sense includes all objects made of clay, moulded into form while in a moist plastic state, and then hardened by fire. Clay, the most widely spread and abundant of all mineral substances, consists essentially of a hydrated silicate of alumina (see vol. x. p. 212), admixed, however, in almost all cases with various impurities. Thus it usually contains a considerable proportion of free silica, lime, and oxides of iron, its color chiefly depending on the last ingredient. The white kaolin clays (see KAOLIN) used in the manufacture of porcelain are the purest; they consist of silicate of alumina, with 5 to 7 per cent. of potash, and only traces of lime, iron, and magnesia.

The making of pottery depends on the chemical change that takes place when clay is heated in the fire; the hydrated silicate of alumina becomes anhydrous, and, though the baked vessel can absorb mechanically a large quantity of water, the chemical state, and with it the hardness of the vessel, remains unaltered. A well-baked piece of clay is the most durable of all manufactured substances. In preparing clay for the potter it is above all things necessary that it should be worked and beaten, with sufficient water to make it plastic, into a perfectly homogeneous mass. Any inequalities cause an irregular expansion during the firing, and the pot cracks or flies to pieces. In early times the clay was prepared by being kneaded by the hands or trampled by the feet (see Isa. xli. 25); modern manufacturers prepare it on a larger scale by grinding it between mill-stones, and mixing it in a fluid state with an additional quantity of silica, lime, and other substances.

During the process of firing all clays shrink in volume, partly through the loss of water and partly on account of increase of density. What are called "fat" clays—those, that is to say, which are very plastic and unctuous—shrink very much, losing from one-third to one-fourth of their bulk; they are also very liable to crack or twist during the firing. "Lean" clays—those that have a large percentage of free silica—shrink but little, and keep their form unaltered under the heat of the kiln; they are not, however, so easy to mould into the required shape, and thus a certain compromise is frequently required. Lean and fat clays are mixed together, or silica (sand or ground and calcined flints) is added to a fat clay in sufficient quantity to enable it to stand the firing. The same result may be attained by the addition of broken pots, crushed or ground, an expedient practiced during the earliest stages of the development of the art of pottery.

Classification.

Classification.—Many attempts have been made to classify pottery and porcelain according to their mode of manufacture. The classification of M. Brongniart (*Traité des Arts Céramiques*, Paris, 1854) has been followed by most later writers. With some modifications it is as follows:

1. Soft pottery, easily fusible.	(*a*) ***Biscuit.***—Simple baked clay, porous and without gloss. Example, a common modern flower-pot. (*b*) *Glossy.*—Fine clay covered with an almost imperceptible vitreous glaze. Example, most Greek vases. (*c*) *Glazed.*—Clay covered with a perceptible coating of glass. Example, common white earthenware plates. (*d*) *Enamelled.*—Clay covered with a vitreous coating made opaque by white oxide of tin. Example, Italian majolica.
2. Stoneware, very hard and infusible.	(*a*) Very silicious clay covered with a lead vitreous glaze. Example, old gray Flemish ware. (*b*) Silicious clay covered with a salt glaze. Example, a modern brown ginger-beer bottle.
3. Porcelain, white, semi-transparent, and only fused at a high temperature.	(*a*) *Hard Porcelain.*—Natural kaolinic clay covered with a felspar glaze. Example, porcelain of China and Japan. (*b*) *Soft Porcelain.*—Artificial paste covered with a lead vitreous glaze. Example, early Sèvres porcelain.

This classification is necessarily imperfect, some pottery coming under two heads, as, for instance, much of the Italian majolica, which is both enamelled and glazed. For this reason in the following article pottery will be treated according to its age and country, not according to its method of manufacture. Porcelain differs from pottery in being whiter, harder, less fusible, and (most essential difference) in being slightly translucent. The paste of which it is formed is a purer silicate of alumina than the clay of which pottery is made. It will, therefore, be described under separate heads (p. 653 *sq.*, *infra*).

Technical terms.

For the sake of clearness it will be well to define the sense in which technical words relating to pottery are used in this article. *Body* or *paste* is the clay of which the main bulk of a pot is made. *Slip* is clay finely ground and mixed with water to the consistency of cream. It is usually applied over the whole surface of a vessel in order to give it a finer face or a different color from that of the body of the pot. It is also sometimes applied partially, forming ornaments in relief, as in the case of some Roman ware and the coarse 17th-century pottery of Staffordshire described below. *Glaze* is a thin coating of glass, evenly fused over the surface of a clay vessel to make it harder, and also to render it impervious to water. Clay simply baked without a vitreous coating is called *biscuit*; its surface is dull, and it is more or less porous. The simplest and oldest form of glaze is a pure silicate of soda; the addition of oxide of lead makes the glaze more fusible, but less hard and durable. For decorative purposes glazes may be colored by various metallic oxides without losing their transparency. *Enamel* is a glaze with the addition of some substance to render it opaque. Binoxide of tin has the peculiar property that when even a small quantity is added to a transparent glass it renders it opaque and white without otherwise altering its character. Great confusion has been caused in various works on pottery by a careless use of the terms "glaze" and "enamel"; they are both of the nature of glass, but the best distinction to make is to apply the word "enamel" to a vitreous coating that is *opaque*, and the word "glaze" to one that is *transparent*; both may be colored. The method of applying vitreous coatings to clay, whether enamel or glaze, is this. The materials are ground fine and mixed with water to the consistency of cream. The pot is dipped in the mixture, or the fluid is applied with a brush; it is then set to dry, and finally fired in the kiln, which must be heated sufficiently to fuse the component parts of the glaze or enamel into one smooth vitreous coating, while on the other hand it must not be hot enough to soften or melt the clay body of the vessel. The use of oxide of lead enables a glaze to be applied to a clay body which would not stand the high temperature necessary to combine and fuse a pure silico-alkaline glaze. In order to prevent the glaze or enamel from blistering or cracking off there must be a certain similarity of substance between the clay body and the vitreous coating. A fine silicious glaze or enamel will not adhere to a soft fat clay unless the proportion of silica in the latter is increased either by admixture of a harder, more silicious clay, or by the addition of pure silica either in the form of sand or of ground flint.

Potter's wheel.

The Potter's Wheel.—All pottery, except the rudest and most primitive sorts, is moulded or "thrown" by the aid of a very simple contrivance, a small round table fixed on a revolving pivot. Fig. 1, from a tomb-painting at Thebes, shows its simplest form. The potter at intervals gives a spin to the table, which continues to revolve for some time without a fresh impulse. This form of wheel, used by the Egyptians (as is shown by existing fragments of pottery) about 4000 B.C., is still employed without any alteration by the potters of many parts of India. A later improvement introduced in Egypt under the Ptolemies was to have another larger circular table, fixed lower down on the same axis, which the potter

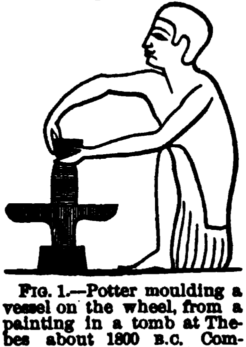


FIG. 1.—Potter moulding a vessel on the wheel, from a painting in a tomb at Thebes about 1800 B.C. Compare the wheel on the left in Fig. 55.

set in movement with his feet, and thus was able to keep up a regular speed and leave his hands free for the manipulation of the clay (see Fig. 2). No process in any handicraft is more beautiful than that of a potter moulding a vessel on the wheel. The ease with which the plastic clay answers to the touch of the hand, and rises or falls, taking a whole succession of symmetrical shapes, and seeming, as it were, instinct with the life and thought of the potter, makes this art beautiful and striking beyond all others, in which the desired form can only be attained by comparatively slow and laborious methods. Ancient poetry is full of allusions to this. Homer (*Il.*, xviii. 600) compares the rhythm of a dance to the measured spin of a potter's wheel; and the rapid ease with which a clay vessel is made and remade in a new form is described by Jeremiah (xviii. 3–4) in one of his most forcible similes (compare Horace, *A. P.*, 21–22). Among the Egyptians of the Ptolemaic period the potter was used as a type of the Creator. Nouf or Knoum, the divine spirit, and Pthah, the creator of the mundane egg, are symbolized by human figures moulding clay on the potter's wheel.[1] The wheel and egg are shown above in Fig. 2.

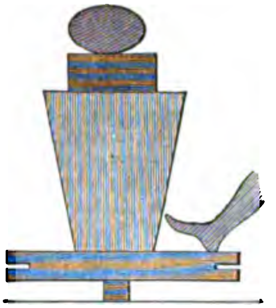


FIG. 2.—Potter's wheel of the time of the Ptolemies, moved by the foot from a wall-relief at Philæ. Compare Fig. 55, the wheel on the right.

Kilns.

Kilns for firing Pottery.—The earliest form of kiln, as represented in Egyptian wall-paintings, is a tall circular chamber of brick with a perforated floor near the bottom. The fuel was introduced from an opening on one side, and raked in under the brick floor. The pottery to be baked was piled up in the upper part of the chamber. Fig. 3, from a potter's votive tablet from Corinth, shows an early Greek form of kiln, with a place for the fuel on one side, and a door in the side of the upper chamber through which the pottery could be put in and withdrawn. The Corinthian kiln differs from the Egyptian kiln in being domed over, but it is the same in principle. Even at the present day kilns shaped almost exactly like this early Greek one are still largely used.

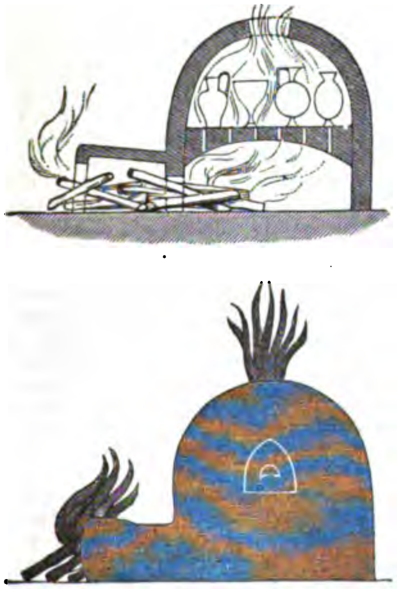


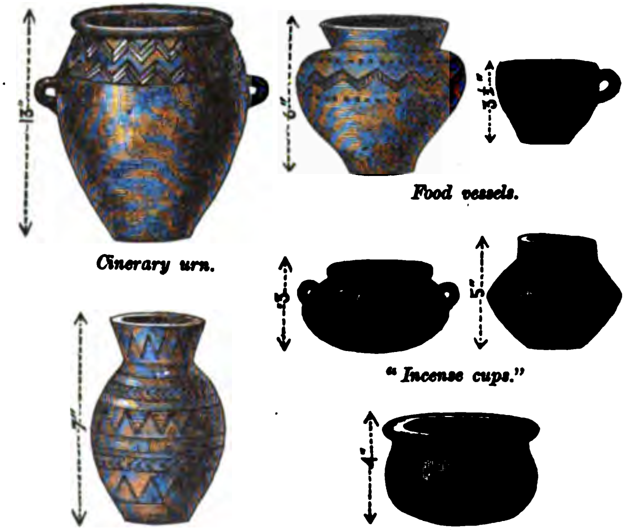
FIG. 3.—Early Greek pottery-kiln, about 700–600 B.C., from a painted votive tablet found at Corinth, now in the Louvre. The section shows the probable construction of the kiln.

SECTION I.—PREHISTORIC.

Prehistoric.

The art of making pottery is one of the most extreme antiquity; with the exception of the cave-dwellers of the Drift or Palæolithic period it was practiced by all known prehistoric races from the Neolithic age downwards. The sepulchral barrows of Britain and other European countries have supplied vast stores of this earliest kind of pottery. It is mostly formed of coarse clay, generally brown in color, though sometimes gray or reddish; some few specimens are fine in texture and have a slightly glossy surface. The clay, while moist, has been kneaded with some care, and is often mixed with a proportion of gravel, coarse sand, quartz crystals, or pounded pottery. The more carefully made specimens, chiefly those of the bronze and iron ages, are frequently covered with a smooth slip, made of the same clay as the body, but finely pounded and thoroughly mixed. All are alike "hand-made," without any assistance from the potter's wheel; some of the smaller ones are scooped out of a solid ball of clay, while in some cases great skill has been shown in the building up, by the unaided hand, of the thin walls of larger vessels, some of which are so round and neatly formed as to appear at first sight to be wheel-made. This, however, is never the case with the pottery of the three great prehistoric periods.

The shapes found in the sepulchral barrows of Britain, France, Scandinavia, and other countries are usually classified thus—(1) cinerary urns, (2) food vessels, (3) drinking-cups, and (4) the so-called "incense cups" (see Fig. 4).



Cinerary urn. *Food vessels.* *"Incense cups."* *Drinking cup.* *Domestic bowl.*

FIG. 4.—Various forms of prehistoric pottery.

(1) Cinerary urns, usually found full of burned bones, are the largest, varying from 12 to 18 inches in height. They are mostly less ornamented and less carefully made than the smaller vessels. Most have their decoration confined to a band round the upper part of the pot, or often only a projecting flange lapped round the whole rim. A few have small handles, formed of pierced knobs of clay, and sometimes projecting rolls of clay looped, as it were, all round the urn. (2) Food-vessels vary considerably in size and form. Some are shaped like a tea-cup, with a handle on one side; others are like small cinerary urns, either quite plain or with pierced knob-handles and bands of ornaments incised or impressed. (3) Drinking-cups, mostly from 6 to 8 inches high, vary but little in form, and are usually completely covered with ornament. They are often made with considerable care and skill, and are not ungraceful

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[1] See Rosellino. *Monumenti dell' Egitto*, pl. xxi. and xxii., 1844.

in shape. The names given to the preceding three classes possibly express their real use, but the name of the fourth class, "incense cups," is purely imaginary. Under this head are comprised a number of small vessels of very varied shape, some with their sides pierced through with square or lozenge-shaped openings, while others, almost globular in shape, have several pierced knob-handles, as if for suspension. Some are quite plain, and others are covered with ornament. Their use is unknown; one possible suggestion is that they were intended to carry fire from some sacred source to light the funeral pyre. Canon Greenwell, probably the best authority on this subject, believes, contrary to the opinion of many antiquaries, that none of the above classes of barrow-pottery were intended for domestic use, but that they were made solely to be buried with the dead. He considers that a fifth class of pottery, chiefly in the form of bowls, which has occasionally been found, not in barrows but in dwellings, is the only kind that was actually used for domestic purposes by prehistoric man (see Greenwell, *British Barrows*, 1877).

The ornament which is often lavishly applied on prehistoric pottery is of especial interest. It frequently consists of lines of small dots impressed from a notched piece of wood or metal, arranged in various patterns—crosses, chevrons, or zigzags. All the patterns were stamped into the body of the pot before it was hardened by fire. The lines were frequently made by pressing a twisted thong of skin against the moist clay, so that a sort of spiral sunk line was produced. Other bands of ornament were made by wooden stamps; the end of a hollow round stick was used to form a row of small circles, or a round stick was used sideways to produce semicircular depressions. In some cases the incised lines or dots have been filled up with a white slip of pipeclay. Considerable taste and invention are shown by many of these combined ornaments, and a certain richness of decorative effect is produced on some of the best drinking-cups; but one thing is to be noted: all the main lines are straight, no wavy lines or circles appearing, except in very rare instances—a fact which points to the very limited artistic development attained by the prehistoric races.

Prehistoric pottery has sometimes been described as "sun-baked," but this is not the case; however imperfectly baked, the pieces have all been permanently hardened by fire, otherwise they would certainly not have lasted to our time. This was done in a very rough and imperfect manner, not in a kiln but in an open fire, so that in some cases the pots have received a superficial black color from the smoke of the fuel. Great quantities of this pottery have been found in the sepulchral barrows of Great Britain and Ireland; those from the latter country are usually very superior in neatness of execution to the British specimens. The British Museum is specially rich in this class of pottery, chiefly the result of excavations made in British barrows by Canon Greenwell.

For prehistoric pottery, see Greenwell, *British Barrows*, 1877; Lubbock, *Prehistoric Times*, 1865; Boyd Dawkins, *Early Man in Britain*, 1880; D. Wilson, *Prehistoric Man*, 3d ed., 1876, *and Prehistoric Annals of Scotland*, 1851; Keller, *Lake-Dwellings in Switzerland* (tr. by Lee, 1878); Bonstetten, *Recueil d'Antiquities Suisses*, 1855–67; Perrin, *Étude Préhistorique*, 1870; Troyon, *Habitations Lacustres*, 1860; Borlase, *Nænia Cornubiæ*, 1872.

SECTION II.—ANCIENT EGYPTIAN.

But few examples remain which date from the time of the earlier dynasties of Egypt, though from the XVIIIth Dynasty downwards a great quantity of specimens exist. Broken fragments, embedded in the clay bricks of which some of the oldest pyramids are built, supply us with a few imperfect samples whose date can be fixed. The early pottery of Egypt is of many varieties of quality: some is formed of coarse brown clay moulded by hand without the aid of the wheel; other specimens, thin and carefully wheel-made, are of fine red clay, with a slight surface gloss, something like the "Samian" pottery of the Romans. Some fragments of brown clay have been found, covered with a smooth slip made of a creamy white or yellowish clay. The early use of fine colored enamels, afterwards brought to such perfection in Egypt, is shown by the enamelled clay plaques in black, white, and greenish blue which decorated the doorway of the great step-pyramid at Sakkára. Each plaque has a pierced projection at the back, so that it could be firmly fixed by means of a wood or metal dowel.

Materials.

Enamelled clay plaques.

Egypt is rich in materials for pottery, both glazed and enamelled. The finest of clays is washed down and deposited by the Nile; the sandy deserts supply pure silica; and a great part of the soil is saturated with the alkali necessary for the composition of vitreous enamels and glazes. In spite, however, of this abundance of materials the Egyptians never learned to apply either their enamels or their glazes, both of great beauty, to their larger works in pottery made of the fine Nile clay. The reason probably was that the clay was too fat, and therefore a vitreous coating would have flaked off during the firing, while they had not discovered the simple expedient of mixing with the native clay an addition of sand (silica), which would have enabled both glazes and enamels to form a firm coating over the body of the vessel. The colors used for Egyptian enamels and glazes are very varied, and of great beauty and brilliance. The glazes themselves are pure alkaline silicates, free from lead. The enamels are the same, with the addition of oxide of tin. The metallic oxides used to give the colors are these—various shades of blue and green, protoxide of copper, or more rarely cobalt; purple and violet, oxide of manganese; yellow, iron or antimoniate of lead; red, sub-oxide of copper or iron; black, magnetic oxide of iron or manganese. The white enamel is simply silicate of soda with oxide of tin. The blues and greens, whether used in transparent glazes or opaque enamels, are often of extreme magnificence of color, in an endless variety of tints—turquoise, ultramarine, deep indigo, and all shades of blue passing into green. The most remarkable specimens of Egyptian enamel work are some clay plaques or slabs, about 10 inches high, which were used to decorate the walls of Rameses II.'s palace at Tel al-Yáhúdíya, in the Delta (14th century B.C.). These have figures of men and animals executed in many different colors in the most complicated and ingenious manner. They are partly modelled in slight relief, and then covered with colored enamels; in other parts a sort of mosaic has been made by mixing fine clay and enamels into soft pastes, the design being fitted together and modelled in these colored pastes while moist. The slab was then fired, and the enamel pastes were at once vitrified and fixed in their places by the heat. A third process applied to these elaborate slabs was to fit into cavities left for them certain small pieces of colored glass or brilliant enamels, giving the effect of precious stones, which were fused into their places by a second firing. The chief figures on the plaques are processions of captives, about 8 inches high; the enamel flesh is varied according to the nationality of the prisoners: negroes are black, others white, red or yellow. Some of the dresses are represented with great richness: various embroidered or textile patterns of the most minute scale are shown by enamel inlay of many colors, and even jewel ornaments are shown by the inserted bits of glass; the dress of some Assyrian captives has patterns of great beauty and richness—the sacred tree between the guardian beasts, and other figures. Besides these elaborate figure-reliefs an enormous number of smaller pieces of clay inlaid with different-colored pastes were used to form a sort of mosaic wall-decoration in this wonderful palace, the ruins of which have supplied a perfect museum of all kinds and methods of enamelled work as applied to pottery. The British Museum and the Louvre have the finest specimens of these wall-slabs (see Birch, *Ancient Pottery*, p. 51, 1873).

Mummy figures.

The term "Egyptian porcelain" has sometimes been given to the small mummy-figures in brilliant blues and greens. This is a misnomer. The little figures, about 3 to 6 inches high, of which immense numbers have been found, mostly dating from about the XXth Dynasty downwards, are simply formed of sand (silica) with a little alkali, and only sufficient clay to cement them together, so that they could retain the form given them by the mould into which they were pressed. The result of analysis is silica 92, alumina 4, and a slight but varying proportion of soda. They are covered with a silicious glaze, brilliantly colored with copper oxide, and are sometimes painted under the glaze with manganese, a deep purple-violet. A few of these figures, and also small statuettes of deities, have had oxide of tin mixed with the paste; the figure has then been exposed to sufficient heat to fuse the whole into one homogeneous vitreous mass, and thus the statuette has become a solid body of fine blue enamel. A few small objects—such as libation cups, bowls, and chalice-like goblets—were also made of the same sandy paste, covered with blue-green glaze. They are thick and clumsy, owing to the very unplastic nature of their paste, which necessitated their being pressed in a mould, not wheel-made. The splendor of their color, however, makes them objects of great beauty; they usually have a little painting, lightly executed in outline with manganese purple, generally a circle of fishes swimming or designs taken from the lotus-plant (see Fig. 5).

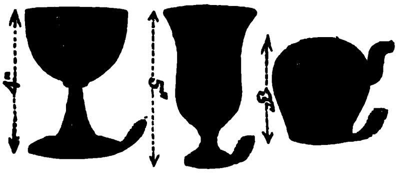
FIG. 5.—Egyptian blue-glazed pottery.

Wall-tiles.

During the XVIIIth and XIXth Dynasties and later pottery was used in many ways for wall-decoration. Bricks or tiles of coarse brown clay were covered with a fine white slip and glazed with brilliant colors. Another method was a sort of inlay, formed by stamping incised patterns into slabs of clay and filling up the sinking with a semi-fluid clay of some other color, exactly like the 16th-century Oiron ware. A number of brilliant war-tiles covered with deep blue glaze, and painted in black outline with figures and hieroglyphs have been found in many places in Lower Egypt; the painting is very simple and decorative in effect, drawn with much skill and precision of touch.

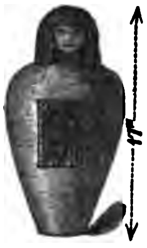
FIG. 6.—Egyptian Canopic vase.

Canopic vases.

The Canopic vases are an important class and great quantities have been found in Egyptian tombs. They are generally made of plain brown-red clay, and have a lid in the shape of a human head. On them hieroglyphs are coarsely painted in black or colors (see Fig. 6). They contained parts of the viscera of the corpse. The mummies themselves are frequently decked out with pectoral plates, necklaces, and other ornaments, made of clay covered with blue and other colored enamels. Some of the pectoral plates are very elaborate works of the same class as the figure-reliefs from Tel al-Yáhúdíya, richly decorated with inlay of different colored pastes and enamels.

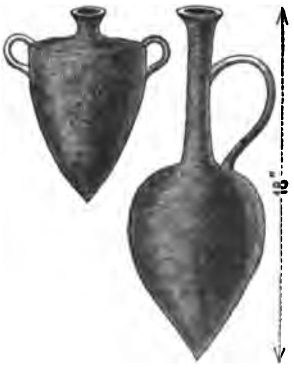
FIG. 7.—Egyptian pottery under the Ptolemies, showing Greek influence in the shapes.

Ptolemaic period.

During the Ptolemaic period a quantity of graceful and well-executed pottery was made in fine red and brown clay, mostly without any painted decoration. Some of the vases are of good form, owing to the influence of Greek taste (see Fig. 7); others are coarsely decorated with rude painting in blue, green, red, yellow, and brown, either in simple bands or with lotus and other flower-patterns (see Fig. 8). Both the body of the vases and the colors are usually quite devoid of any gloss. The duller colors are various earths, ochre, and white chalk, while the bright blues and greens are produced by mixing powdered enamel of the required color with light-colored clay, the depth of the tint depending on the proportion of the clay or chalk.

Certain very gaudy and ugly pots were made to imitate granite and steatite vessels (see Fig. 8). They are of brown clay, rudely dabbed and speckled with brown, red, yellow, and gray colors to represent the markings of the stone; others are yellow with gray streaks—imitations of marble; most have a painted white tablet, on which are hieroglyphs in black. The pigments are very shiny in texture, and appear to be unfired. Among the most delicate and carefully made kinds of Egyptian pottery are the round flat flasks shaped rather like the mediæval "pilgrim-bottle" (see Fig. 9). They are sometimes made of blue paste, fine clay colored with oxide of copper, and are delicately enriched with impressed ornaments, stamped from a mould, in low relief or slightly incised. The ornament is often designed like a gold necklace hung round the bottle; others have tablets with inscriptions. The surface is biscuit; and the flasks range in color from light turquoise to deep ultramarine, the color not being superficial but of equal strength all through the paste. Small vases of other forms, made of this same material, also occur, but they are rare.

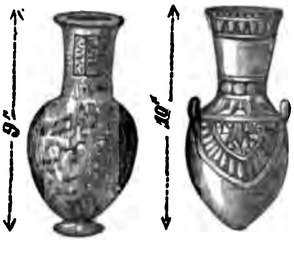

FIG. 8.—Egyptian pottery with painted ornament and sham marbling.

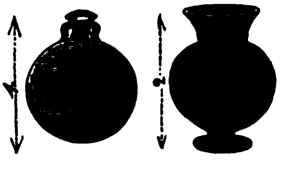
FIG. 9.—Egyptian pottery made of fine blue paste.

Literature.—Wilkinson, *Ancient Egyptians* (ed. Birch, 1878); Birch, *Ancient Pottery*, 1873. A large number of works on ancient Egypt have some account of the pottery, but none are specially devoted to the subject. The most valuable contribution to the chronological arrangement of Egyptian pottery is contained in an article by Flinders Petrie, published in the *Archæological Journal* for 1883, vol. xl. p. 269. See also Pierret, *Dictionnaire d' Archéologie Égyptienne*, 1875; De Rougé, *Études Égyptologiques*, 1880; and Mariette, *Monuments du Musée . . . à Boulaq*, 1864.

SECTION III.—ASSYRIAN.

But little remains to us of the pottery of the primitive Accadian races of Babylonia and Assyria. It was all extremely simple and undecorated, partly hand-made and partly wheel-made, mostly graceful and natural in form, owing its beauty chiefly to the simple elegance of its shape and the fine material of which it was made,—the close-grained light yellow and brown clays in which the country between the Tigris and the Euphrates is so rich. The great city of Babylon—"figulis munitam urbem," as Juvenal (x. 171) calls it—was essentially a brick city, and depended for its magnificence to a great extent on such decoration as the potter could supply. Herodotus and Ctesias describe its lofty circuits of brick walls, the two inner walls lined with bricks enamelled in various colors, with figure-subjects, scenes of war and hunting (see BABYLON). The technical methods and enamel pigments used in Assyria and Babylonia were for the most part the same as those used in Egypt; but the Assyrian potters understood the use of oxide of lead as a flux to mix both with glazes and enamels,—an admixture which, though it to some extent injures the durability of the vitreous surface, enables it to be applied with greater ease, and to less silicious clays, without fear of its cracking off or blistering in the kiln.

Painted bricks.

The ruined palaces of Babylon and Nineveh have supplied great quantities of bricks painted in various colors, some as early as the 12th century B. C. The colors applied are of two distinct classes,—(1) thoroughly *vitrified enamels*, often coarse and bubbly in texture, and applied in considerable body, which are mostly brilliant though harmonious in tint, with a hard vitreous surface; (2) *earth colors*, chiefly ochres in various shades of quiet yellows and browns, owing their colors to different iron oxides and a pure white made of lime. The earth colors are very thinly applied, and have no surface gloss. Paintings executed in this manner were neither so hard nor so durable as those in the vitrified enamels, and were probably used mainly for panels of ceilings and the upper parts of walls, which were out of the reach of ordinary wear or injury. In a few paintings both methods are combined. The bricks themselves are of light brown or yellowish clay, with which a considerable quantity of straw was mixed. This was burned out in the firing, and so cavities were left, making the bricks light and porous. Many of the enamelled bricks are moulded in relief, with simple patterns of leaves, interlacing bands, waves, and the like, and were used to form cornices and running bands above and below the flat friezes or dados painted with human figures. The reliefs are picked out in colors with enamel, white, yellow, deep orange, soft red, brown, green, and blue, the enamel being sometimes nearly one-eighth of an inch thick. A common size for the bricks is 12 to 14 inches long by 6 to 7 wide, and about 4 inches thick. Sometimes two or three courses go to make a single moulded band. The British Museum and the Louvre possess the best specimens of these enamelled architectural features. The finest examples of pictured bricks were found in the great palace at Nimrúd; they appear, judging from the imperfect fragments that remain, to illustrate a victorious expedition by the Assyrians against a foreign nation. The paintings represent long lines of captives, and processions of the conquering Assyrians on foot, on horseback, and in chariots. They are executed on grounds of different colors—dull green, yellow, and blue—and show a strong feeling for harmony of color and great skill in decorative arrangement; the figures are about 9 inches high. Some complete paintings were executed on one slab or panel. A fine one, about 9 inches by 12, also found at Nimrúd, and now in the British Museum, has a picture of the Assyrian king under a fringed canopy giving audience to an officer. The king is followed by an attendant eunuch.

Wall decorations.

In addition to figure-subjects and ornaments, large wall-surfaces were covered with cuneiform inscriptions, having letters about 1½ inches high painted in white and yellow on blue or green grounds; these are executed on large slabs of coarse brown clay, to which a smooth surface, fit for painting, has been given by a thin coating or slip of fine-ground yellowish clay. Large slabs with pendants for ceilings, painted in the same way with very graceful patterns, have been found, all in simple earth colors. Another even more magnificent application of the potter's art to wall decoration was by the use of colored enamel pastes, like those described under the pottery of Egypt. These are reliefs modelled by hand, or pressed into clay moulds and then touched up by a modelling tool. The smaller ones, with delicately-executed figures in low relief, are all in paste of one color—blue—with sufficient enamel added to the clay to give it a brilliant tint, but not sufficient for complete vitrification. Other fragments exist of life-size or even colossal figures, both in the round and in high relief, worked in pastes of many colors in a kind of mosaic fashion, extremely brilliant and striking in effect.

Literary use of pottery.

The most remarkable application of pottery in Assyria and Babylonia was its use for literary records. Tablets, cylinders, and polygonal prisms were impressed with cuneiform characters in the moist clay, and then baked, thus forming the most imperishable of all kinds of MSS. (cp. BABYLONIA, vol. iii. p. 166). The large inscribed cylinders and prisms were made hollow, and turned on the potter's wheel. The prisms were first moulded in a circular shape, the sides being afterwards made flat by slicing. All are *circular* inside, and bear distinct ring-like marks, showing the movement of the wheel as they were scooped out by the potter's thumb.

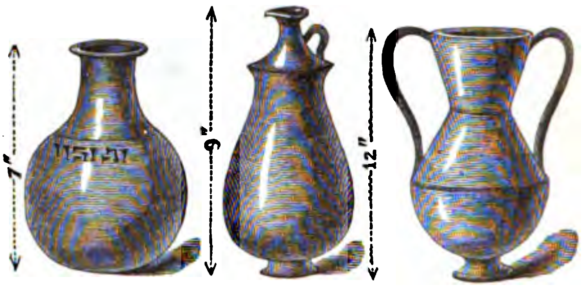

FIG. 10.—Assyrian biscuit pottery.

Vases and vessels.

The vases and domestic vessels of Assyria may be divided into four classes: (1) plain biscuit clay, undecorated; (2) biscuit clay with painted decorations; (3) fine clay stamped with minute reliefs; (4) clay glazed or enamelled.

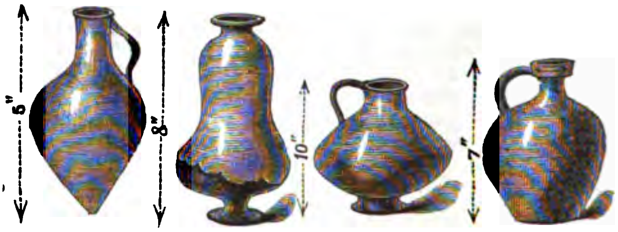

Fig. 11.—Assyrian glazed and enamelled pottery.

(1) By far the greater proportion of the pottery belongs to the first class. It is frequently graceful in shape, is well made and baked, and is of a fine close clay, generally light in color. Fig. 10 shows some of the commonest forms. Some specimens have cuneiform inscriptions incised with a pointed tool in the same way as the cylinder letters. The coarser clays are usually covered with a fine whitish slip, and a rather rare variety of the pottery is made throughout of a close-grained almost white clay. One sort of pottery, of which very few specimens have been found, has simple patterns incised on the gray body of the vessel; these patterns were then made conspicuous by being filled in with white clay, a method of inlay like that used in Egypt. (2) Very few examples of the second class are known. Some vases of brown clay, covered with white slip, have rude paintings of human figures, bowmen and other soldiers, executed in brown outline, with rapid and skilful touch. Others have cuneiform inscriptions and geometrical floral patterns painted in silica and lime-white with yellow and brown ochres. They appear to belong to the 9th century B.C. Both the clay body and the earth pigments are quite

free from any vitreous gloss in all this class of ware. A few fragments have been found of a coarse brown pottery, decorated with simple patterns in gold leaf, applied after the ware was fired. (3) A very fine sort of Assyrian pottery, of which examples exist dating from the 10th to the 8th century B.C. is made of a close-grained ivory-white clay, or else a hard grayish black clay; the surface is biscuit, and is ornamented with bands of human figures in relief,—soldiers, captives, royal personages, and others, with representations of cities, all most minutely executed, the figures scarcely an inch high. Other bands have cuneiform inscriptions, also in delicate relief. The bands appear to have been formed by rolling a cylinder die or mould over the surface of the clay while soft and moist. The few specimens of this pottery that have been found are mostly in the form of cylindrical drinking-cups. This method of decoration is one largely used in the earliest variety of Etruscan pottery. (4) Glazed and enamelled pottery (see Fig. 11) is more abundant; it consists chiefly of small articles of fine clay, bottles, two-handled jugs, miniature amphoræ, and pilgrim-flasks, very carefully made, and apparently articles of luxury. Some are of white clay, covered with a colorless glaze of silicate of soda, rendered more fusible by the addition of oxide of lead. Partly owing to this addition the glaze is generally in a very decomposed state, often presenting the most brilliant iridescent colors. Other examples are coated in a similar way, except that the transparent glaze is tinted a brilliant blue or green with oxides of copper, very like the blue glaze so much used in Egypt, but usually less hard and bright in color. A few small specimens have been discovered coated with a white tin enamel. Both the glazed and the enamelled pottery is undecorated by any painting.

Clay coffins.

At Warka (the Chaldæan Erech) a large number of very curious clay coffins were found in cave-tombs stacked closely one upon another. They are made of coarse clay, and bear outside patterns rudely stamped in blunt relief; the whole is covered with a plumbo-silicious green glaze. They are about 7 feet long and very peculiar in form; the body was introduced through an oval opening at the head, over which a similarly glazed clay lid fitted closely. These coffins are probably not earlier than the Sasanian period. Clay coffins of much greater antiquity have been found in Babylonia, but they are of plain biscuit clay.

Literature.—Layard, various works on Nineveh and Babylon; Rich, *Babylon and Persepolis;* Loftus, *Chaldæa and Susiana*, 1857; Oppert, *Expédition Scientifique en Mésopotamie;* Lepsius, *Denkmäler*, part ii. p. 163; Botta, *Monument de Ninive*, 1847–50; Place, *Ninive et l'Assyrie*, 1866–69.

SECTION IV.—PHŒNICIAN AND OTHER ARCHAIC CLASSES.

Phœnician pottery.

The discoveries of recent years have opened out a new field in the history of the origin and growth of Hellenic art, especially as relating to pottery. Excavations in Cyprus, Rhodes, Thera (Santorin), the plains of Troy, Mycenæ, Attica, and the coasts of southern Italy have revealed the existence of an abundant class of pottery of great antiquity, a large part of which, in its forms and decoration, appears to have been due, directly or indirectly, to the Phœnicians. The designs are of a curiously complex character. Purely Assyrian motives, such as the sacred tree with its guardian "cherubs," are mingled with figures and ornaments peculiar to Egypt; other characteristics which modify and blend these two styles seem due to the Phœnicians themselves; while, lastly, various local influences are shown in the representations of such plants and animals as were commonest in the special place where the pottery happened to be made. Possibly some of the designs, such as the sacred tree of Assyria, might be traced farther back still, to the distant Asiatic home of the Indo-European races; but any derivation of this kind would, in our present state of knowledge, be purely conjectural.

The islands of Thera, Rhodes, and Cyprus, which were colonized by the Phœnicians at a very early period (see PHŒNICIA, vol. xviii. p. 817 *sq.*), have supplied large quantities of archaic pottery, ornamented with characteristically Phœnician patterns and figures. The equally rich finds of pottery from Mycenæ and the Troad, though not free from Phœnician influence, have mostly a more native style of decoration. Though in some few cases the finding of Egyptian objects with dated hieroglyphs suggests a probable age for the pottery they were found with, yet in the main it is impossible to give even an approximate date to this large class of archaic pottery. Its production evidently extended over many centuries, and little or no help towards a chronological classification is given by any clearly-defined stages of artistic development. Some of the earlier specimens may possibly be as old as the 18th century B.C. (scarabs of Amenhotep III. were found with pottery in Rhodes), while the later ones, not very different in style, were probably made as late as the 8th century.[1]

Forms and materials.

Forms and Materials of Archaic Pottery.—There is a special charm about this early pottery. Graceful as the Greek vases of the best period of art are, there is something rigid and slightly mechanical in their highly-finished beauty, their polished surface, and their shape, accurately produced after some fixed model, from which but little deviation was permitted. Endless varieties of form occur in archaic pottery, changing with the mood and individuality of each potter; full of spirit and life, in their easy grace and the multiplicity of their flowing lines, these simple clay vessels give one—more perhaps than any other works of art—that keen æsthetic pleasure which consists in a retrospective sympathy with the joy that the artist took in his own handiwork. Extreme fertility of invention, as well as the utmost freedom of touch in the manipulation of the revolving mass of clay, are its chief characteristics. Fig. 12 gives some of the many forms. It is usually thin, light, and well baked, formed either of pale buff, whitish, or straw-colored clay; or, if a darker clay is used, the surface is generally covered with a fine white slip composed of silica, lime, and a little alumina. This forms a ground for the painting, which is executed in ochre earths, browns, and reds of different shades, the colors of which are due to oxides of iron. Most of the pottery is biscuit, clay ground and painted

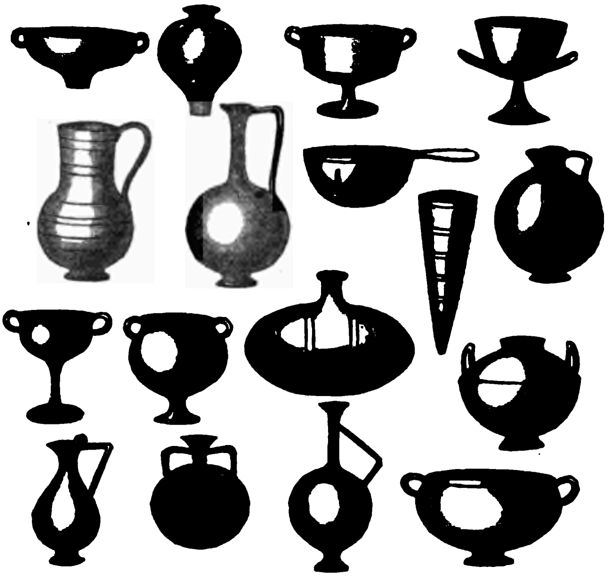

FIG. 12.—Shapes of archaic pottery.

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[1] See Schliemann, *Mycenæ* (1877), *Troy* (1875), and *Ilios* (1880); Cesnola, *Cyprus*, 1877; Dumont, *Les Céramiques de la Grèce*, 1881; Salzmann, *Nécropole de Camiros*, 1874–75.

ornament being alike free from any gloss; but in some cases silica and an alkali (probably carbonate of soda) have been added to the ochre pigment, which has thus become vitrified in the kiln and acquired a glossy surface. This does not occur among the earlier specimens.

Enamelled vases, etc.

Enamelled Pottery.—In some of the tombs in Ægina and Rhodes a quantity of small vases, statuettes, and other objects have been found, executed under Egyptian influence, with decoration of various colored enamels. The colors used and the methods of manipulation resemble the enamel work of Egypt so closely as to need no special description. Some fine pilgrim-flasks of blue and green have blundered copies of hieroglyphs and representations of Egyptian deities incised in the moist clay. Less purely Egyptian in style are certain small vases (see Fig. 13), coarsely ornamented with bands and chevrons in various enamels—white, blue, green, purple-brown, and yellow. The Louvre and the British Museum have the best specimens of these. Small vases, exactly similar in design and execution to those from Ægina and Rhodes, have been found in the tombs of Vulci and other places in Etruria, probably brought there by Phœnician traders, to whose intercourse with Egypt and knowledge of the Egyptian designs and mechanical processes the existence of the enamelled pottery of Rhodes is probably due. Other specimens have been found in the recently discovered Etruscan necropolis on the Esquiline in Rome.[1] One curious variety of early pottery is of fine glossy red like the later Samian ware. Its smooth surface of rich red is due to the application of a thin finely-ground mixture of silica, soda, and some alumina, forming a vitreous enamel to which the opaque red color was given by a large proportion of oxide of iron (see Fig. 14). Some of this red pottery is of extreme antiquity; it is either smooth and undecorated, or has rudely-incised hatchings and zig-zags, scratched down to the clay body of the vessel through the red enamel. Another variety of very early pottery from Mycenæ and the Troad is of a hard black clay, with glossy surface (see Fig. 15).

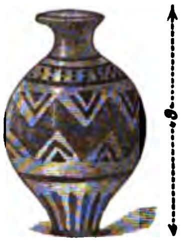

FIG. 13.—Enamelled pottery from tombs in Rhodes, made under Egyptian influence.

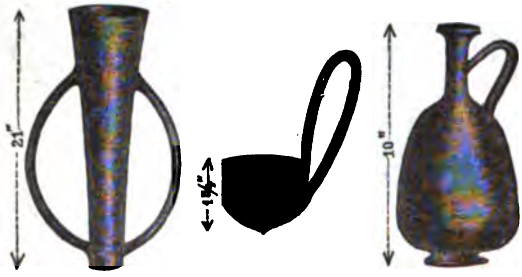

FIG. 14.—Prehistoric red pottery from the Troad and Mycenæ.

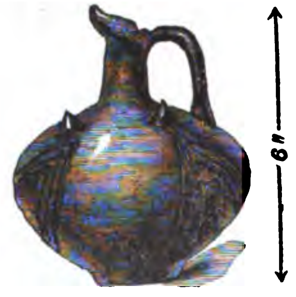

FIG. 15.—Prehistoric black pottery from the Troad and Mycenæ.

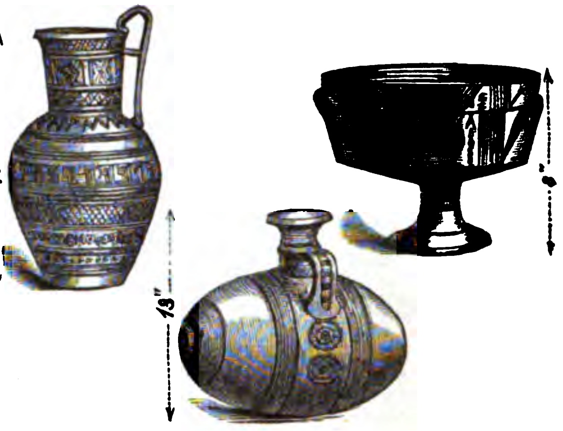

FIG. 16.—Archaic vessels decorated with simple line ornament.

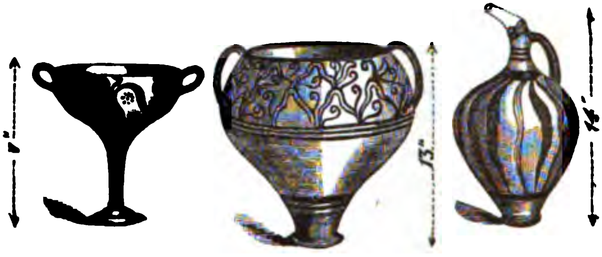

FIG. 17.—Archaic pottery decorated with natural objects—cuttle-fish, aquatic plant, and strips of seaweed.

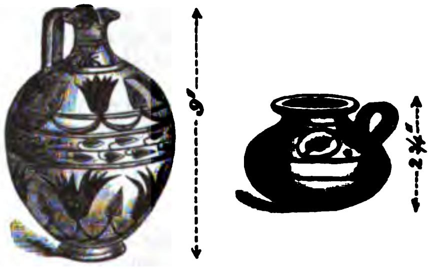

FIG. 18.—Archaic pottery with flower ornament worked into conventional patterns.

Painted ornament on vases.

Painted Ornament on Archaic Vases.—This may be divided roughly into four classes. (1) Hatchings, concentric circles, chevrons, and other simple combinations of lines, arranged frequently in designs obviously suggested by matting or textile fabrics, and also various arrangements of spirals, apparently taken from patterns used in metal-work. Some of the designs of this class seem common to all races of men in an elementary stage of progress, and occur on the earliest known pottery, that of the Neolithic age (see Fig. 16). (2) Representations of plants (often seaweeds) and marine animals, such as cuttle-fishes, medusæ, and star-fishes, or occasionally aquatic birds. This class of ornament appears to be more native in character—derived, that is, from various objects with which the potter was familiar—and not to have been a Phœnician import (see Fig. 17). (3) Conventional ornament, a decorative arrangement in bands or scrolls of certain plants, such as the lotus or papyrus and the palm-tree. This class of ornament is distinctly Phœnician, and shows a predominance, sometimes of Assyrian, sometimes of Egyptian influence (see Fig. 18). (4) Very rude and badly-drawn figures of men and animals. They are mostly purely decorative and meaningless, are often merely drawn in outline, and have little or no help from incised lines, which became so important in the next stage of the development of pottery. Some of the figures are strongly Assyrian in character, while others of the rudest execution seem to be native.

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[1] See *Ann. Inst.*, 1882, p. 2.

It appears at first sight as if there was a distinct chronological order of development in these four classes of ornament—growing from simple line-patterns to the copying of easily represented natural objects, then to the invention of regular geometrical floral patterns, and lastly arriving at the rude depiction of human figures. Various points, however, combine to contradict such a theory of arrangement, such as the combinations in which these vessels have been found, the manner in which the various classes of ornament are mingled on the same vase, and lastly the fact that some elaborate and highly-finished vases, obviously of later date, are decorated solely with the straight-line and hatched patterns of the first of the four classes of ornament. Again, the ornament of the second class, which appears to be native and local, can hardly be so altogether. Pottery found at places so far distant as Rhodes and Mycenæ has in some cases exactly similar painting of this sort, showing that a common artistic influence was at work in both places. The whole subject is a very difficult one, and little that is really definite can be asserted abont it with safety—at least as yet.

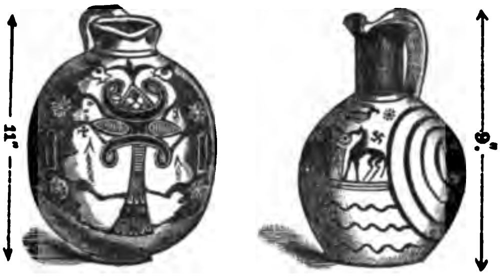

FIG. 19.—Early vases (œnochoæ) with Assyrian sacred tree, or altar between guardian beasts.

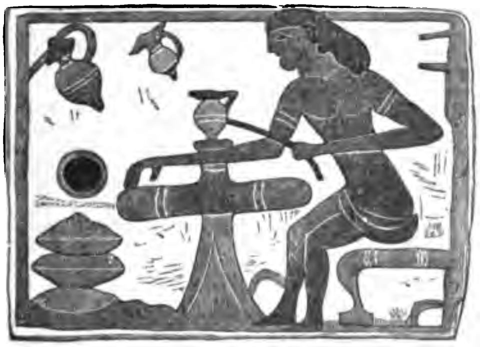

FIG. 20.—Votive tablet from Corinth, full size; a potter applying painted bands while the vessel revolves on the wheel.

Fig. 19 gives two vases of great interest. One shows the common decoration with wheel-applied circles, and also the Assyrian altar-like object between two beasts; the other, from Cyprus, has the Assyrian sacred tree, with similar guardian animals. One of the most striking characteristics of archaic pottery of all classes, and especially of the earliest, is the great use made of the potter's wheel in applying the painted ornaments. Very many of the vessels are decorated with a number of encircling bands or lines, or on their sides with a number of concentric circles. These were easily applied, and very true circles were obtained by setting the pot (after it was dried in the sun) for a second time on the wheel, in the required position, either on its side or upright as it was originally turned. A brush held against the revolving vessel marked out the bands or circles. A very interesting votive tablet from Corinth (now in the Louvre), probably 700-600 B.C., shows a potter at work in his shop, applying painted bands in this way. He sets the wheel in motion with one hand, while with the other he holds the brush against the revolving pot. The wheel here shown (see Fig. 20) is one of the earliest form, without the lower foot-turned disk.[1] The smaller circles were struck out with compasses, the central point of which has usually left a deep mark. The patterns used on the first class of pottery consist mostly of straight lines, hatched and crossed, arranged in squares, chevrons, triangles, and other simple figures, combined with concentric circles or, more rarely, wavy bands, the whole arranged frequently in very complicated and effective patterns. The second class has frequently varieties of seaweed and many marine creatures, all treated very simply, but drawn with great skill and appreciation of the characteristics of each object and its decorative capabilities. The third class—that of geometrical floral patterns—has but little variety. Some of the lotus patterns are almost identical with those used in Egypt and Assyria, and continued in use for vase decoration down to the most flourishing period of Greek art, though latterly in a stiff and rather lifeless form. The fourth class—that of figure-paintings—is of great interest; the earlier patterns are merely drawn in outline. Fig. 21 shows an œnochoe from Cyprus, now in the British Museum, of rather coarse red clay with yellow slip, on which is pencilled in outline a one-horse chariot driven at full speed by a slave; behind him stands a bowman shooting an arrow; the whole is strikingly Assyrian in style. Another œnochoe, found in Attica, of more primitive style, has a central band covered with a number of warriors with round shields, all alike, most rudely executed; almost exactly similar figure-paintings occur on some of the Mycenæ pottery, and also on a large amphora from Cyprus (now in the British Museum), which has many bands, on which are painted in red ochre lines of men with crested heads (looking like North American Indians) riding long weasel-shaped horses. Other bands on the same vase have centaurs, foot-soldiers, and various beasts, the latter, especially some stags, rather better drawn. They are painted in coarse dabs, and, except for a few of the eyes, have no incised lines. Smaller ornaments, such as the svastica 卍 and simple forms of rosettes, are often used to decorate the backgrounds and fill up spaces, but not to so great an extent as in the succeeding class of pottery.

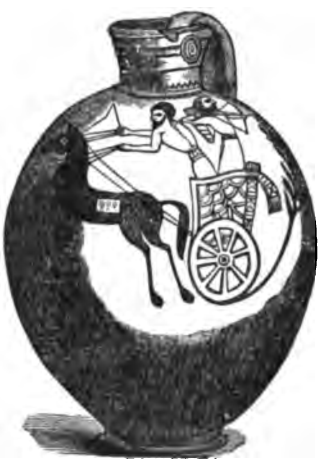

FIG. 21.—Œnochoe with painted bowman in a chariot, Assyrian in style.

Among the earlier pottery from Mycenæ and the Troad are several very strange vases in coarse clay rudely modelled to indicate a human form. Some have the upper part formed like a head, very like the Egyptian Canopic vases. A great number of "pithi" (πίθοι), enormous vases shaped something like amphoræ, have been discovered in Rhodes, the Troad, and other places, some as much as 7 feet high. Such vessels are often decorated with patterns in relief, chiefly combinations of spirals and the like, some closely resembling the designs on the sculptured architrave from the "Treasury of Atreus" at Mycenæ.

Vases with animals and flowers.

Vases with Bands or Friezes of Animals on Grounds sprinkled with Flowers.—This is a very large and important class, and very numerous specimens have been found widely scattered over the shores of the Mediterranean

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[1] The writer of the article in *Ann. Inst.* (1882) on this painting has missed the chief point of interest, which is that the potter is using his wheel, not to mould the vase, but to apply the bands of color round it.

(see Fig. 22). The production of vases of this style appears to have lasted for many centuries; the earlier ones are rudely executed in dull ochre colors on biscuit clay, like most archaic pottery, while the later ones have paintings in brilliant black enamel on a ground of red clay, thinly covered with a true vitreous glaze. This class of vase-painting, though mostly the work of Greek potters, is distinctly Oriental in character, probably Assyro-Phœnician. It is of extreme decorative richness: the surfaces of the vases are well covered, and the designs, though simply treated, are very effective, in many ways far more successful as works of decorative art than the elaborate and exquisitely drawn figure-pictures on later Greek vases. The ground is thickly covered with small decorative patterns; Fig. 23 shows those used on more archaic vases. The animals that occur most frequently on the bands are lions, leopards, bulls, goats, deer, with various birds, such as cocks and swans, and also griffins, sphinxes, and sirens. A favorite motive of design is the sacred tree or a sort of column, each with a guardian beast at the sides. This is one of the most interesting of all designs in the history of ornament; it dates from an extremely early period, was used in ancient Chaldæan art, and was handed on by the Sasanians to the Moslem conquerors of Persia; it survived, though altered and after its meaning was long forgotten, till even the 15th century in the textile fabrics worked in Italy after Oriental designs. The column between the beasts occurs on the Lion Gate of Mycenæ. In the later art of the Persians a fire-altar takes the place of the column.

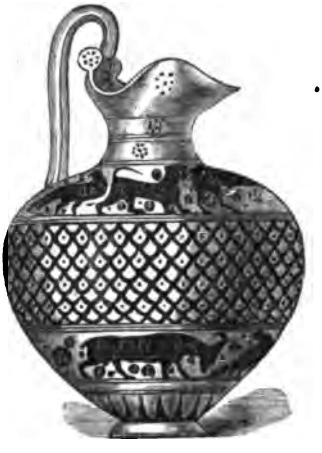

FIG. 22.—Vase with bands of animals, Oriental in style. (British Museum).

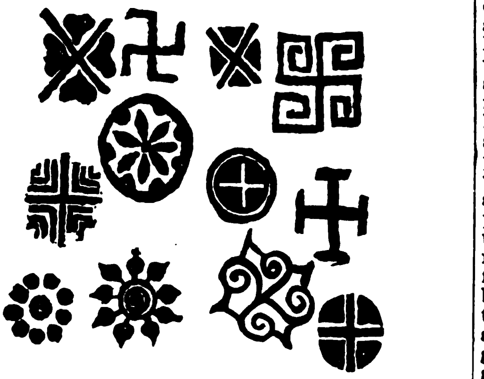

FIG. 23.—Examples of small ornaments with which the ground of early vases is often studded.

Before passing on to consider the various classes of distinctly Hellenic pottery it will be convenient to give a list of the technical methods employed in all classes of pottery found in Hellenic sites, and also some account of the inscriptions and various forms of letters which are found on Greek vases.

Technical Methods and Inscriptions—Archaic and Greek Vases.

From Hellenic sites.

1. *Prehistoric Pottery from Mycenæ, the Troad, and other Hellenic Sites.—Materials:* yellow, red, or black clays; composition, silicate of alumina, with free silica and lime, colored by different oxides of iron; slip, made of similar clays ground to a smooth paste. *Methods of Treatment:* (*a*) plain biscuit clay; (*b*) clay covered with fine slip; (*c*) ornament of incised patterns, scratched through the slip upon the body of the pot, and sometimes filled in with whiter slip to make a conspicuous pattern; (*d*) pottery of hard fine clay, made glossy by a mechanical polish. Most if not all of this pottery was made without the wheel; but some was so skilfully modelled as to make it difficult to distinguish between hand-made and wheel-made vessels.

Phœnician, etc.

2. *Phœnician and other Archaic Pottery.*—This and all succeeding classes are wheel-made. *Materials:* clays and slip as class 1; a quite white slip was also used made of a natural sort of pipeclay, or in some cases of a mixture of lime and silica with a little clay to bind it together. *Pigments*: earth-colors, made of brown and red ochres, occasionally mixed with an additional quantity of oxide of iron and free silica. *Methods*: the white or yellow slip was usually applied while the vase was revolving on the wheel, either with a brush or by the potter dipping his hands into a bowl of fluid slip just before finishing the final modelling or throwing of the vase; in some cases it has been applied by dipping the pot into the slip. The method of applying the painted bands is shown above in Fig. 20. As a rule these vases were not fired at a sufficient heat to give them a vitreous gloss, though in some cases the heat has been enough to partly vitrify those of the ochre colors which contained a proportion of free silica and alkali.

With black figures and incised lines.

3. *Vases with Black Figures and Incised Lines.—Materials:* (*a*) clay, silica 56 per cent., alumina 19, red oxide of iron 16, lime 7½, magnesia 1½ per cent.,—the average of many analyses; (*b*) slip, the same clay finely ground, and sometimes tinged a deeper red with additional red oxide of iron,—the white slip is like that in class 2; (*c*) glaze, of almost imperceptible thickness, a silicate of soda; (*d*) black pigment,—a true vitreous enamel, which owes its deep black to the magnetic oxide of iron (composition—soda 17, silica 46, alumina 12, black peroxide of iron 17, lime 6 per cent.); (*e*) chocolate-red pigment, an ochre red sometimes mixed with finely-ground fragments of red pottery; (*f*) white pigment like the white slip of class 2,—various analyses, silica 54 to 62, alumina 34 to 43, lime ½ to 3½ per cent. *Methods:* the vase was first turned on the wheel, and in order to give the pot a surface of deeper red, the slip was applied by a brush or by the hands of the potter while it was still revolving. The outline of the design was next roughly sketched, either with a point or in light-red ochre with a brush. After the vase had dried sufficiently in the sun so as to become firm, it was again put on the wheel, and the glaze, finely powdered and mixed with water, was applied to it with a brush as it revolved. The vase then appears, at least in some cases, to have been for the first time fired in the kiln in order to get a smooth almost non-absorbent surface for the use of the painter. In other cases the materials of the red slip and the silicate glaze were mixed, and the two applied together, as was done in the case of the Roman Samian ware. The painter next set to work and put on the black enamel figures and ornaments with a brush. If a part of the vase round its whole circumference was to be black, such as the foot and neck, the vase was again set on the wheel and the black enamel put on as it revolved. This repeated use of the wheel for the application of slip, glaze, and black enamel was in order to secure an even coating with uniform grain, far more difficult to get with the unaided brush. The grain thus produced can usually be distinctly traced in each of the three coatings. The firing of the black enamel must have been done with great care and skill, as a very slight chemical change in the black oxide of iron converts it into the red oxide. Thus the same stroke of a brush is often (in the earlier vases of this class) half black and half vermilion-red, or one side of a vase is red and the other black, according as it has been played upon by oxidizing or deoxidizing products of combustion in the kiln. In the finest vases the black enamel is of great beauty, with wonderful rich softness of texture, which no modern skill has been able to approach. The tombs of Nola, Capua, and other places in Magna Græcia have supplied the most technically perfect vases, both for the fineness of their clay and the brilliance of their black enamel. After the firing of the enamel the details were drawn in by incised lines, cutting through the enamel down to the clay body of the vase. The clear and slightly-chipped edges of the lines show that they were done *after* firing, when the black enamel was in a hard vitreous state. This must have been done with some very sharp and hard point, probably a natural crystal of diamond or corundum, such as was used for engraving gems; the incised details on some vases are of almost microscopic minute-

ness.[1] The "non-vitreous" colors, red and white, were sometimes put on before, sometimes after the incised lines. They were fixed in their place by a slight firing, not enough to vitrify them or to soften the edges of the incised lines in the enamel. Both these changes have been shown to take under a not very violent heat, by experiments made by the present writer on fragments of such vases. The white was used to depict the flesh of females and of some of the Gods, such as Eros, or for the bodies of horses and the hair of old men. Chocolate-red was mostly used for ornamental touches on dress, armor, harness, and the like. Both are used in painting the heraldic beasts or ornaments which so often occur on the round shields of Greek warriors. Both the white and red are applied *over* the black. Thus the female figures are first completely painted in black, and the white afterwards applied over the face, hands, or other nude parts.[2]

With red figures.

4. *Vases with Red Figures.*—The *materials* employed and the first stages in the manufacture of this class are the same as those of class 3; but, instead of the *figures* being painted in black, the *ground* is covered with black enamel, and the figures left, showing the glazed red slip which covers the whole vase. This method produced a great artistic advance in the beauty of the figures, the details and inner lines of which could be executed with freedom and ease by brush-marked lines instead of by the laborious process of cutting incised lines through the very hard black enamel. The outline of the figures was drawn, with wonderful precision and rapidity, with a brush fully charged with fluid enamel, boldly applied so as to make a broad line or band about one-eighth of an inch wide all round each figure, one edge of the band giving the boundary of the required form. Details and inner markings were then added with a fine-pointed brush capable of making the thinnest and most delicate strokes. On many of the finest vases the contour-lines of muscles and other markings intended to be less salient were painted in pale brown instead of black. Last of all, the main part of the ground between the black outline bands was filled in. The greater thickness of the enamel, where it was more concentrated in the bands, is generally visible; the enamel used for filling in was thinner because it spread over a larger space as it flowed from the brush. In some cases a face or other part has had a thin black outline before the wider band was put on; and then *three* distinct thicknesses of enamel can be seen, the thin outline standing out perceptibly more than the rest. It is evident that the fluid black enamel was applied in a somewhat thick viscid state, and thus a slight degree of relief was often produced, enabling black *lines* to show over the black *ground*, as is the case sometimes with the strings of lyres. This slight relief often gives additional effect to the treatment of curly hair, represented by a series of dots or globules, as in the transitional amphora described below (p. 630). This method recalls the free use of the drill in the representation of hair on early engraved gems. Touches of white and red were occasionally used, as in the preceding class of vases, but to a much more limited extent. Some of the finest black and red vases, especially specimens from Nola, Vulci, and Capua, have enrichments in gold applied in relief.

Polychromatic vases.

5. *Polychromatic Vases.*—*Materials:* the same as in the preceding classes with the addition of bright red, blue, green, and gold. The red used on some vases is an oxide of iron; but a very brilliant minium crimson also occurs, which appears to have been added after the final firing, and is not therefore, properly speaking, a "ceramic" pigment. The blue and green are different oxides of copper, fused with silica and soda to make a bright vitreous enamel, which was then finely powdered and mixed with a proportion of white pigment (silica and lime) according to the strength of the tint required. This powdered enamel pigment is the "smalto" of mediæval Italian painters. The gold was applied in leaf, not on the flat surface of the vase, but on a ground modelled in slight relief with semi-fluid slip of ordinary fine red clay, thus very much enhancing the effect produced by the gold leaf. Necklaces, bracelets, and other gold ornaments are always modelled in perceptible relief, producing a rich effect which no merely flat application of gold could give. Polychromatic vases may be divided into four main classes. (*a*) Vases in which the colors are used as *additional* decoration to the ordinary red figures, *e.g.*, the celebrated amphora from Camirus (Rhodes), with the scene of Peleus winning Thetis as his bride (see Plate V.). (*b*) Vases painted in brown outline, on a fine white slip, with the addition of red and yellow ochre colors, and occasionally a little gold, *e.g.*, the cylix in the British Museum with Aphrodite seated on a flying swan (see Plate V.); this is a rare and usually very beautiful variety, and is more fully described below (p. 631). (*c*) Attic funeral lecythi, which have the neck and foot in brilliant black (wheel-applied) enamel and the main body of the vase covered with a non-vitreous white slip. The design was sketched in rough outline and the red pigment put on with a small brush over the white ground. The drawing is generally careless and rapid, but often shows great skill and beauty of touch. The colors, generally red, blue, or green, were then thickly and often clumsily applied over parts of the red outline drawing, mostly over the draperies. These vases were not meant to be handled, as their colors rub off very easily: they were simply intended for sepulchral purposes, either to hang *on* the stele or *within* the tomb. (*d*) Vases, especially from Magna Græcia, such as rhytons, small œnochoæ, and others, moulded skilfully in a variety of fanciful shapes, heads of animals or deities, sphinxes, and other figures, either grotesque or beautiful. They are decorated partly with the usual red figures, and with the most brilliant black enamel, while other parts are painted in white and brilliant crimson with further enrichments in gold leaf. These bright colors seem to have been applied *after* the last firing, and not to be true ceramic colors.

Metal-like black vases.

6. *Black Vases of Metal-like Designs.*—These vases often have the finest sort of black enamel, especially the large amphoræ from Capua and other places in Magna Græcia, covered all over with fluting or gadroons. Some have wreaths of vine, olive, and other plants, or imitations of gold necklaces modelled in slip, slightly in relief, and afterwards covered with gold leaf. A number of "phialæ omphalæ" (saucer-shaped vessels), of about 200 B. C., were made by being pressed into a mould, and were thus stamped with figures in relief, such as processions of deities driving chariots. Some of these made in Magna Græcia after its conquest by the Romans, have Latin inscriptions. One made at Cales is inscribed with the potter's name **C. CANOLEIOS. L. F. FECIT. CALENOS** (see *Ann. Inst.*, 1883, p. 66). Small asci were decorated with highly-finished figure-subjects, stamped on emblemata or tablets of clay which were embedded in the vase while it was soft. Such elaborate and metal-like pieces of pottery are entirely covered with black enamel. They are often of great beauty, both in the composition of the relief figures and in their delicate execution. Vases of this class have been found entirely covered with gold or silver leaf, copies of metal plate.[3]

Vases with statuettes.

7. Vases, such as large asci, many from Magna Græcia, made of simple yellowish biscuit clay, and modelled into shapes of female heads, or covered with a number of statuettes of female figures. They are generally painted simply in distemper in "non-ceramic" colors; but they fall rather under the head of TERRA-COTTA (*q. v.*). Some are of very great beauty, and are covered with statuettes very like those found at Tanagra.

Debased Greek vases.

8. *Greek Vases of Debased Style, last period.*—These have the usual red figures on a black enamel ground, of the same materials, and applied in the same way as on the earlier vases, except that the black enamel is much thinner and very inferior in quality, frequently having a hard metallic gloss instead of the soft richness of the earlier vases. A great part of the figures and ornaments is executed in white, red, brown, and yellow pigments, with shading and gradations of color, used to produce an effect of relief, which is unsuited to vase-painting, and, especially in the later examples, is executed with extreme rudeness and clumsiness of drawing. Vase-painting became degraded in style at a period when the other arts of Greece showed but little signs of decadence, and ceased altogether to be practiced nearly a century before the Christian era. No painted vases were found in the buried cities of Pompeii, Herculaneum, and Stabiæ; and Suetonius (*Julius Cæsar*, c. 81) mentions the eagerness with which certain Greek vases found in tombs near Capua were sought for. The floral ornaments on these later vases are very elaborate and realistic compared with those of the earlier period. Bands of graceful scroll-work with growing foliage are much used, often, in spite of their attempted relief, very beautiful and much superior to the figure-subjects which accompany them. Some strikingly resemble in style the painted friezes on Pompeian walls, and have lost all purely ceramic character.

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[1] A very remarkable early vase, in the collection of Countess Dzialinska in Paris, is decorated with incised lines only, the whole being covered with the black enamel.

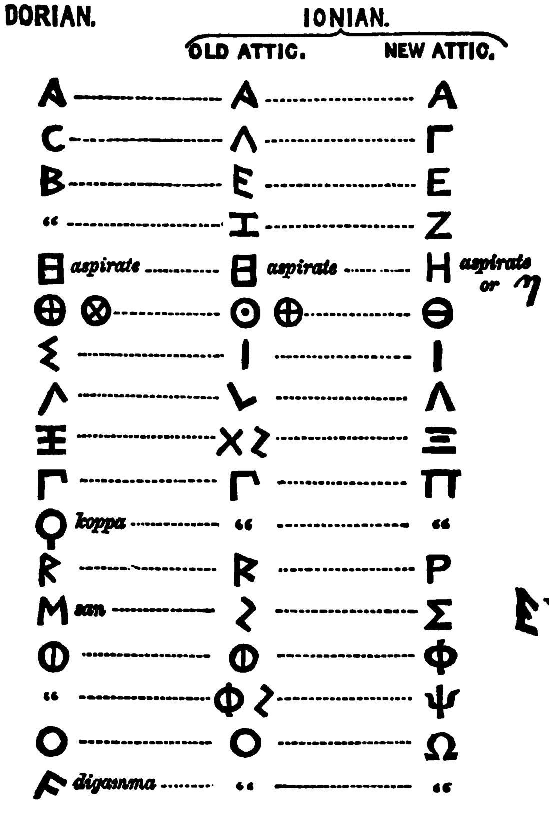
[2] Unfortunately many Greek vases have been much injured while in the hands of dealers by the restoration of the white and red pigments. Vases which have been thus treated should be washed carefully with spirits of wine, which removes the modern touches without injury to the ancient pigments.

[3] See Otto Jahn, *Vasen mit Goldschmuck*, Leipsic, 1865.

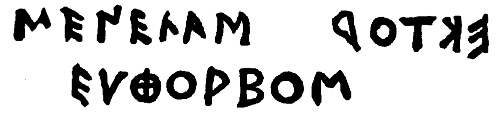
Two abnormal and comparatively rare methods of vase-painting must be mentioned. One occurs on a number of Corinthian vases mostly now in the Louvre, pseudo-archaic in style, but apparently of the 5th century B.C. Such were first covered with white slip, which was in turn completely covered over with black enamel. The design was then made by the awkward process of cutting away the black in parts so as to leave black figures on a white ground—a kind of "sgraffiato." Another strange method was practiced in southern Italy during the extreme decadence of vase-painting. The whole surface was covered with black enamel, and the figures were afterwards painted in red *over* the black so as to imitate the ordinary Greek vases with red figures and a black enamel painted *round* them. Most specimens are mere feeble imitations of the works of an earlier period; but a cylix in the British Museum is painted in this style with a graceful seated figure of Adonis or Meleager—a very remarkable work, executed in warm browns and yellows, giving the effect of flesh, and shaded and touched with high lights in a thoroughly pictorial manner, which, though on a miniature scale, recalls the best wall-paintings of Pompeii or Rome.

Inscriptions.

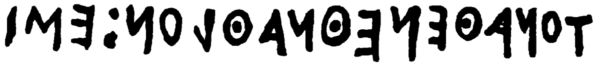
Inscriptions on Vases.—Inscriptions are very numerous during the middle period of Greek art, while on the most archaic vases and those of the decadence they are mostly absent. They are of great interest in the history of Greek palæography, but are not always a safe guide as to the dates of vases, because archaic forms of letters were often used by vase-painters long after other forms of letters had come into general use. Vase-inscriptions may be divided roughly under two heads—Ionian and Dorian, the latter occurring mostly on the numerous vases from Corinth and her colonies. The accompanying table[1] shows the usual forms of letters which differ from the New-Attic alphabet; the latter is still in use, and has been but little changed since about 400 B.C., when the long vowels were introduced. Some of the early letters have no representative in the latter Greek alphabet, *e. g.*, the digamma *Ϝ*, the koppa Ϙ, and the aspirate B or H.


DORIAN.
IONIAN.
OLD ATTIC.
NEW ATTIC.
aspirate
aspirate
aspirate or
koppa
san
digamma

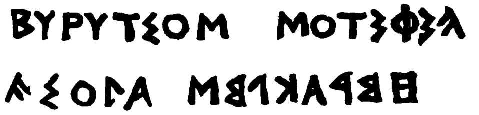
One of the earliest vase-inscriptions known is that mentioned below (see Fig. 24, p. 629) as occurring on a "pinax," or large flat platter, with archaic painting in brown, found at Camirus in Rhodes and now in the British Museum. Each figure has its name thus—



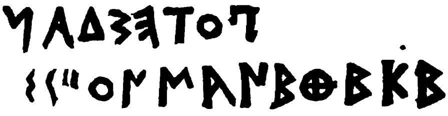
for ΜΕΝΕΛΑΑΣ ΕΚΤΟΡ (retrograde), and ΕΥΦΟΡΒΟΣ. This curious inscription has the Ionian form of Ε, the Dorian Μ (san) for Σ, and a common archaic form of Θ for Φ, a very strange and exceptional combination of characters. The Burgon Panathenaic amphora (see Fig. 25) has a very curious Old-Attic inscription, written downwards—



for ΤΟΝ ΑΘΕΝΕΘ[Ε]Ν ΑΘΛΟΝ Ε[Ι]ΜΙ, "I am one of the prizes from Athens," the usual inscription on prize vases. Vase inscriptions are usually *painted*, if on a red ground in black or brown, if on a black ground in red or white. Some are *incised*, scratched after the vase was fired; but such occur less often. They are written both retrograde, and from left to right, apparently without any fixed rule. Both methods frequently occur in the same inscription. A fine early Corinthian crater, found at Cære and now in the Louvre, with black figures representing Heracles feasting with Eurytius, has the names of the persons represented inscribed in the characteristic early Dorian manner—



for ΕΥΡΥΤΙΟΣ, ϜΙΦΙΤΟΣ ϜΙΟΛΑ (Viola, a lady present at the feast), and ΗΕΡΑΚΛΕΣ. On the handle of the crater is scratched ϘΟ, for Corinth, the place where it was made.[2] Another Dorian inscription of great interest occurs on a votive clay tablet dedicated to Poseidon, about 4 by 2¼ inches, now in the Louvre. Poseidon is represented at full length, holding a trident and a wreath, in black with incised lines; at each corner is a hole for fixing the tablet to the temple wall. It is inscribed—

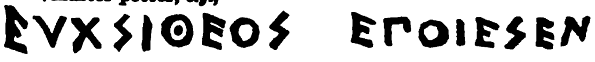


for ΠΟΤΕΙΔΑΝ . . . ΟΝ Μ'ΑΝΕΘΗΚΕ, "—on dedicated me to Poseidon." This curious tablet was found at Corinth; the letters are very archaic in form, though the painting can hardly be earlier than the 6th century B.C.

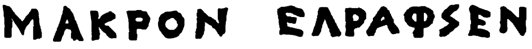
Subjects of inscriptions.

The great majority of vases have inscriptions in Old-Attic characters, such as are shown in the two following examples. The subjects of the inscriptions may be divided into five heads, though other miscellaneous ones also occur.

(1) On early vases rudely scratched trade-marks, or potters' marks, indicating the number of vases in a special batch and their prices. (2) Potters' and artists' names. The majority have only one name, possibly that of the master-potter, *e.g.*,



for Εὐξίθεος ἐποίησεν. In other cases, mostly on the finest vases, the name of the painter occurs as well as that of the potter, *e.g.*,



for Μάκρων ἔγραψεν. Some artists, probably distinguished for their skill, painted the vases of several potters; other painters' names chiefly occur on the vase of one special potter. (3) Names of people, animals, and even things represented on the vases. A large proportion of the earlier vases have a name by the side of each figure, or at least, by the side of the most important ones. Names of horses and dogs occasionally occur, and in a few instances even inanite objects are designated by a name, *e.g.*, the balance on cylix of Arcesilaus in the Paris Bibliothèque and Zeus's rone on an early amphora in the Louvre. (4) Speeches tered by the vase figures, *e.g.*, in a scene representing a me at ball one of the players says **ΧΡΗΣΑΝ ΜΟΙ ΤΑΝ** **[Α]ΙΡΑΝ**, "Throw me the ball." Other vases have ords of compliment or greeting, such as **ΧΑΙΡΕ**, "Hail!" words relating to their contents, *e.g*, **ΗΔΥΣ ΟΙΝΟΣ**, The wine is sweet." (5) Names of owners, often with adjective **ΚΑΛΟΣ** or **ΚΑΛΕ** (if a lady), possibly ended for gifts, like the majolica plates inscribed with a y's name followed by the epithet "diva" or "bella." amphora with a very curious inscription has recently en found at Orvieto, in early Attic characters—**ΖΞΛΙΘ-ΙΜΙΑΧΟΥΞΒΟΥΔ** (retrograde)—meaning δὺ ὀβελὼ καὶ με ἔχεις, "Two obols, and you have me."[1]

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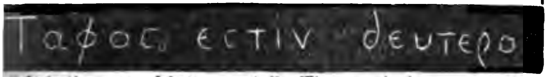
[1] Those letters which have the same form in all three lists are omitted.

[2] See *Mon. Inst.*, vol. vii.

A quite different species of inscriptions occurs on vases of he latest class. Artists' and potters' names cease to appear ith the rapidly increasing decadence of the art. A black rater in the British Museum has a dedicatory inscription ainted in white round the neck, **ΔΙΟΣ ΣΩΤΗΡΟΣ**, "Zeus he Saviour." A fine black fluted amphora has the owner's ame, **ΑΡΙϹΤΑΡΧΟ ΑΡΙϹΤΩΝΟΣ**, in which the late form of Σ occurs. On a small black ascus in the British useum is scratched rudely **ΠΡΟΠΙΝΕ ΜΗ ΚΑΤΘΗΙΣ**, Drink, do not set me down." Aud some plain black easures have their capacity incised on them, *e. g.*, **ΗΕΜΙ-ΚΟΤVΛΙΟΝ**, "Half a cotylion," on a cup-shaped vessel rom Corcyra. One of the earliest known instances of reek cursive writing occurs on a covered pyxis divided nto four compartments (in the British Museum). It appears o have been used to contain the ashes of a Roman called ergius. Under the foot is rudely scratched—

"My beloved Sergius, farewell." The last word is blunered. And on the inside of the lid is a similar incised nscription—



Ταφοϲ εϲτιν δευτερο

"It is the second interment." The pyxis is apparently uch older than the inscription, a supposition which is onfirmed by the note as to its being a later burial.

One sort of inscription, used more largely by the Romans han the Greeks, was impressed from incuse stamps, method chiefly used for large amphoræ and other essels of plain biscuit clay, especially those made in hodes and Cnidus. These inscriptions, which date rom the time of Alexander the Great down to the 1st entury after Christ, usually give the name of an eponyous magistrate or chief priest, and have frequently addition one of the thirteen months of the Doric alendar. Some of the stamps are circular, copied from urrent Rhodian coins, and have the legend round a ont face of Helios, or the rose-blossom ῥόδον, which as the badge of the island. Other stamps are square lozenge-shaped; they are usually impressed on the eck or handle of jars.[2]

Having considered the technical methods emloyed in the manufacture of Greek vases and he various classes of inscriptions which occur pon them, we will now return to the styles of ase-paintings and the subjects which are most requently represented.

SECTION V.—HELLENIC.

rchaic.

Archaic Class.—The manner in which the styles of ornament on early pottery merge almost insensibly one into another akes it difficult to arrange it in distinct classes, nd it is not easy to say at what precise stage the erm "Hellenic" can be given to the archaic vesels. The presence of Greek inscriptions makes, owever, a convenient starting-point.

Probably the earliest known Greek ceramic inription occurs on the Rhodian pinax mentioned above ee Fig. 24). The painting on this, though rudely xecuted in brown and red ochres on a pale yellow slip-covered clay, the same in method as the earlier non-Hellenic paintings, shows a marked artistic advance by the fact that it represents a definite historical scene taken from the *Iliad*. No incised lines are used except for the feathers of the heraldic eagle on Hector's shield. A large number of other pinaces were found at Camirus, of the same date, but without inscriptions, and with purely decorative paintings, such as geometrical lotus-patterns, and spirited figures of bulls, sheep, and other animals, or sphinxes and gorgons' heads. Some large clay coffins, also found at Camirus and others at Clazomenæ, belong to this class of pottery.[3] One of those from Camirus is in the British Museum. The top is decorated with painting in red and brown ochre colors.

At the head is a bull between two lions, and below them two curious helmeted heads of warriors drawn in profile, both unfortunately much injured by restoration. Other parts are decorated with figures of beasts on a ground studded with rosettes and other small designs, in which some antiquaries see varieties of solar symbols; but, whatever their original meaning may have been, they appear on this pottery to be used merely as decoration. Other vases of a very early period with figure-subjects and inscriptions, probably of the 7th and 6th centuries B.C., have been found at Corinth, such as the "Dodwell pyxis," now at Munich, on the lid of which is painted the scene of the Caledonian boar hunted by various heroes in the presence of Agamemnon; each figure has an inscribed name. At Corinth also curious votive tablets have recently been found, some inscribed, with painted figures either of the god or of the donor; one of these is shown in Fig. 20. It is very early in date.

The "Burgon amphora," so called from its finder, now in the British Museum (see Fig. 25), is a very interesting specimen of this early class; it is one of the prize amphoræ which, filled with sacred olive oil, were given to the victors at the games held during the Panathenaic festival. It was found at Athens, filled with the ashes of its owner, and is no doubt the work of an Athenian potter. One one side is the usual figure of Athene Promachos in black, except the goddess's flesh, which is white, and the inscription and touches on the dress, which are in crimson. On the reverse side is the winner of the vase driving a biga,

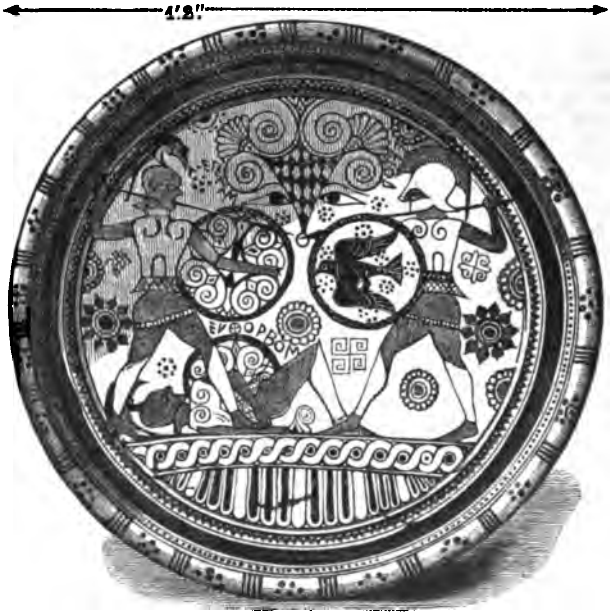


FIG. 24.—Early inscribed pinax from Rhodes, with contest of Menelaus and Hector over the body of Euphorbus.

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[1] See *Ann. Inst.*, 1882, p. 58.

[2] See Dumont, *Inscr. Céram. de Grèce*, Paris, 1872; and *Corp Inscr.* r.

[3] *Journal of Hellenic Studies*, 1883.

apparently in the act of winning the race which gained him the prize. On the neck of the vase is the owl sacred to Athene. The drawing of the figures is very rude, probably dating from the 6th century B.C.

The "François crater," found at Chiusi, now in the Etruscan Museum in Florence, is another important example of this early class. It is signed as the work of the potter Ergotimus and the painter Clitias, and is painted with a long series of subjects, all relating to the life and death of Achilles. It has no less than 115 explanatory inscriptions.[1] Of about the same date, 6th century B.C., is the cyclix of Arcesilaus found at Vulci, now in the Paris Bibliothèque. It is painted in black and red on a cream-white slip, and represents Arcesilaus, one of the Cyrenian kings of this name, superintending the weighing of a number of bags of the silphium plant. All the figures and even the scales have their names painted by their side. It is executed with great neatness and technical skill, but the drawing is stiff and awkward. The scene, which is represented with great dramatic vigor, appears to be on board a ship, judging from the complicated cordage overhead and the yard-arm from which the large balance is suspended.

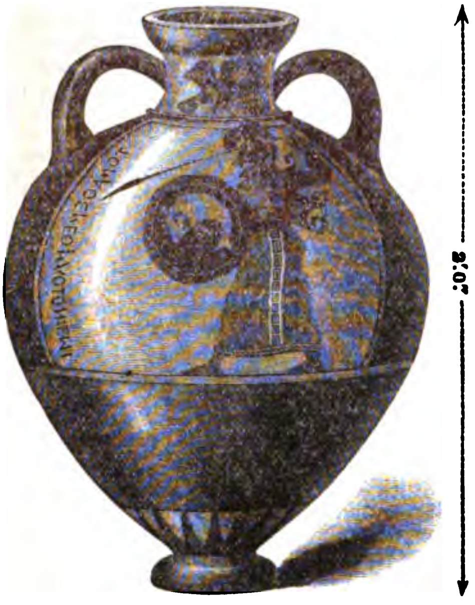

FIG. 25.—The Burgon Panathenaic amphora, with early Greek inscription.

It is at present impossible to fix with any certainty the dates of this early Hellenic pottery, as is also the case with the still older pottery of Rhodes and Mycenæ, but the increase of our knowledge on the subject tends to give a much more remote period to its production than has been hitherto assigned to it by the majority of writers on the subject. The foregoing class of pottery forms a link, with various stages of development, from the glossless vases painted in dull ochre browns and reds to that large and important class of Greek pottery which has figures painted in glossy black enamel, on a red, slightly glazed, clay ground, or less frequently on a cream-white ground. The vases of this class, found in large quantities over a wide area in Greece, Italy, and Sicily, include paintings of the most different kinds, from the rudest almost shapeless daubs to the most carefully-executed pictures, drawn with great beauty of composition and firm accuracy of form, though always retaining some amount of archaic stiffness and conventionalism. Though the faces are nearly always represented in profile, the eyes are shown front-wise, a method of treatment which continued in use even on the earlier vases of the next period, those with red figures on a black ground. Fig. 26 shows the progressive treatment of the human eye by vase-painters, from the earliest introduction of figures down to the end of the 4th century B.C.

Red vases with black figures.

Many of the floral ornaments of this period still retain clear signs of their Oriental origin. The sacred tree of Assyria, in an elaborate and highly conventionalized form, very frequently occurs, or, worked into a running pattern, it forms a continuous band of decoration, out of which the Greek so-called "honeysuckle pattern" seems to have been developed. These vases have far greater variety and richness in their decorative patterns than those with the black ground, the natural result of the great ease and freedom of hand with which delicate floral designs could be touched in with the brush in black, while in the later manner the red patterns had to be laboriously left out by working the black ground all round them. Hence the stiffness and poverty of invention which are so remarkable in the decorative patterns on the vases of the "best period." Many of the black figures of men and animals are executed with extraordinary minuteness, owing largely to the engraved gem-like treatment with which the incised lines are applied, especially in the representation of the hair of men or animals, and also in the rich textile patterns with which the draperies are often covered. Some of the vases, judging from their general form and thin band-like handles, were evidently copied from metal vessels, as, for example, a number of small amphoræ found in various places, executed in the workshop of Nicosthenes, a rather inartistic potter, who appears to have turned out a large number of vases with little or no variety in shape or ornament.

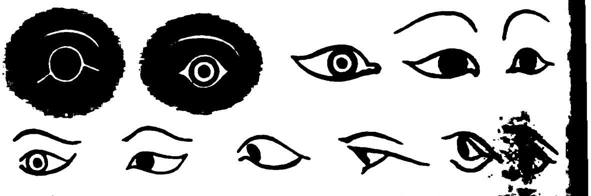

FIG. 26.—Series of human eyes from painted vases, showing the development of drawing, and power of representing the eye in profile.

Transition.

The later vases, with black figures, were produced simultaneously with the earlier ones decorated with red figures; and during this transitional period (about the middle of the 5th century B.C.) some vase-painters worked in both styles, both kinds of painting sometimes occurring, even on the same vase. The British Museum possesses one of the finest specimens of these, a large amphora with nobly designed paintings. On one side are two seated figures of Greek warriors, probably Ajax and Achilles, playing at a game like draughts. They are painted in black with chocolate-red touches, and minute details, such as the drapery over their armor and their wavy hair, executed in incised lines of extreme fineness and gem-like treatment. The other side of the vase has *red* figures on a *black* ground, a most powerfully drawn group of Heracles strangling the Nemæan lion in the presence of Iolaus, and an archaic statue-like figure of Athene. As in the painting with black figures, some touches of red are used. The treatment of Heracles's hair is peculiar and again recalls gem-engraver's work, in which hair is represented by a series of drilled holes; in this painting the stiff curls are given by a number of round dots of the black enamel, applied in considerable body so as to stand out in relief. This treatment frequently occurs on the fine vases of this and later periods, and the same method is occasionally used in a very effective way to represent bunches of grapes and the like.

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[1] *Bull. Inst.*, 1845, pp. 113, 120, and *Ann. Inst.*, 1848, p. 382.

Black vases with red figures.

Vases with Black Ground and Red Figures.—After about the middle of the 5th century B.C. this method superseded that with the black figures, and to this class belong the finest vases of all. The drawing of the earlier specimens is strongly sculpturesque in style, sometimes recalling the noble though slightly archaic pediment figures from Ægina, while the vase-paintings of a few years later seem to belong to the Phidian school; the forms are noble and massive, treated with great breadth and simplicity, and kept strictly to one plane; faces are nearly always drawn in profile, and all violent foreshortening of limbs is avoided. Some vase-painters of this period (*c.* 450–400) retain a slight touch of Oriental feeling in their drawing, as, for instance, the beautiful amphora by Euxitheus in the British Museum, which has single figures of Achilles and Briseis, one on each side (see Fig. 27).

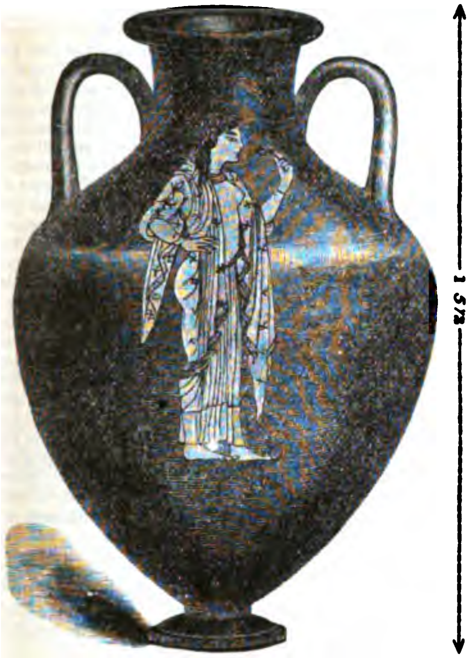

FIG. 27.—Amphora by Euxitheus (*c.* 450 B.C.), figure of Briseis; the other side has Achilles.

It should be remarked that the style of vase-paintings is generally rather archaic as compared with other branches of contemporary art, as was the case with their inscriptions, and a certain conventionalism of treatment, such as would not be found in sculpture, lingers till quite the end of the 5th century B.C. Fig. 28 shows a painting from the inside of a cylix, remarkable for the severe beauty and simple grace of its drawing and composition. The scene represents the moment when Peleus has won Thetis for his bride, and is leading her away in triumph, gently overcoming her modest reluctance; her shrinking and yet yielding attitude is drawn in the most refined and masterly manner possible.[1]

In the succeeding century both drawing and composition began to gain in softness and grace, while losing something of their old vigor. Vase-paintings became more pictorial, and the compositions more elaborate and crowded; the British museum has an amphora from Camirus (Rhodes), one of the most beautiful of this later class, elaborately decorated on one side with various colored pigments and gold applied over the finished black and red figures. As in the earlier cylix of Fig. 28 the scene represents the final triumph of Peleus in his pursuit of Thetis; in order to fill up the space some of the figures are placed, as it were, in the air, a method of composition peculiar to the later vase-paintings. Though not highly finished in details, such as the hands and feet, this picture is a perfect marvel of skilful touches rapidly applied, and of extreme beauty of form and general composition (see Plate V.). The funeral lecythi from tombs in the neighborhood of Athens are a remarkable class of vases, *c.* 350–300 B.C. (see Fig. 29). On these, over a white ground, are painted scenes representing mourners visiting sepulchral stelæ with offerings in their hands. They are drawn carelessly, but with great skill, in red outline and then coarsely filled in with colors. Some of the seated females are designed with wonderful grace and pathos, the whole pose full of a tender longing for the departed one. Besides the funeral lecythi a few pieces of pottery have been found, dating from about the same period, which have paintings executed on a ground of white slip. Some of them are of most extraordinary beauty; perhaps the finest of all is a cylix from a Rhodian tomb, now in the British Museum, on the inside of which is a drawing, chiefly in outline, representing Aphrodite seated on the back of a flying swan. For delicacy of touch and refined beauty of drawing this painting is quite unrivalled. The exquisite loveliness of Aphrodite's head and the pure grace of her profile, touched in with simple brush-formed lines, are quite indescribable, and show a combination of mechanical

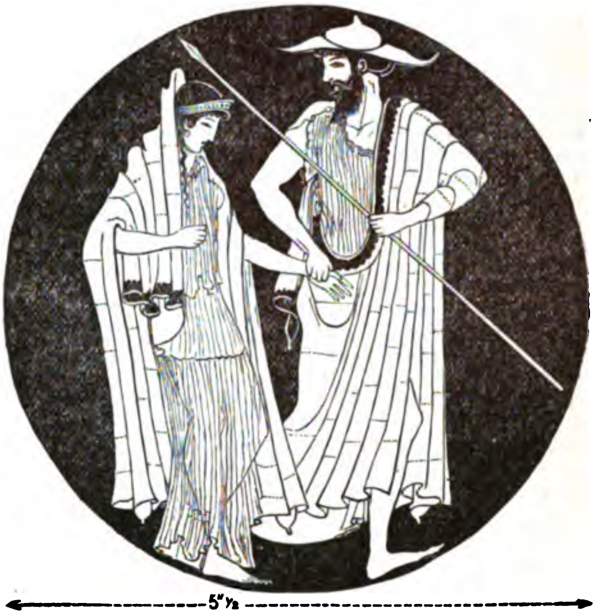

FIG. 28.—Peleus leading home his bride Thetis; painting inside a cylix found in a tomb at Vulci (*c.* 440–420 B.C.).

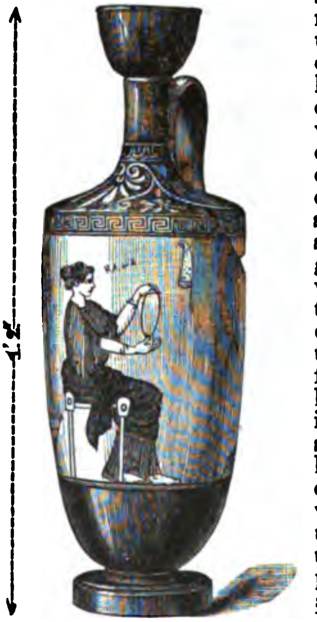

FIG. 29.—Sepulchral lecythus from a tomb near Athens. (British Museum.)

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[1] The same design, though with inferior execution, is repeated on a cylix found at Corneto; see *Mon. Inst.*, ix., table xx.

skill united to imaginative power and realization of the most perfect and ideal beauty such as no people but the Greeks can ever have so completely possessed (see Plate V.).

Vases of the decadence.

Vases of the Decadence.—The vases of this class are often of enormous size, covered with very numerous figures, often possessing much graceful beauty in form, but very inferior in execution and purity of drawing to the earlier paintings. The figures, especially in the later specimens, are thoroughly pictorial in treatment; many of them are painted in cream-white, with shaded modelling in yellows and browns. Effects of perspective are introduced in some of the architectural features, particularly in the bands of rich floral scroll-work. In the 2d century, till about 100 B.C., when painted vases ceased to be made, the paintings became extremely coarse and devoid of any merit whatever, though even at this time molded vases, either decorated with reliefs all over or with small inserted emblemata, continued to be made of great artistic beauty. The extreme degradation to which vase-painting of this period fell seems to be due not so much to the general decay of the arts among the Greeks as to the fact that the vases were no longer made by able artists, but were turned out in large quantities from the hands of an uneducated class of artisans. This was probably partly owing to increasing wealth and love of display, which created a demand for gold and silver plate rather than for the cheaper but more artistic beauty of painted clay.

Dates of vases.

The dates of Greek vases are difficult to fix, partly from a natural tendency to archaism, which varies with the productions of different places, and partly because in some cases there was an artificial reproduction of old styles and methods. The following chronological classification, which is commonly accepted, is only very roughly correct, and is not applicable in all instances: (1) black figures on red ground, about 8th century to 440 B.C.; (2) red figures on black ground, of the best period, *c.* 440–300 B.C.; (3) period of decadence, *c.* 300–100 B.C. Fine moulded black vases, and vases with polychromatic paintings of good style, were made towards the end of the 4th and early part of the 3d century B.C.

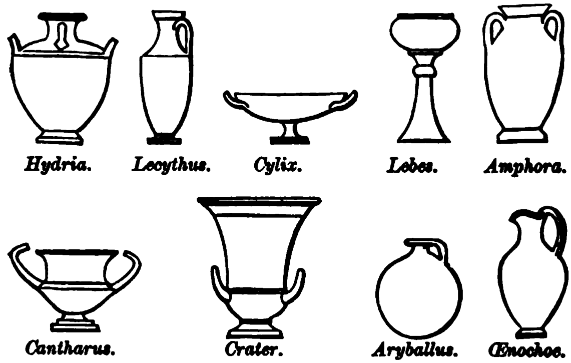

FIG. 30.—Principal shapes of Greek vases and their names.

Shapes and uses.

Shapes of Vases and their Use.—From the 5th century and afterwards but little scope was left to the fancy of the individual potter in the forms of his vases. One special pattern was pretty closely adhered to for each sort, though, of course, modifications in shape took place as time went on. Fig. 30 gives the forms of the chief sorts of vases; a large number of others exist, each with its special name. Amphoræ and hydriæ are the largest and most important, and have the grandest picture-subjects painted on them. The cylices frequently have paintings of wonderful delicacy and beauty; the later Athenian lecythi are remarkable for their polychromatic decoration. The uses of the painted vases is a very difficult question; few show any signs of wear, though they are made of soft clay easily scratched, and most of those which are represented in use on vase-pictures are plain black without any paintings. A beautiful little pyxis, or perfume-box, in the British Museum, shows in its pictured scene of a lady's toilet several painted vases, which are set about the room as ornaments, and have flowers or olive-branches in them (see Fig. 31). Many vases are blank on one side, or have on the reverse side a painting of inferior execution, apparently because they remained set against a wall or in a niche. Nearly all those now existing came from tombs, and it is probable that the ornamental vases were selected for sepulchral purposes, while a plainer and less decorated class was employed for actual domestic use.

Panathenaic amphoræ.

Panathenaic Amphoræ.—This is a very important class of vases,[1] extending over a long period, from the 6th to the end of the 4th century B.C. Fig. 25 above gives the earliest known specimen. They all have on one side a figure of Athene Promachos, and on the other a scene from the public athletic games. They are inscribed ΤΟΝ ΑΘΕΝΕΘΕΝ ΑΘΛΟΝ ΕΙΜΙ, and some of the later ones have the name of the eponymous archon as well, *e.g.*, ΠΥΘΟΔΗΛΟΣ ΑΡΧΩΝ on an amphora from Cære, now in the British Museum. Pythodelus was archon in 336 B.C., and so the date of the vases thus inscribed can be accurately determined. A number found at Benghazi and Teuchira in the Cyrenaica are now in the British Museum and the Louvre. Some of the archons' names on them are these—Nicocrates (333 B.C.), Nicetes (332 B.C.), Euthycritus (328 B.C.), Cephisodorus (323 B.C.), Archippus (321 B.C.), and Theophrastus (313 B.C.). The figure of Athene on all of them is rudely painted in pseudo-archaic style—the figure in black and white, with incised lines, on a red ground; the other side is painted in the same way, but is not archaic in drawing. Long vowels occur in the archons' names, but sometimes the same amphora has the obverse inscription written in the old way. They are all poor as works of art. One in the British Museum is of special interest from the design painted in white on Athene's shield. This is the celebrated sculptured group of Harmodius and Aristogiton by Critias and Nesiotes, of which an ancient copy exists in the Naples Museum, though the bronze original is lost.

Subjects of vase-paintings.

Subjects of Vase-paintings.—These are of great interest, and are almost endless in number; only the scantiest outline can be given here, and, with so wide a range, any classification is necessarily imperfect. The following list includes the majority of subjects. (1) Stories of the gods, scenes such as the Gigantomachia or the birth of Athene. (2) Scenes from the heroic age, as the achievements of Theseus and Heracles, the wars of Thebes, the battles with the Amazons, the voyage of the Argonauts, the Trojan War, the return of the Greeks from Troy, and the like. (3) Dionysiac subjects, such as orgies of Dionysus and dances of satyrs. (4) Scenes from real life, such as the vintage, olive-gathering, marriages, feasts, dancing, hunting, sacrifices, and theatrical subjects. (5) Funeral subjects, as mourners bewailing the dead or bringing offerings to a tomb. (6) Scenes from the gymnasium and various athletic exercises. (7) Allegorical subjects, with figures of happiness, wealth, youth, and the like. (8) Historical subjects, which, however, are rare: a very fine vase in the Louvre, of the best period, has Crœsus on his funeral pyre; the cylix of Arcesilaus has been mentioned above; Anacreon playing on his lyre, and followed by his pet dog occurs on several fine vases; the meeting of Sappho and Alcæus is also represented; other portrait-fig-

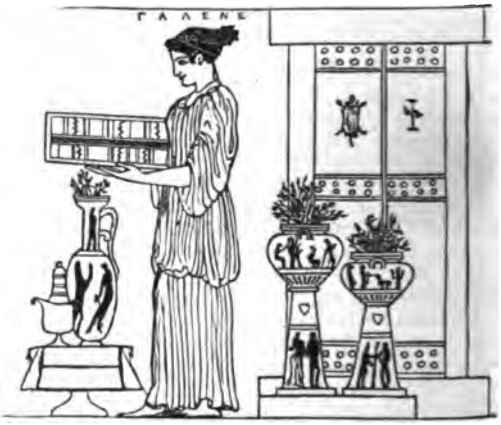

FIG. 31.—Painting from a small toilet-box or pyxis, showing painted vases used to decorate a lady's room. On the left is a gilt pyxis with a tall lid, and an œnochoe on a low table: on the right two tall vases (lebes) on a plinth. All except the pyxis are decorated with painted figures, and contain flowers.

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[1] See *Ann. Inst.*, 1830, p. 209, and 1877, p. 294; also *Mon. Inst.*, x. tables xlvii., xlviii.

ures appear, chiefly of poets and philosophers, many with inscribed names which are now unknown. (9) Humorous subjects: these are common on the vases of the latest period and are usually very coarsely painted; caricatures of mythological subjects frequently occur in which the gods are represented as dwarfs or hunchbacks.[1]

Places where Greek Vases have been found.—Till within the Localities. last twenty years most were discovered in the tombs of Magna Græcia, Sicily, and Etruria. Capua, Nola, and Vulci supplied a very large quantity of vases of the finest sort with the most rich and brilliant enamel. Special characteristics of style and technique can be traced in the production of special localities, but these differences are not very important. Of late years Attica, the Isthmus of Corinth, and other places on Hellenic soil have yielded a great many fine vases; the islands of the Ægean Sea and the western shores of Asia Minor are rich in sepulchral stores of these and all branches of Greek art. Athens possesses a fine and rapidly-increasing collection chiefly from Attica. The British Museum collection is on the whole the finest for Greek vases of all periods, though it is very poor in Etruscan pottery. The other chief collections of Europe are in the Louvre, at Naples, in the Vatican, at Florence, and Turin; Munich, Vienna, Berlin, and St. Petersburg also have very fine collections; and there is a small one in the Bibliothèque, Paris.

SECTION VI.—PREHISTORIC AND ETRUSCAN IN ITALY.

Very many of the numerous vases discovered in the tombs of ETRURIA (*q.v.*) are imports either from Greece and its islands or from the neighboring country of Magna Græcia. Nevertheless there is a large class of pottery which is distinctly native, extending over a very long period, from quite prehistoric ages down to the time when the Roman rule extended throughout the peninsula. This pottery may be divided into six classes,—(1) prehistoric; (2) black glossy Etruscan; (3) pottery rudely painted with figures of purely Etruscan design; (4) plain biscuit clay, unpainted, but decorated with stamped reliefs; (5) later vases, badly-executed imitations of painted Greek vases, but having Etruscan subjects, or Greek subjects treated in a distinctly Etruscan manner; (6) large clay slabs, with painted figures, used for the wall-decoration of tombs.

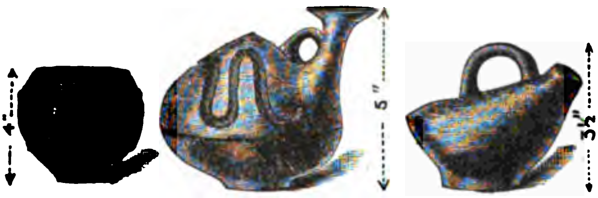

FIG. 32—Prehistoric pottery from Italy.

1. *Prehistoric.*—This is the work of the Siculi, Oscans, Umbrians, and other occupiers of Prehistoric. Italy before the arrival of the Etruscans. It is mostly small, made without the wheel, of coarse brown or blackish clay, slightly ornamented with ridges of clay modelled in relief. One curious variety is in the form of a primitive Oscan hut, with a movable door, fixed with pegs.[2] The Museo del Collegio Romano has a fine collection of the prehistoric pottery of Italy, Sardinia, and other places. Fig. 32 shows some of the commonest forms.

2. *Etruscan Black Ware.*[3]—It is remarkable that Etruscan black ware. the Etruscan race, though so extraordinarily skilful in most of the handicrafts, did not excel at any period in their pottery. They were especially famed for their skill in metalwork, and hence perhaps this largest and most numerous class of their fictile ware is mostly shaped after metal forms and decorated with designs not specially suited to clay. The clay of which this black ware is composed consists (taking the average of many analyses) of the following ingredients, silica 63, alumina 15, peroxide of iron 8, lime 3½, magnesia 2, and carbon 2. It is hard and metallic in appearance, generally of a glossy black, but sometimes gray. Its black is partly due to the superficial presence of free carbon, showing that the vases were fired in a close kiln, under the direct contact of the carbonaceous smoke from the fuel, a process called in modern times "the smother kiln." If heated to a bright red in an open fire the ware loses its black color and becomes grayish white or brown. Its forms and the figures stamped in blunt relief all suggest that they were copied from metal originals, a supposition strongly borne out by the fact that many of them are completely covered with gold or silver leaf (see Fig. 33). The reliefs upon them consist of lions and other animals, sphinxes, chimæræ, human figures, or geometrical patterns, all coarsely executed, and very blunt in their forms, partly from want of sharpness in the moulds they are stamped from, and partly through the shrinkage of the clay in the kiln. Some of the shapes are graceful, especially those undecorated by reliefs (see Fig. 34). Others are very fanciful, worked into forms most unsuited for clay, such as "situlæ" or buckets, with movable ring handles; incense cups supported on thin bands of clay stamped with reliefs; and jugs shaped like hollow rings. A few have their shapes copied from Greek vases, *e. g.*, a number of small amphoræ of exactly the same form as those made by the Greek potter Nicosthenes. A common form of Etruscan vase has a lid shaped like a human head, copied apparently from Egyptian Canopic vases. Some have human arms rudely modelled in clay and fastened on by pegs. Besides the black vases of this form, there exist many made of red clay covered with yellow slip.

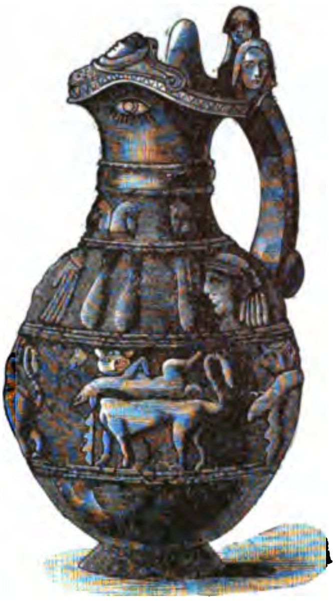

FIG. 33.—Etruscan œnochoe, of black ware, with figures in relief. (British Museum.)

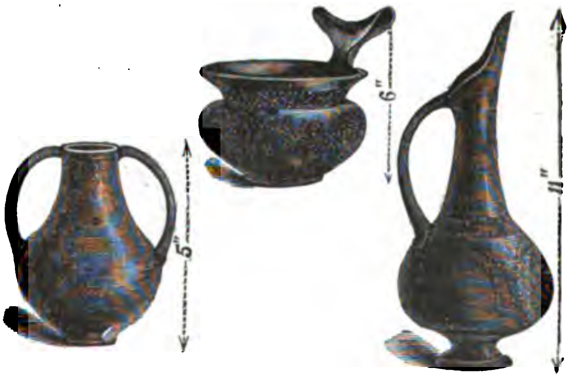

FIG. 34.—Plain Etruscan black pottery.

3. *Etruscan Painted Vases.*—A number of very

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[1] See Heydemann, *Humoristische Vasenbilder*, Berlin, 1873.

[2] See Virchow, *Die italienischen und deutschen Haus-Urnen*, Berlin, 1884.

[3] See Lenormant, "Vases Étrusques de terre noire," in *Gazette Archéologique*, 1879.

costumes are interesting; many of the garments fit tightly to the body, and the men mostly wear a peculiar sort of high boot turned up at the tip. It is doubtful whether they are executed in true ceramic colors fired in the kiln. They may possibly be only tempera paintings, like those on the tuff-walls of some of the excavated tombs. The great size of the well-baked clay slabs on which they are painted shows that the Etruscans must have constructed pottery-kilns of considerable dimensions.[1]

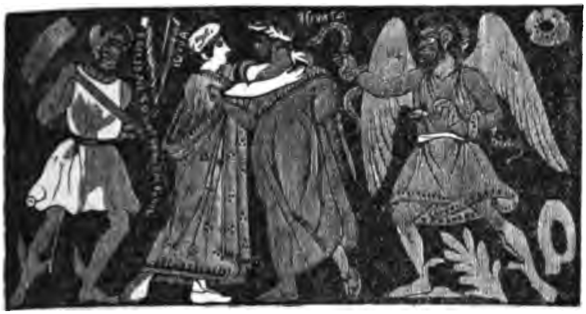
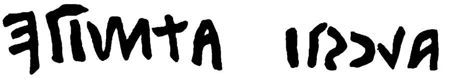


FIG. 38.—Etruscan painting, an amphora of later Greek style; parting scene of Alcestis and Admetus, with Etruscan inscriptions.

Inscriptions.

Inscriptions on Etruscan Vases.—Painted words or phrases are not uncommon on the vases which are imitated from the Greek; they are usually illustrative of the subject, as, for example, the vase mentioned above with the parting scene of Alcestis and Admetus, which has, in addition to the names of the two principal figures, a sentence in the Etruscan language, spoken by Charun—"Eca ersce nac aqrum wlerorce" (I bear thee to Acheron). The names of Admetus and Alcestis are written retrograde,[2] thus—



Several Etruscan vases of black ware have been found with the complete Etruscan alphabet rudely scratched upon them. They give early forms of the twenty-two Phœnician letters, and are arranged in the Semitic order.[3] A cup in the museum at Grosseto has two Greek letters added after the twenty-two which composed the Etruscan alphabet. Some late vases, not earlier than about 200 B.C., are interesting from having inscriptions painted in white, which give early forms of the Latin language. They are mostly dedicatory with names of Latin deities, *e.g.*, **VOLCANI POCVLOM**, "the cup of Vulcan;" **BELOLAI POCVLOM**, "the cup of Bellona," and others.

Dates.

Dates of Etruscan Pottery.—These can only be roughly estimated. The black moulded ware (class 2) seems to range from about the 8th to the 3d century B.C. The large jars with stamped bands (class 4) appear to be all very early in date, about the 8th century B.C. They are not found in those tombs which contain painted vases. The large vessels with rude native paintings (class 3) are probably of the 6th and 7th centuries. The vases with imitations of Greek paintings extend over a long period, from about the 6th to the 2d century B.C.

Localities.

The greatest quantities of Etruscan pottery have been discovered in the tombs of Tarquinii, Cære, Veii, Cervetri, Chiusi, and near Orbitello, Volterra, Orvieto, and other places in central Italy, but above all at Vulci. The best collections are in the Louvre and the Vatican, at Florence, Naples, Turin, Bologna, Brescia, and many small towns in Italy in the neighborhood of the various Etruscan cemeteries, such as Orvieto, Perugia, Grosseto, Volterra, Arezzo, and at Capua, where a very important ceramic museum is being formed.

Literature.—The best articles on the subject of Greek and Etruscan pottery are scattered through the numbers of various archæological publications, especially the *Annali*, the *Monumenti*, and the *Bulletino dell' Instituto di Corrispondenza Archeologica*, Rome, 1829, and still in progress. See also the *Bulletino Archeologico Napolitano*, 1842–59; Stephani, *Compte rendu de la Commission Archéologique*, St. Petersburg, 1859 (in progress); *Bull. de Cor. Hellen.*, in progress; *Archäologische Zeitung*, Berlin; *Philologus: Zeitschrift für das klassische Alterthum*; *Rheinisches Museum für Philologie*; *Archæologia*, Soc. Ant. London; *Berichte der sächsischen Gesellschaft der Wissenschaften*; Panofka, *Antiques du Cabinet Pourtalès*, 1834; C. T. Newton, *Catalogue of Greek Vases*, British Museum, 1851-70: Gerhard, *Antike Bildwerke* (1828–44), *Auserlesene griechische Vasenbilder* (1840–58), and *Griechische und etruskische Trinkschalen* (1840); Benndorf, *Griechische und sicilienische Vasenbilder*, 1877, in progress (with fine colored plates, all full size); Helbig, *Wandgemälde Campaniens*, 1868; Inghirami, *Pitture di Vasi fittili*, 1832–39; Millingen, *Unedited Monuments*, London, 1822–26; Lenormant and De Witte, *Monuments Céramographiques*, 1844–61; Raoul-Rochette, *Monuments d'Antiquité Grecque*, etc., 1833; Zahn, *Gemälde aus Pompei*, etc., 1827–29; Bröndsted, *Thirty-two Greek Vases*, 1832; Fiorelli, *Vasi dipinti*, etc., 1856; Gargiulo, *Vasi fittili Italo-Greci*, 1831; Heydemann, *Griechische Vasenbilder*, 1870, and *Die Vasensammlungen des Musen zu Neapel*, 1872; Jahn, *Ueber Darstellungen griechischer Dichter auf Vasenbildern*, 1861, and *Vasensammlung zu München*, 1854; Levezoff, *Verzeichniss der antiken Denkmäler*, 1834; Stephani, *Die Vasensammlung der Ermitage*, 1869; De Witte, *Vases peints de l'Étrurie*, 1837, and *Vases peints de la Collection Castellani*, 1865; Brunn, *Probleme in der Geschichte der Vasenmalerei*, 1871; Dumont, *Peintures céram. de la Grèce*, 1874, and *Vases peints de la Grèce*, 1878; Dumont and Chaplain, *Les Céramiques de la Grèce*, Paris, 1883 (in progress, with excellent illustrations); Kekulé, *Griech. Vasengemälde im Mus. zu Bonn*, 1879; Roulez, *Vases du Musée de Leide*, Ghent, 1854; Collignon, *Cat. des Vases du Mus. d'Athènes*, Paris, 1877; Froehner, *Anatomie des Vases Grecs*, Paris, 1880; Thiersch, *Die hellen. bemalten Vasen*, Munich, 1848. The following works deal specially with the vases found in Etruria: Inghirami, *Museo Chiusino*, Fiesole, 1833, and *Mon. Etruschi*, 1845; Conestabile, *Mon. di Perugia*, 1855–70; Noel Desvergers, *L'Étrurie*, Paris, 1862-64; *Bull. degli Scavi d. Soc. columbaria*, Florence, in progress; Gozzadini, *Necropoli a Marzabotto* (1865–70), *Sepolcri d. Necropoli Felsinea* (1868), *Necropoli di Villanova* (1870), and *Sepolcri nell' Arsenale di Bologna* (1875); Zannoni, *Scavi di Certosa di Bologna* (1871), *Scavi Arnoaldi* (1877), and *Scavi di via d. Pratello* (1873); all these works by Gozzadini and Zannoni are printed at Bologna. See also Pindar, *Nemæan Ode*, x. 64–67, and Strabo, viii. p. 381. For inscriptions on vases, see *Ephemeris Epigraphica*, and Böckh, *Corp. Iscr. Gr.*

SECTION VII.—GRÆCO-ROMAN AND ROMAN.

Græco-Roman glazed ware.

Some specimens of very peculiar glazed pottery have been found at Cyrene, Cyme, Pergamum, Smyrna, Tarsus, and other Roman colonies in Asia Minor. It is very delicate and often graceful in shape (see Fig. 39), with very thin handles, fashioned more like glass than pottery. It is remarkable for being covered with a thick vitreous glaze, usually colored either green, orange, or purple-brown, with oxide of copper, antimoniate of lead, or manganese, quite unlike the thin almost imperceptible glaze of Greek vases. This pottery is mostly small; some pieces are in the shapes of œnochoæ, two-handed cups, or asci, the latter covered with graceful patterns of vines or other plants moulded in slight relief. Statuettes and delicate reliefs, parti-colored with different glazes or enamels, have been found at several of the above places, and also larger vessels, craters, and bottle-shaped vases, decorated with moulded clay emblemata, wholly covered with a fine blue glaze. The Louvre and the British Museum have the best specimens of this rare ware, which probably dates from the 1st century B.C. downwards.

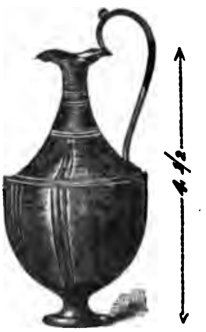


FIG. 39.—Græco-Roman œnochoe, highly glazed ware, from Asia Minor. (British Museum.)

"Samian" ware, the characteristics of which are described below, was made in Italy during the first period of Græco-Roman art. In 1883 some moulds for cups and bowls were found at Arezzo, all of the most wonderful beauty and gem-like delicacy of execution. The figures on them are from about 3 to 4 inches high, but are large and sculpturesque in their breadth of treatment. Some of the exquisite reliefs represent dancing fauns and bacchanals, with flowing drapery, on a background enriched with vine plants in slight relief. Another has a love scene of extraordinary grace and refined beauty. The modelling of the nude throughout is most masterly. The treatment of these reliefs recalls the school of Praxiteles, though they are probably not earlier than the 1st or 2d century B.C.

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[1] See Dennis, *Cities of Etruria*, ed. 1878.
[2] See Birch, *Ancient Pottery*, 1878, p. 460.
[3] See Taylor, *Alphabet*, 1883, vol. ii. p. 78.

Roman Pottery, 1st Century B.C. *to 5th Century* A.D.—Throughout Italy, Spain, France, Germany, Britain, and other countries occupied by the Romans great quantities of pottery have been found, varying but little in design or manner of execution. The principal varieties of this large and widely-spread species of ware may be classified thus—(1) Samian ware; (2) plain biscuit clay; (3) pottery decorated with slip in relief; (4) black ware; (5) glazed ware.

Samian ware.

1. The first class is a fine glossy red ware called "Samian" from its resemblance to the red pottery produced in the Greek island of Samos. The name is a convenient one, and as it is used by Pliny (*H. N.*, xxxv. 46) and other early writers it is well not to discard it, though probably the real Greek Samian pottery bore little resemblance to that made by the Romans except in color and glossy surface. It is of a fine red sealing-wax-like color, of pleasant texture, and is generally decorated with moulded reliefs. *Materials*: the clay body usually consists of silica 50-64 parts, alumina 18-25, red oxide of iron 7-10, and lime 2-9 parts; these proportions vary in different specimens. The red vitreous glaze, or rather enamel, which gives the ware its fine glossy surface consists of silica 64 parts, soda 20, and red oxide of iron 11 (average analysis). *Method of manufacture:* the bowls, cups, and other vessels, richly decorated outside with reliefs, were made thus. In the case of a bowl, a mould was first prepared, of hard well-burned clay, covered *inside* with incuse designs; these sunk patterns were made either by hand-modelling or, more usually, with the aid of stamps modelled in relief. Thus the *inside* of the bowl-mould corresponded to the *outside* of the future Samian bowl, which was first turned on the wheel quite plain, but of the right size to fit into the mould. Then, while it was still soft it was pressed into the mould, and afterwards both were put upon the wheel together. As the wheel revolved, the potter could at the same time press the clay into the sunk ornaments of the mould and finish neatly the inside of the vessel. In some cases he raised the walls of the bowl high above the mould by adding clay, and thus with the same mould could produce a variety of forms, though the lower or decorated portion always remained the same. A fine crater in the Louvre was made in this way. The vessel was then removed from the mould and the reliefs touched up by hand (in the finer specimens) with bone or wooden modelling-tools. The reliefs thus produced are often very graceful in design, but are mostly wanting in sharpness, many being blunted by the touch of the potter's fingers in handling the pot after it was removed from the mould.[1] It was next covered with the materials for the red enamel, very finely ground and fired in the usual way. Fig. 40 shows a design of typical character. The outer reliefs consist generally of graceful flowing scroll-work of vines, ivy, or other ornaments, mixed occasionally with human figures and animals. The finest sorts of Samian ware were made at Arezzo (Aretium) in Italy[2] and Saguntum in Spain (the modern Murviedro). It was also produced in France and Germany, and the discovery of a Samian bowl-mould at York makes it appear probable that it was made in Britain, where great quantities of it have been found. This ware is of great beauty, both in color and in its delicate surface reliefs; it is the most artistic sort of pottery that the Romans produced. It appears to have been highly valued, as many Samian bowls have been found carefully mended with bronze or lead rivets. In addition to the moulded ware many vessels of the same class were made plain from the wheel; others have a peculiar scale ornament in relief applied by the potter's thumb, a form of decoration common in other varieties of Roman Pottery.

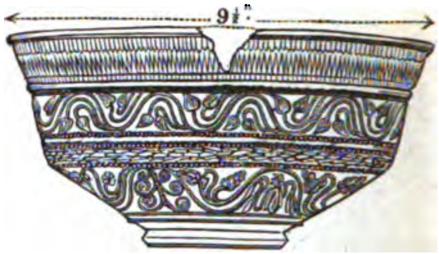

FIG. 40.—Bowl of Samian ware, with moulded patterns in slight relief.

Plain biscuit.

2. *Plain Biscuit Pottery* is made of simple unglazed clay, without decoration, of a soft body and quite porous. The clay is mostly composed thus: silica 48-69 per cent., alumina 10-22, oxide of iron 8-13, lime 1½-18 per cent., but it, of course, varies according to the locality where the pottery was made. Fig. 41 shows some of the forms of this simple ware. It was specially used for amphoræ, often nearly 2 feet high, sepulchral urns, and vessels for common domestic use. The forms are mostly graceful and natural. The clay is of many colors, including all shades of red, gray, brown, yellow, and (rarely) almost pure white. Some of this pottery has the grain which had been produced by the wheel carefully smoothed out by a tool or the potter's hand, or in some cases by dipping the piece into a bath of thin fluid slip, but it is more commonly left without any attempt at smoothness or high finish.

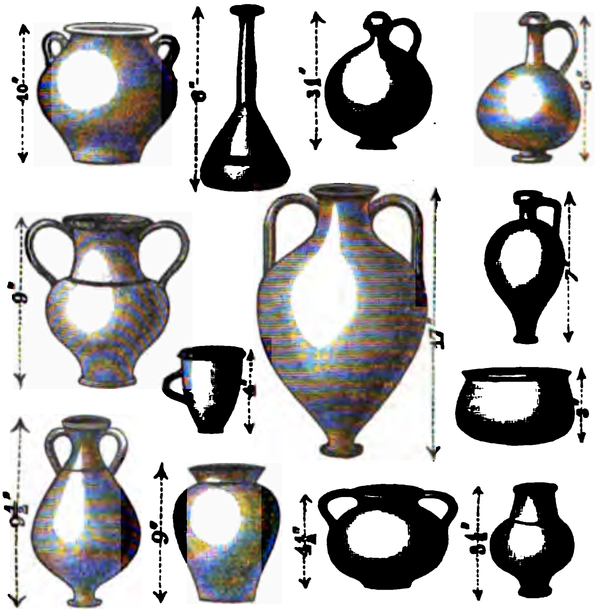

FIG. 41.—Typical shapes of common Roman biscuit pottery.

Pottery with reliefs in slip.

3. *Pottery with Reliefs applied in Slip.*—This is a very remarkable kind of decoration, in which great skill was shown by the Roman potters. The slip, finely-ground clay, was mixed with water to about the consistency of very thick cream, and was allowed to run slowly or drop off a wooden point or flat spatula upon the out-

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[1] In some rare cases the reliefs were moulded separately and then applied to the plain wheel-turned vessel while yet soft, but this was exceptional.

[2] See Fabroni, *Vasi fittili Aretini*, 1841, and Inghirami, *Mon. Etrus.*, 1845.

side of ordinary wheel-made pottery. Very spirited figures of animals (see Fig. 42)—hares pursued by dogs, lions, goats, horses, deer, or even complicated subjects with human figures such as gladiators' combats—and a great variety of graceful scroll-ornaments of vine, ivy, or convolvulus were produced in this way with wonderful ingenuity. Both the outline and the modelling were given with curious precision by the quantity of semi-fluid slip which was allowed to flow off the tool. The body, *e.g.*, of a dog would be poured off a sort of small palette-knife, and its thinner legs formed by trailing along a point dipped in the slip. Tools for this purpose have been found near Roman kilns. One of the most elaborate specimens of this kind of pottery is a cup in the Colchester Museum, covered with reliefs of chariot races and gladiators' combats, done with great vigor and even minuteness of detail considering the difficulties of the process. In some cases, especially when the designs are simple scroll or geometrical ornaments, additional effect is produced by the use of a slip colored differently from the body of the pot. Frequently the relief-patterns are white, made of pipeclay, applied to a red or dark colored vessel. The vessels with this class of decoration are mostly small bowls, cups, or bottle-like vases. Some few are made of the Samian ware, but more commonly they are gray or blackish with body and slip both of the same clay. A great deal of coarse Roman pottery is rudely decorated with a thin slip of red, white, or yellow clay, put on with a brush in coarse bands or scroll-patterns. The slip in this case is treated as a pigment of the simplest kind, and does not stand out in relief. With this trifling exception, nothing in the form of painted vases was produced by the potters of Roman times.

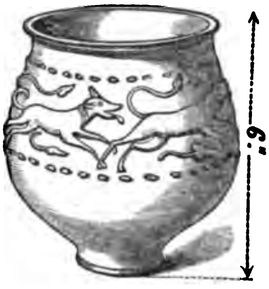


FIG. 42.—Roman cup, with reliefs of a stag pursued by a hound, executed in semi-fluid slip.

Black ware.

4. *Black Pottery* is usually made from a very silicious or sandy clay, composed thus—(average of several analyses) silica 76 parts, alumina 10, oxide of iron 9, lime 2. It owes its black color and rather metallic gloss to the direct contact of smoke in a close or smother kiln. If heated in an open fire it burns out usually to a grayish white. A great deal of this ware belongs also to class 3, as it is frequently decorated with simple patterns in white slip; the presence of the white clay on the black body implies a second firing, free from the contact of smoke, and not high enough in temperature to burn the black out of the body of the pot. This ware was largely made at many places in Germany along the Rhine, in France, and especially at Castor in Northamptonshire, where remains of many Roman kilns have been found. It varies very much in shape and in method of decoration. Some of the numerous specimens from Bonn and Rheinzabern are treated in a manner different from the British varieties. A few are coated with a black similar to that used by the Greeks, but very thin and poor in quality. Others have a mechanical polish applied after firing, whilst the pot was again set on the wheel, by rubbing it with black lead, occasionally applied in bands of alternately dull and bright black all round the pot. A fine specimen from Coblentz, now in the Sèvres Museum, has a curious combination of stamped work and reliefs formed in fluid slip. The design represents a lion running through vine-branches. The body of the lion and the grapes are stamped from a mould, the rest being done in slip. Cups and small jars of this ware are frequently modelled into strange shapes by being pinched in at various places by the potter's fingers while they were fresh from the wheel. Others are decorated with groups of dots, made of semi-fluid slip, apparently applied through a pierced stencil-plate (see Fig. 43). The dots are arranged in close rows, forming rectangular patches, arranged round the body of the vessel,—a very dull kind of ornament, which may, however, have had a practical use in making the pottery less liable to slip from the holder's fingers.

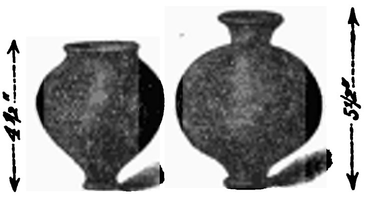


FIG. 43.—Roman black ware decorated with groups of dots in relief, and blackened in the smother kiln.

Glazed ware.

5. *Glazed Pottery.*—This is rare, but has been found in most of the countries once occupied by the Romans. Some of the best specimens resemble that described above as Græco-Roman glazed ware. Most are, however, very inferior, both in execution and in the quality of the glaze, which is a true glass, usually colored light green or brownish yellow. A cake of semi-fused greenish glass, apparently intended for this purpose, was found in the ruins of a kiln in Britain. This glazed pottery is small, and is decorated in various ways, by incised lines, or groups of dots in relief, or by brush-applied stripes of red or white clay.

Mortaria.

In addition to the forms of Roman domestic pottery shown in the above figures one peculiar shape occurs very frequently, namely, the "mortarium," a large shallow dish, made of thick clay, with a spout at one side, used for triturating cooked vegetables or other soft substances. The inside of these mortar-like dishes is often roughened by being sprinkled, while in a soft state, with crushed quartz or pottery, apparently to aid the process of pounding. They are made of various kinds of ware, especially red Samian and yellow biscuit clay.

Clay lamps.

Clay lamps were very largely used by the Romans, mostly made of plain biscuit clay, but the finest specimens are in the red Samian ware. A few have been found with a thick vitreous glaze, colored like the rest of the Roman glazed wares (see LAMP, vol. xiv. p. 248).

Baked bricks.

An extensive use of baked clay was made by the Romans in the manufacture of bricks, roofing-tiles, flue-tiles, drain-pipes, baths, and even coffins. The bricks are generally very large and thin, some 15 to 18 inches long, and only 1½ inches thick, and walls were entirely built of them. They were also used to form alternating bands in stone walls, the brick bands usually consisting of from three to five courses. In Rome bricks were merely used as a facing to concrete walls. They are always triangular in shape, except such as were set at the angles of walls and used as facing to arches. Those used for the latter purpose are generally two Roman feet square (about 1 foot 11½ inches English). See ROME. The system of heating employed by the Romans in their houses and baths was very ingenious and complete. Sometimes the whole walls of a room were lined with clay flue-pipes, square in section, which, being connected at the bottom with the hypocaust, carried the hot air over the whole wall-surface as well as under the floor (see BATH), the mosaic and concrete area of which (the "suspensura") was supported on large clay slabs carried on short brick pillars. Flanged tiles, similar to those used for roofing, were often built up on edge, with others set across the top, to form graves, and to protect the sepulchral urns and other buried objects from being crushed by the weight of earth upon them.

Roman kilns.

Roman Pottery Kilns.—Great numbers of Roman kilns have been found in various countries, but none quite perfect. They are small, round, or oval structures of brick, with a place for the fuel at one side, and a floor made of pierced slabs of clay, on which the pots were piled, the flames and hot air passing through the holes in the clay floor. Most kilns were probably covered by a brick dome with a central opening, exactly the same in principle as the early Corinthian kiln shown in Fig. 3. The smother kilns may, however, have been arranged rather differently, so as to fire the pots in an atmosphere of heated smoke; or this may have been done by partly closing the aperture at the top, in order to half smother the fire and prevent its burning with a hot clear flame. Fig. 44 shows the remains of one of the Castor kilns, about 7 feet in diameter, with an arched opening for the insertion of the fuel, and a pierced floor, made of large clay slabs radiating to a central point, where they were supported by a brick pillar. Other kilns have been found in the Upchurch marshes (Kent), along the Severn banks in Shropshire, at Ashdon (Essex), Colchester, London, York, and many other Romano-British towns. Though varying in shape, yet in general principle Roman kilns, in whatever country they are found, are practically the same.

Inscriptions.

Inscriptions on Roman Pottery.—Potters' names, impressed from oblong or circular incuse stamps, occur very frequently on many varieties of Roman pottery, especially on the plain biscuit and Samian wares. Teutonic and Gaulish names sometimes appear, showing that in certain cases native potters worked at the Roman potteries. When the potter's name is in the nominative, it is followed by **F.** or **FECIT**; if in the genitive, by **MANV** or **OFFICINA**, usually in some contracted form. In addition to the potter's name those of the owner of the workshop and of the estate from which the clay came occasionally occur, as, for example, **OP(US) DOL(IARE) L. IVLI THEOD(OTI) E(QVITIS) R(OMANI) FIG(LINAE) SAL(ARIAE) EX PR(AEDIS) FL(AVII) TITIANI C. V.** (clarissimi viri). "Pot-work from the salarian manufactory belonging to L. Julius Theodotus, a Roman knight, (the clay taken) from the estate of Flavius Titianus, a most distinguished person," this last being a title used like the English "esquire." This brick stamp is from a house built against the ancient wall around the Capitoline hill, and dates from the middle of the 2d century A. D. Few brick stamps found in Rome are older than the end of the 1st century A. D.; but some have been found at Velia in Cisalpine Gaul dated with the names of the consuls for 75 B. C. Others have also the name of the ruling emperor. Roman soldiers were often employed to make bricks and tiles; and many such are stamped with the mark or number of a Roman legion, *e. g.*, **LEG. VI.** for "legio sexta." Amphoræ were occasionally inscribed, in rudely-painted ochre colors, with words to indicate the quality of wine they contained or their measure of capacity, but such inscriptions were probably added when the amphoræ were in their owner's cellar, and were simply painted in tempera. Numbers of large amphoræ were frequently embedded in the concrete of which Roman vaults were made, especially during the 3d and 4th centuries A. D., one object of this being to gain lightness without much loss of strength. The circus of Maxentius and the mausoleum of the empress Helena, both outside the walls of Rome, are examples of this curious use of pottery.

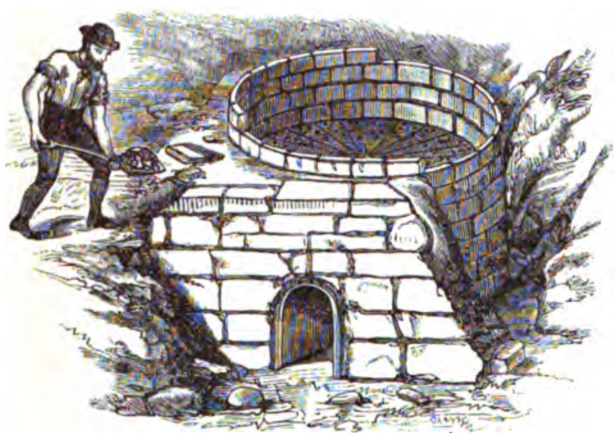


FIG. 44.—Roman kiln found at Castor. The low arch is for the insertion of the fuel; the pots rested on the perforated floor, made of clay slabs; the top of the kiln is missing,—it was probably a dome.

Literature.—Pliny, *H. N.*, xxxv.; Birch, *Ancient Pottery*, 1873; Jewitt, *Ceramic Art of Great Britain*, vol. i., 1877; Artis, *The Durobrivæ of Antoninus*, 1828; Church, *Corinium Museum*, 1871; Cochet, *Archéologie céramique*, 1860; Roach-Smith, *Roman London*, 1859; Wright, *The Celt, the Roman, and the Saxon*, 1861; Marcilly, *L'Art céramique en Gaule*, 1874; Fabroni, *Vasi fittili Aretini*, 1841; (Samian ware); Robert, *Les figures des poteries rougeâtres antiques*, 1865; Shortt, *Sylvia antiqua Iscana*, 1841. See also many articles in *Archæologia*, the *Archæological Journal*, and other societies' *Proceedings*.

SECTION VIII.—PERSIAN AND MOSLEM.

It is convenient to class under this head all the numerous varieties of pottery which were the work of Moslem races. In all this pottery, with the exception of that included under the head "Hispano-Moorish" (see p. 641), there is a great similarity in character of design and in methods of execution, both of which appear to a great extent to have been originated and brought to highest perfection under the Persians, who seem to have inherited, through the Sasanians, much of the skill in manipulating clay and manufacturing enamels and glazes which was possessed by the people of ancient Assyria. The Persians of the 10th to the 17th century, perfect masters of all the decorative arts to a degree possessed probably by no other race or age, excelled in pottery as in other handicrafts. Their enamels and glazes are made and applied with the greatest skill; their colors are brilliant and yet harmonious; and the patterns painted on their pottery are designed with the most wonderful grace and freedom, together with a perfect sense of the right kind of ornament to use for each special place and material.

Materials.

Materials used by Persian Potters.—In most cases the clay body of Persian pottery is completely covered either with a white enamel or with slip, and therefore any sort of clay sufficiently plastic for the wheel suited the purpose, whatever its color. The enamel was much the same as that used by the ancient Assyrians, except that it contained a much larger proportion of oxide of lead, of which there were often three parts to one of oxide of tin and five of silicate of soda. The white slip is silicate of alumina with some alkali. The glaze is either a pure silicate of soda, or has in addition a little oxide of lead to increase its fusibility. The pigments are oxides of cobalt and copper for the blues and greens, manganese for the purples, oxides of copper and iron for the reds, magnetic oxide of iron for the black, and antimony for the yellow; a rich warm orange was produced by a mixture of antimony and red oxide of iron. It is not always possible without actual analysis to tell whether the white ground of Persian pottery is a tin enamel or a glazed slip, especially as in many cases a glaze is applied *over* the enamel; but this is not a point of great importance, as the decorative treatment of the white ground was in either case much the same.

The following are the chief varieties of Persian pottery:

Lustred ware.

1. *Lustred Ware.*—The application of lustre colors requires a special process of firing. The following description applies equally to the other two classes of pottery in which lustre pigments were largely used, namely, Hispano-Moorish and Italian majolica. The special beauty of the lustre depends on the decomposition of a metallic salt, usually silver or copper; the required design was painted in a pigment composed mainly of this salt over the surface of the smooth enamel or glaze *after* it had been fired. The vessel with the lustre pigments was then fired again in a kiln specially so arranged that the heated gases and smoke should come into contact with the metallic pigments; the minute and heated particles of carbon in the smoke combined with the oxygen of the salt, setting free the metal, which was left, in a finely-divided state, fixed on the surface of the enamel. In this way a beautiful prismatic effect was produced like the colors of mother-of-pearl. The lustre colors when looked at from one point of view are simply various shades of browns and yellows, but when seen at an angle they appear shot with the most brilliant violets, blues, purples, and red. They were used generally, and with best effect, over a white ground (see Fig. 45), but also over deep-blue or green enamels. Lustre colors were specially used by the Persians for wall-

decoration (see TILES), but they also used them on both white and blue enamel grounds to ornament hookah-bottles, bowls, plates, ewers, and tall rose-water bottles. The lustre is generally used alone, and not, as in the Italian majolica, combined with other non-lustre pigments. Its use is very early in Persia: dated specimens exist of the 10th century; and its manufacture has continued down to the present time, though that now made is of a very inferior quality.

Ancient coarse pottery.

2. Coarse pottery covered with a fine white silicious slip, on which arabesques and other simple patterns are painted in black, the whole then covered by a transparent green glaze. This is a very ancient sort of ware, made in Egypt during the XVIIIth Dynasty and many centuries after by Moslem potters, from the early years of their occupation of Egypt down to a very recent period. To this class belong the "bacini" or large dishes with which some of the 12th-century churches in Pisa and other towns in Italy were decorated. They were built in on the outside walls of the campanili, or used in rows to form friezes. In design and method of execution they have nothing in common with Italian majolica, and the oft-repeated story of their being the models from which the Italians learned to make their majolica appears to be a baseless fable.

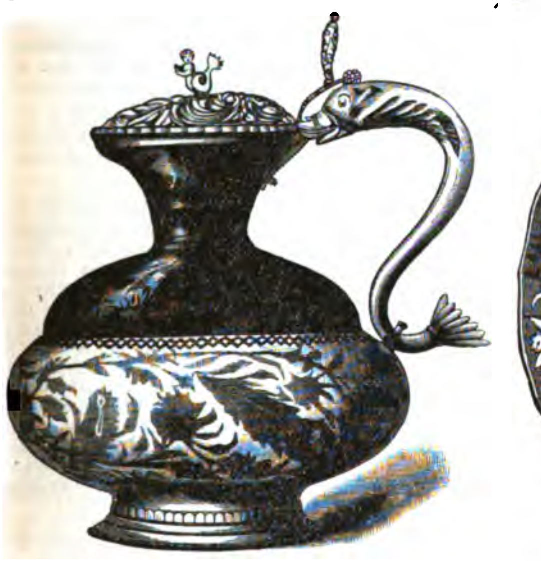


FIG. 45.—Persian ewer, white enamelled ground, with pattern in brown copper lustre; the upper part has a blue ground. The mounting is gilt bronze, Italian 16th-century work. (British Museum.)

Sgraffiato ware.

3. *Sgraffiato Ware.*—These are certain large bowls or jars decorated in a peculiar way, being covered first with a coating of white enamel and then with a complete coating of brown or deep-blue enamel. The pattern, usually graceful branches of plants with pointed leaves, is formed by cutting through the upper colored layer down to the white enamel underneath before firing in the kiln. Thus the design appears in white with a colored ground. The white is, of course, slightly sunk below the colored layer. Bowls thus decorated are mostly white inside, with a little simple painting in blue, the sgraffiato or incised work being only on the outside.

White enamel patterns in relief.

4. The next class is the reverse of the incised ware in treatment: the whole vessel is covered with brown or blue enamel, and the design, either arabesques geometrically treated or natural sprays of foliage, is painted over it in white enamel, thickly applied so as to stand out in slight relief. This and the preceding class are usually glazed *over* the enamels, a common Persian practice, to gain additional richness and brilliance of surface. Somewhat akin to this ware in style is a very beautiful sort of pottery with most graceful and delicate designs touched on with a fine brush over a white enamel ground. The pigments are blue, green, gray, and a very rich orange tending to red, and are all thickly but very delicately put on; these pieces are of extreme beauty both in colors and in design. Tall jars, bottles, bowls, plates, and hookah-jars are the vessels usually decorated in this way. Some of the large plates are perfect marvels of decorative beauty of the most refined and graceful kind.

Damascus ware.

5. *Damascus Ware.*—Under this head is generally included a good deal of Persian pottery made at other places besides Damascus, but of similar style and coloring. It is mostly remarkable for the fineness of its white enamel or slip, its rich glaze, and the beauty of the designs and colors. One class is painted wholly in various tints of blue, the design being often regular and treated with some geometrical stiffness. Other sorts have in addition a soft olive green, and purple-brown made of manganese (see Fig. 46). One of the finest specimens of the ware is a lamp taken from the Dome of the Rock at Jerusalem, and now in the possession of Mr. Drury Fortnum, F.S.A. (see Fig. 47). It is inscribed in large blue letters with pious sayings of Mohammed, and in small black characters round the lower rim, "In the year 956, in the month Jumádá 'l-úla. The painter is the poor, the humble Mustafa." According to our reckoning this date is June, 1549, A.D., the year when the Dome was restored by Sultan Suleiman, who was probably the donor of this beautiful lamp. One class of painted decoration used in Damascus ware has flowers treated in a simple way, yet with much natural beauty, such as the rose, hyacinth, tulip, carnation, and others, arranged on large plates and bowls with the most perfect skill and good taste. The plate shown above (Fig. 46) is a good example of this sort of design.

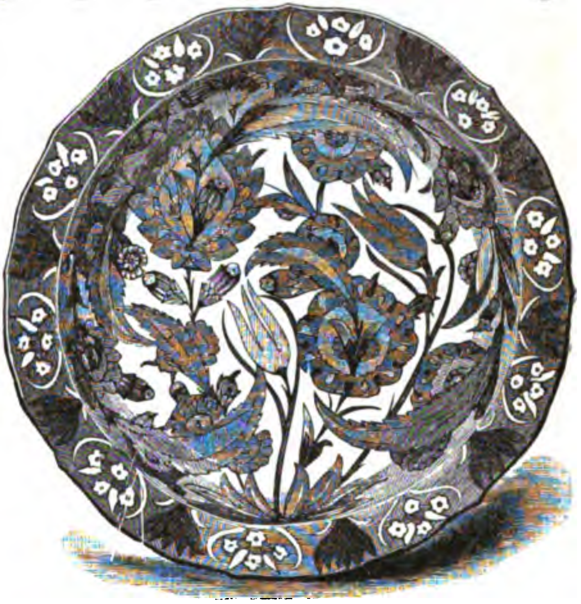


FIG. 46.—Plate of Damascus ware, painted in several tints of blue, a quiet green, and manganese purple. (British Museum.)

Rhodian.

6. *Rhodian ware*, so called because it was largely manufactured by Oriental potters in the island of Rhodes, is made of rather coarse clay, covered with a fine white silicious slip, on which the decorations are painted, the whole being then covered with a thick glaze formed of silica, oxide of lead, and soda. Its chief characteristics is the use of a fine red pigment, which owes its color to the red oxide of iron. This pigment was applied in very thick body, so that it stands out in actual relief like drops of sealing-wax. Plates, tall bottles, jars, mugs, and

pitchers with handles are the usual forms. They are all decorated with patterns of great beauty and splendor of color, brilliant blues, greens, and the peculiar red being the chief (see Fig. 48). The designs are mostly flowers, exactly the same in drawing and arrangement as those on the last-mentioned sort of Damascus ware. Other more geometrical patterns are also used, but mostly for wall-decoration. The finest specimens of Rhodian ware date from the 16th and first half of the 17th centuries. Other pieces of this pottery, which appear to have been made for European buyers, have coats of arms or human figures, the latter very coarsely executed, and probably later in date than the purely Oriental designs. The town of Lindus, where ruined kilns yet remain, was one of the chief places in Rhodes for the production of this kind of pottery. With other Oriental wares it was imported into western Europe during the 16th century. Some specimens exist with English silver mounts of the time of Elizabeth, very elaborately wrought. It was probably included under the title of "Damas ware," a name which often occurs in mediæval inventories, and appears to include many varieties of Oriental pottery, all of which were very highly valued in France, Italy, and England during the long period when the native pottery in those countries was of a very rude description. The South Kensington Museum and the Hôtel Cluny in Paris have the finest collections of this magnificent class of Oriental pottery; some very choice specimens are in the British Museum and the Louvre.

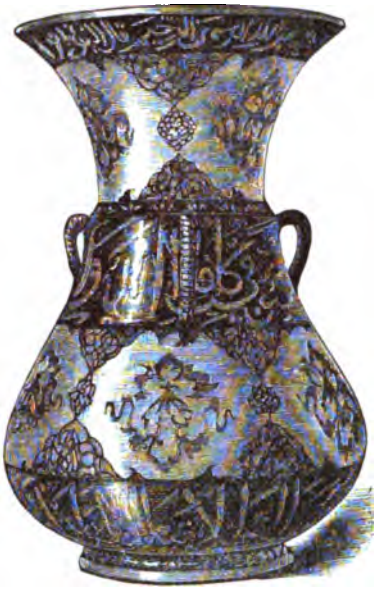


FIG. 47.—Lamp from the Dome of the Rock, painted in the same colors as Fig. 46. (Collection of Mr. Drury Fortnum.)

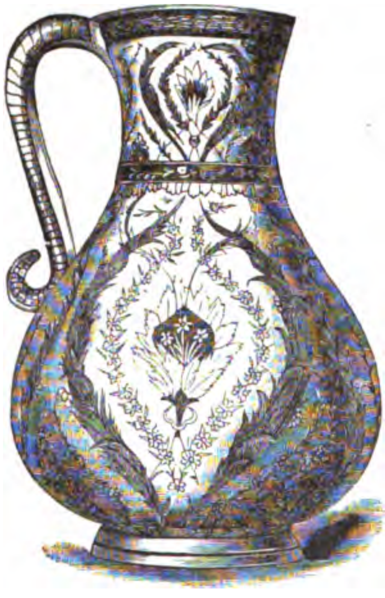


FIG. 48.—Rhodian Jug.

Perso-Chinese ware.

7. *Pottery made in Persia under Chinese Influence.*—This includes several varieties more or less strongly Chinese in method of execution or in design. It is recorded that Sháh 'Abbás I., a great patron of all the arts, about the year 1600, invited a number of Chinese potters to establish themselves at Ispahan for the sake of introducing improvements in the manufacture of pottery. Though no hard porcelain like that of China appears to have been made in Persia, several new methods of work were introduced, and a new style of decoration, half-Chinese and half-Persian, was largely used for a long period after the arrival of the Chinese potters.

The main varieties of this Perso-Chinese ware are the following. (1) A sort of semi-porcelain, called by English dealers, quite without reason, "Gombroon ware," which is pure white and semi-transparent, but, unlike Chinese porcelain, is soft and friable where not protected by the glaze. It is composed of silicate of alumina, with free silica, and an alkaline flux; in the heat of an ordinary porcelain furnace it fuses into a transparent glass. It is very fragile, but is of an extremely pleasant texture and slightly creamy tint. It is frequently decorated with simple patterns pierced through the sides of the vessel; the holes are filled up by the transparent glaze which covers the whole, thus forming, as it were, little windows of clear glass. It is also often decorated with painted flowers or arabesques in cobalt blue and manganese purple. The forms of the ware are small and delicate, mostly cups, plates, bowls, and flower-vases with many necks; these were made from the 17th down to the 19th century. (2) Céladon, very like that made in China, but grayer in tint, is common earthenware covered with a green enamel. It was much valued by the Persians and other nations on account of the belief that a cup of this ware betrayed the presence of poison either by breaking or by changing color. The Persians call it "jachmi" (jade), from its resemblance to that

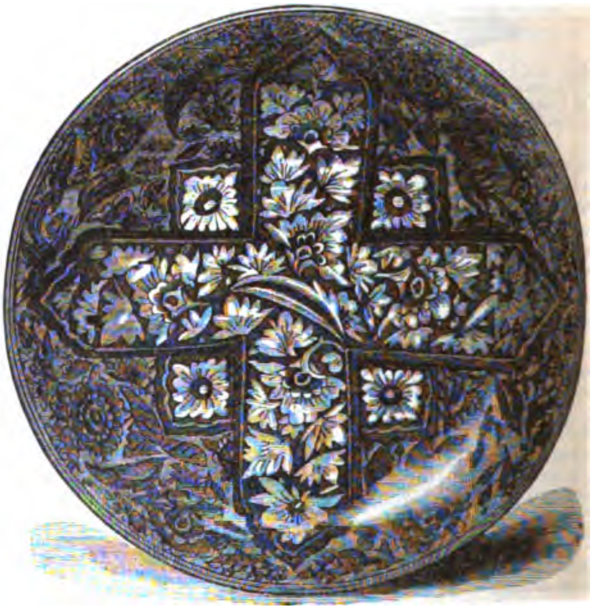


FIG. 49.—Persian plate painted in blues only. (South Kensington Museum.)

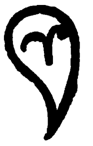
valuable stone. (3) Pottery of coarse clay, modelled with blunt reliefs, and the whole covered with green enamel. Another variety is covered with a bright blue enamel, chiefly used for ewers, hookah-bottles, and tall jars. The moulded reliefs are either flowers or human figures, poor both in design and execution. This kind of decoration was much used for heavy square bottles or tall jars; it has little or no trace of the usual Persian tastefulness of design, and the color is harsh. Most of this ware is not older than the 18th and 19th centuries. It is very largely Chinese in style. (4) Pottery painted in cobalt blues on a white ground, with some black, used chiefly for outlines. This is the largest class of Perso-Chinese pottery, and of it were made large dishes, bowls, bottles, ewers, and almost all forms of domestic and ornamental vessels. In some the design is purely Persian, in others almost purely Chinese, while in others the two styles are mingled. The Chinese grotesque dragons and mannered treatment of fir trees and even human figures frequently occur, but the more graceful designs have flowers and foliage arranged with that great decorative skill and good taste for which the Persians are so remarkable. Fig. 49 shows a dish from the South Kensington Museum in which there is little or no Chinese influence in the design; it is painted only in blues, and dates from the 17th century. Some few pieces have figures and flowers moulded in low relief, merely indicating the form, and then painted in blues and black lines. On the whole this class of pottery is very decorative in effect; the glaze is thick, and the blues frequently softened by having run a little in the firing; the different shades of blue are very varied and harmonious, ranging from indigo to a deep ultramarine.

Hispano-Moorish.

Hispano-Moorish Pottery, and Enamelled Lustre Wares produced under Oriental Influence in Sicily and the Balearic Isles.—To the earlier or Arab period of Oriental rule in southwest Europe no existing specimens of pottery can be attributed, though there are sufficient records to show that the Arab potters of Spain, as of other parts of the world, were highly distinguished for their skill and the artistic beauty of their wares. The existing specimens of Hispano-Moorish pottery, which are very numerous, date from the early years of the Moorish occupation, towards the end of the 13th century, and continue down to the 17th century. During this long period three stages were passed through, each with characteristics of its own, but passing imperceptibly one into another,—(1) pottery made by the Moors for their own use; (2) pottery made by them for the use of their Christian conquerors; (3) pottery made by Spanish potters who imitated the technical methods of the Moors, and to some extent their designs and style of decoration.

Technical methods, etc.

Technical Methods, Colors, etc.—The technical methods remained the same throughout all three periods. The process was this. After the pot had been thrown on the wheel, a rather coarse red or yellowish clay being used, it was dipped into a cream-like mixture of the materials for its white enamel coat. This, like the white enamel of Persian pottery, was simply a glass rendered white and opaque by the addition of oxide of tin. When fired, the vessel was covered with a smooth coat of enamel, slightly creamy in color and very pleasant in texture. Only two colors were used for decoration, and very often only one. The chief of these was a lustre, made with oxides of copper or silver, and varying in tint from a pale lemon yellow to a deep coppery red. The peculiar application of lustre-color has been described above under the head of "lustred ware" (p. 638). The other color is a deep indigo blue, varying in tint, and produced sometimes with copper and sometimes with cobalt oxides. The blue was applied before the lustre, which always required a special and final firing under different conditions from those necessary for the fusion of the white enamel and the blue pigment. The chief towns in which the ware was manufactured were Malaga, Valencia, and Manises (in the province of Valencia); the celebrated amphora-shaped vase found in the Alhambra was probably from the first of these places. Ibn Batuta (14th century) describes the beauty of the "gold-colored pottery" of Malaga, and says that it was largely exported into distant countries. Marineo (*Cosas memorables de España*, 1517) and Ercolano (*Historia de Valencia*, 1610) both praise highly the "gilt pottery" made at Valencia and Manises. The term "gilt" refers to the metallic golden color of the lustre. Pieces of Valencia ware occur with the accompanying mark (No. 1). The usual forms of this pottery chiefly consist of deep dishes and bowls, jars, drug-pots, goblets, and large bucket-shaped vessels. The early ones, such as the Alhambra amphora, dating from the early part of the 14th century, are decorated with delicate and graceful arabesque patterns, or branches of a plant like the briony, the leaves of which are often alternately in blue and in yellow lustre. A few have Arabic inscriptions. The designs are most masterly, drawn with great freedom of touch, and very decorative in effect. The delicacy and minuteness of the painting are often increased by white lines on the yellow lustre, done with a wooden point by wiping out the lines through the lustre pigment before it was fired; this could be done easily, because the lustre was painted on the hard smooth enamel *after* it was fired, not on an absorbent biscuit surface.

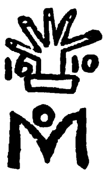

Potter's mark No. 1.

Classes of ware.

The pottery of the earlier period has mostly a lustre of pale almost lemon yellow made with oxide of silver, while the later and coarser varieties have a deep-red lustre made from copper, which is rather harsh and too metallic in appearance. The decorations of the second period are very frequently heraldic in character. A favorite design for large dishes is a lion rampant or a displayed eagle, the latter used as the emblem of St. John the Evangelist, the patron saint of Valencia; others have shields with the arms of Castile and Aragon or of royal personages. Many of the grandly-decorated dishes are not only ornamented on the front but also have their backs elaborately covered with rich and graceful arabesques. Some of this ware is moulded in slight relief; plates have slightly projecting ribs, and goblet-shaped cups have swelling gadroons, a form copied from metal originals. Fig. 50 shows a fine dish, now in the British Museum, painted in copper lustre and blue; though Moorish in style, it has a Spanish inscription, **SENTA CATALINA GVARDA NOS**. The pottery of the third class is very inferior in all respects to the work of the Moorish potters. Not only is the lustre harsh in quality but the designs are very coarse and often rudely executed, though still for the most part retaining strong traces of their Oriental origin. The mark appended (No. 2) is attributed to the manufactory of Manises, which was very productive in the 17th century.

Balearic pottery.

In addition to the lustred pottery of this sort made in Spain ware of similar design and execution was produced in the Balearic Islands. Many pieces exist bearing the arms of Inca in Majorca. The beauty of Balearic pottery is mentioned by Giovanni da Uzzano, who wrote a treatise on trade and navigation in 1442. It was also alluded to by J. C. Scaliger (*Exercitationes*, xcii.) in the 16th century. This pottery was largely imported into Italy, where it no doubt influenced the design of some of the so-called "majolica," though it can hardly have originated its manufacture, as has so often been asserted.



Potter's mark, No. 2.

Siculo-Moorish.

Another class of pottery has been attributed to the Moslem conquerors of Sicily, though without much distinct evidence. It is very similar to the Hispano-Moorish ware, except that the lustre is painted over a ground of *blue* not *white* enamel. Some other pottery, with paintings in blue with black outlines, on a white silicious slip, and covered by a thick vitreous glaze, may be the work of Siculo-Moorish potters. The designs are very bold and effective, often with inscriptions in large Arabic characters, or grotesque horses and other animals, boldly drawn. The attribution of Moslem pottery to special localities is always difficult and uncertain, owing to the great similarity in design and in methods of execution that is always common to Moslem races wherever they may have chanced to settle.

The Kensington Museum and the Hôtel Cluny have the best collections of Persian and Hispano-Moorish wares. The British Museum, the Louvre, and the Archæological Museum of Madrid have many very choice specimens.

Others are scattered through the various museums of Europe.

Other Moslem countries.

In other parts of the world, especially among the Moslem people of India, Persia, and northern Africa, very graceful pottery is now made, especially the plain biscuit varieties, in accordance with traditional forms and methods. The common pottery of Egypt is very beautiful in shape and often pleasant in color and texture; at several places on the banks of the Nile a fine red ware, very like the Roman "Samian," is still largely manufactured, and the water-jars made of the common brown clay are generally fashioned in shapes of almost Hellenic beauty, which seem to have been continually used since the time of the Ptolemies.

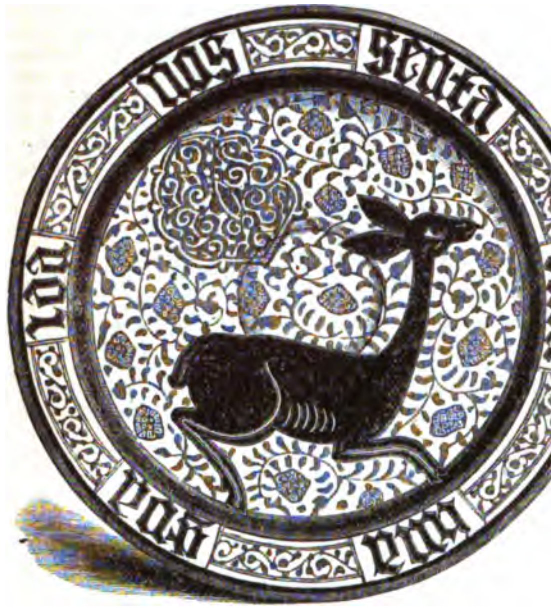


FIG. 50.—Hispano-Moorish plate, painted in blue and copper lustre.

Literature.—For the subject of the preceding section the reader may consult Chardin, *Voyages en Perse c.* 1650 (printed in 1811); Rochechouart, *Souvenirs d'un Voyage en Perse*, 1867; Henderson, *Collection of Pottery*, etc., 1868; Fortnum, *South Kensington Museum Catalogue of Pottery*, 1873; Davillier, *Les Faïences Hispano-Moresques*, 1861; and many works on the general history of pottery.

SECTION IX.—TEUTONIC, SAXON, AND GAULISH.

Cinerary urns.

Great quantities of sepulchral urns have been found dating from the departure of the Romans from Britain to the 10th century, but almost no specimens exist of the domestic pottery of this period. The shapes, the character of the clay, and the ornamental patterns on the cinerary urns are very much the same whether they are found in Germany, Scandinavia, Britain, or France: they mostly show traces of Roman influence; some are even coarsely-executed copies of red Samian ware, and are skilfully wheel-made and well fired. Others are very rude, hand-made, and scarcely to be distinguished from the pottery of the early iron age. In the main, however, the urns are much neater, more glossy, and more elaborately ornamented than the prehistoric pottery. They are made of hard well-burned clay, generally gray, brown, or blackish in color. The decoration is often very elaborate, with incised lines, some arranged in wavy bands, others in wheel-made rings. The most characteristic ornaments are simple geometrical patterns, stars, crosses, the svastika, and others, impressed in the soft clay from wooden stamps (see Fig. 51). Many urns have a ring of bosses pressed out from the inside by the potter's thumb, and some few have bands or stripes in coarse ochre colors or white. The surface of the urns is frequently glossy, partly from the hard silicious quality of the clay, but often because it has been mechanically polished. A black shining surface was sometimes given with graphite (plumbago), as was the case with some of the Roman black pottery. A lump of graphite was found with blackened urns in a tomb at Högelberg.[1]

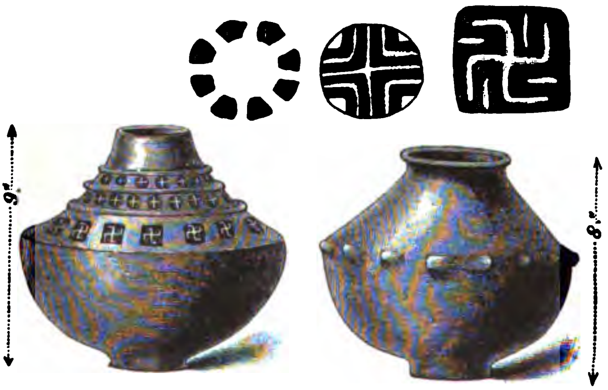


FIG. 51.—Saxon cinerary urns; the stamped patterns are shown full size.

English and French mediæval ware.

Mediæval Pottery of England and France. 11th to 15th Century.—Though great quantities of pottery for domestic use were made during this period it was extremely fragile, and, being of very coarse ware, without artistic beauty, few specimens have beeen preserved to our times. It consisted mostly of tall jugs, globular pitchers, bowls, dishes and drinking-cups, all of which were made for some centuries with but little variation in shape or quality. Fig. 52 shows a selection of common forms, usually made of coarse red or yellow clay, often covered with white slip, and partly glazed with a green or yellow vitreous glaze, rendered more fusible by the presence of a large proportion of oxide of lead. Some have coarse painted stripes in colored ochres; others have heraldic badges or fanciful ornaments, rudely modelled, and fastened to the body of the pot; and some grotesque jugs are formed in the shape of animals or knights on horseback. The most graceful in shape were pilgrim-bottles, flattened globes, very like one of the forms common in Egyptian and Assyrian pottery. The common domestic pottery of the Middle Ages was made and used in enormous quantities. Though it was wonderfully cheap, yet the ease with which it was broken made it a serious and often-recurring item in the household expenses of rich or royal personages. The list of expenses of a feast on the anniversary of Queen Eleanor's death (wife of Edward I.) contains this item, "pro M^{le} et D discis, tot platellis, tot salseriis, et CCCC chiphis xliis,"—that is, 42s. for 1500 dishes, 1500 plates, 1500 saucers, and

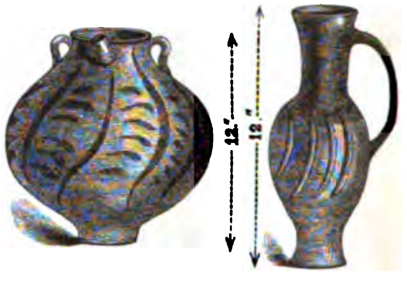


FIG. 52.—Common forms of mediæval pottery; the upper part of the slender jug is covered with a green vitreous lead glaze; the other is unglazed with stripes of red ochre.

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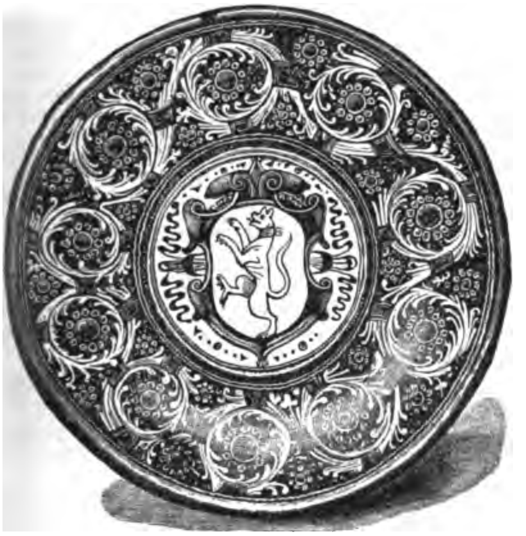
[1] See Du Cleuzion, *La poterie Gauloise*, 1872, and Cochet, *Archéologie céramique*, 1860.

400 cups. The 42s. are perhaps equal to £25 of modern money, a small sum for 4900 pieces of pottery.

Section X.—Mediæval and Modern Italian.

grafiato ware.

Sgraffiato Ware was made by covering a vessel of red clay with a coating of white slip made of some natural white earth like pipeclay. This was done by dipping or by pouring the iuid slip over the red vessel. When the white coatng was dry the design was formed by cutting it away o as to expose the red body underneath. In this ray bowls, dishes, ewers, and other vessels were decoated with human figures, or with graceful scroll-paterns of foliage and flowers. The patterns were then icked out with bright colors,—yellow, blue, and green; nd finally the whole was glazed with a very fusible ead glaze (see Fig. 53). This is probably a very early nethod for the decoration of pottery in various parts f Italy ; but only few existing specimens are older han the second half of the 15th century. Some of he earlier specimens have very graceful designs, of lmost Gothic style, executed with great spirit, and ery decorative in effect. Sgraffiato ware continued to e made during the 16th and 17th centuries, especially n the neighborhood of Pavia. It was, however, but ittle esteemed owing to the greater popularity of ainted majolica. Rude imitations of it were made in ermany and France.



ig. 53.—Italian sgraffiato plate, 16th century. (South Kensington Museum.)

Iajolica.

Italian Majolica.[1]—The history of this ware in its early stages of development is almost unknown. According to popular tradition, it was first copied from certain plates brought y the Pisans from the island of Majolica (or Majorca) n the 12th century. This is extremely improbable ; he fabrication and use of a white tin enamel were nown to Italian potters long before they found out the ecret of lustre colors, a discovery not made in Italy ill the 15th century. We know from various sources hat lustred pottery from the Balearic Islands was argely imported into Italy during the 15th century (see bove), and it is quite possible that the sight of the rilliant lustre on the imported Moorish ware set the otters of Italy to work, and led them to find out, ither by experiments or from some traveller who had isited the Balearic kilns, how to compose and fire the etallic salts required to produce the lustre; but this occurred long after the Pisan victory at Majorca. It was to the lustred ware only that the Italians gave the name of "majolica," though now it is commonly applied to all the Italian enamelled pottery of the 15th and 16th centuries. It was the lustre only that was a fresh discovery in the 15th century; enamelled ware had been made by Italian potters many years before. This is an important point, and it should be noted that the accounts given by Vasari and several other old Italian writers on the subject are quite misleading. "Mezza-majolica" is a word of rather uncertain meaning which occurs in early writers on Italian pottery. It has been used to mean pottery covered not with a tin enamel but with a white slip, made of a white clay like that found at Vicenza; and in many museums the earlier and ruder sorts of majolica have been arranged under this name. The fact, however, seems to be that even the rudest and earliest specimens of majolica in the various museums of Europe are covered with a true tin enamel. Curious specimens of pottery, covered with a rude enamel made of the white kaolinic "terra di Vicenza" mixed with an alkaline silicate, have recently been found in tombs of the 11th and 12th centuries in various parts of Italy. These earliest attempts at what we now call majolica are coarsely decorated in green, yellow, and blue, on a white ground, with patterns of semi-Oriental style. The pigments used appear in some cases to be simply colored glass reduced to powder,—a kind of *smalto*. This style of pottery is probably the mezza-majolica of Vasari. It is evidently the first step towards the production of the true majolica, in which the kaolinic clay of Vicenza is replaced by a tin enamel. This discovery is of great importance as regards the early history of Italian pottery. The few pieces yet known are mostly preserved in the office of public instruction in Rome, and are not yet exhibited in any museum.

Very few early examples of developed Italian majolica are now known. One of the most important is a small jug 5 inches high, in the Sèvres Museum, which is made of reddish clay covered with a white tin enamel, and painted with a shield and simple ornaments in manganese purple and bright green (oxide of copper). It is supposed to have been made at Rimini, and dates from the 13th or 14th century (see Fig. 54). It was not, however, till the second half of the 15th century that Italian majolica began to be largely produced. Owing to the great difficulty of determining the special towns where the earlier varieties were made, it will be convenient to treat this ware according to style and date rather than under the heads of the different potteries. During the earlier and more important period the production of majolica was confined to a very small part of Italy. Bologna on the north, Perugia on the south, Siena on the west, and the Adriatic on the east roughly indicate the limits within which the chief majolica-producing towns were situated; these were Forli, Faenza, Rimini, Cafagiolo, Pesaro, Urbino, Castel Durante, Gubbio, Perugia, and Siena. Towards the middle of the 16th century distant cities such as Venice also produced fine majolica, but of the later style.

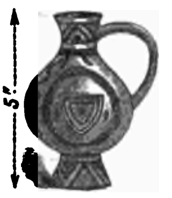


Fig. 54.—Ewer of Rimini ware, probably the earliest known specimen of Italian majolica. (Sèvres Museum.)

Materials.

Materials.—Fortunately ample information on this subject has been preserved to us. A potter of Castel Durante occupied himself for some time in writing a full description of the materials, the methods of using them, the "throwing wheels," the kilns, and all the varied processes of his craft. His original MS., copiously illustrated with clever pen-sketches, is in the library of the South Kensington Museum, and the work was printed, with facsimiles of the drawings, at Pesaro in 1879. It is called *I tre*

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[1] In this article the word "majolica" is used in its modern ense to include non-lustered pottery.

libri dell' arte del Vasajo by Cipriano Piccolpasso of Castel Durante, and is dated 1548.

Piccolpasso himself did not produce lustred ware, but he describes the process and the special kiln it required; his description of materials and methods, though not written till 1548, applies in all important points to the majolica of the second half of the previous century. Various receipts differing in the proportions of their ingredients are given; the following examples are selected as typical instances:

1. The clay body, "terra," was to be, if possible, clay deposited by a river. It was carefully prepared for use by being beaten, ground in a mill, and passed through a sieve, so as to bring it into a smooth homogeneous plastic state, fit for being moulded on the wheel. It was all the better for being dug out a long time before it was used.

2. The white enamel, "bianco," was composed of thirty parts of "marzacotto" to twelve of oxide of tin. The marzacotto was simple powdered glass, a pure silicate of potash, made from clean sand and the alkaline tartar deposited by wine. According to Piccolpasso the decorations were painted on the enamel ground sometimes *before* it was fired, and sometimes *after*. This was an important difference. The enamel *before* firing formed a slightly granular and very absorbent ground, like clay in the biscuit state; and the paintings on it had to be bold and broadly decorative, not delicate and miniature-like; the touch of the brush had to be rapid and certain; little or no alteration could be made, as the unfired enamel sucked the pigment out of the brush and absorbed it below the surface. The earlier and more boldly decorative sorts of majolica appear to have been painted in this way on the *unfired* enamel, and owe much of their richness of effect to the fact that the different pigments have sunk below the surface of the ground. This process may be compared to that of painting in true fresco, while the painting on the fired enamel resembles the more deliberate method of the painter in oil. After passing through the kiln the whole character of the enamel was completely changed; it formed then a hard, smooth, non-absorbent, vitreous surface, on which the finest lines and the most minute paintings could be executed, and any part of it could easily be altered or wiped out. It was in great part owing to this change of method that the later majolica paintings became more pictorial and more minute in execution, the almost inevitable result of painting on a hard glassy ground. In some instances it is not easy to decide which method of painting has been adopted, though in most cases there is a distinct difference in the quality of the lines. One peculiarity is a sure test: when delicate patterns in white have been formed by covering the enamel ground with some color, and then *wiping out* the pattern by using a pointed piece of stick or ivory on the soft pigment, in that case the enamel certainly was fired first. The color could not be wiped cleanly out from an absorbent biscuit surface. Much of the delicate beauty of the Persian lustre paintings, especially those on wall-tiles, is due to this method of getting minute patterns in white. It was also practiced, though in a much more limited way, on some of the Italian majolica. The difference of handling between "under-glaze" and "over-glaze" painting corresponds exactly to that of the unfired and fired enamel; but in the latter case another important difference is introduced: under-glaze pigments require much greater heat than those over the glaze, and are consequently very limited in range of color, while in majolica painting the same pigments were used in either case.

3. The glaze, "coperta," an ordinary glass, made more fusible by the presence of lead, consisted of oxide of lead 17 parts, silica (sand) 20, alkali 12, and common salt 8 parts.

4. Pigments, "colori," all owe their color to a metallic oxide, yellow being derived from oxides of iron and antimony, green from oxides of copper and antimony, blue from oxide of copper, red from Spanish oxide of iron, Armenian bole, and red ochre, and black from black oxide of copper and manganese. Most of these had a certain proportion of oxide of lead, not to affect the color but to make them more fusible. Other tints were produced by combinations of these pigments, and different gradations of tone were obtained by adding more or less of the ingredients of the white enamel.

Manufacture.

Methods of Manufacture.—Piccolpasso gives sketches of the potters at work throwing vessels on the wheel. The wheel itself ("torno") consists of a vertical axle, with a large lower wooden disk for the potter's foot to keep it revolving, and a smaller upper disk on which the clay was moulded by the potter's hands,—an apparatus which differs in no respect from that used in Egypt under the Ptolemies, and is still employed in the great porcelain factory at Sèvres. The potter to the right of Fig. 55 is working with a wheel like that drawn by Piccolpasso. The earlier kind of majolica is almost wholly wheel-moulded, but during the 16th century a good many plates and vases were formed after shapes copied from silver-work, with sunk bosses or gadroons. These were formed by pressing thin disks of soft clay into moulds made of plaster ("gesso"), bone-ash, and pounded marble. An elaborate description of the method is given in Piccolpasso's MS. Another practice also had arisen in his time, that of finishing the pottery on a joiner's lathe when it was dry, but before it was enamelled or fired,—a practice unfortunately common at the present day, which makes the form of the vessel more mathematically correct, but greatly injures the freedom and spirit of touch given by the potter's hand. After the pottery was brought to the required shape it was dipped into a bath of the materials for the white enamel, finely ground and mixed with water; and, after being allowed to dry, it was fired for the first time. The painted decoration was applied on the white enamel with brushes of various sizes, and the vessel was then dipped into a second bath of the glaze materials, finely ground and mixed with water like the enamel. It was afterwards fired a second time. If it had lustre colors, they were put on over the glaze, and a third firing in a different kiln was necessary for the reasons explained above under the head of "Persian pottery." The application of the transparent glaze over the enamel was not absolutely necessary, and was occasionally omitted, but the finer sorts of majolica usually had it for the sake of the increased brilliance which it gave to the non-lustre colors. The kiln for the ordinary colors and first two firings, as drawn by Piccolpasso, is exactly the same in principle as that used by the potters of ancient Greece and Rome,—that is, an arched chamber in two stories, with a perforated floor between—the lower compartment for the fire, the upper for the pottery. A sketch is also given in Piccolpasso's MS. of the lustre-kiln, in which the pottery is enveloped in flames and heated smoke. Fig. 55, from a Venetian woodcut of the middle of the 16th century, shows majolica potters at work throwing pots on the wheel. Two different wheels are being used; the man on the left keeps his going by giving it a succession of spins with one hand, the other works his wheel by the help of a lower foot-turned disk. To the extreme left a small kiln is shown; the lower arched opening is for the insertion of the fuel, the upper for the pottery; the holes at the top are for the escape of the heated air and smoke.

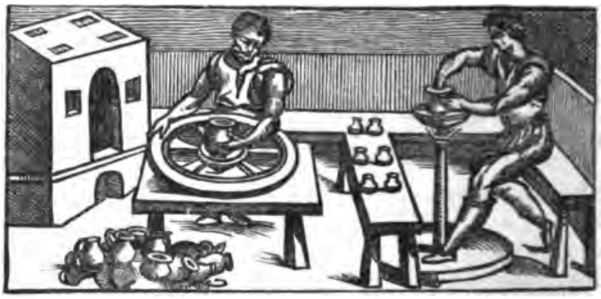


FIG. 55.—Two forms of Italian potter's wheels, about 1540.

Decoration.

Styles of Decoration.—In general character the painted decoration on the majolica of the latter part of the 15th and beginning of the 16th century is very different from that of a few years later. The first retains much of mediæval purity and simplicity of design, while the later sort follows the richer and more florid style brought into fashion by the rapidly-approaching decadence of art. The principal variety of the early class is the ware painted in blues with a yellow lustre, manufactured chiefly in the workshops of Pesaro, Gubbio, and Deruta. With these two simple colors effects of the greatest decorative beauty were produced, far more truly artistic and suited to their special purpose than the elaborate pictures in many colors painted some years later in the workshops of Urbino and Durante. In the firm precision of the drawing and extreme skilfulness of touch in the blue outlines one is reminded of the paintings on Greek vases of the best iod. Some of the large plates of this ware have ire-subjects, usually sacred scenes. A very beauti-one in the Louvre has a Madonna and Child en-oned, drawn and composed with the simple grace Raphael's early manner. Most, however, have traits of ladies drawn in profile, the background ed up with simple flowers, and an inscribed scroll, en with the lady's name and the word "bella" or iva," or with epigrammatic mottoes (see Fig. 56).

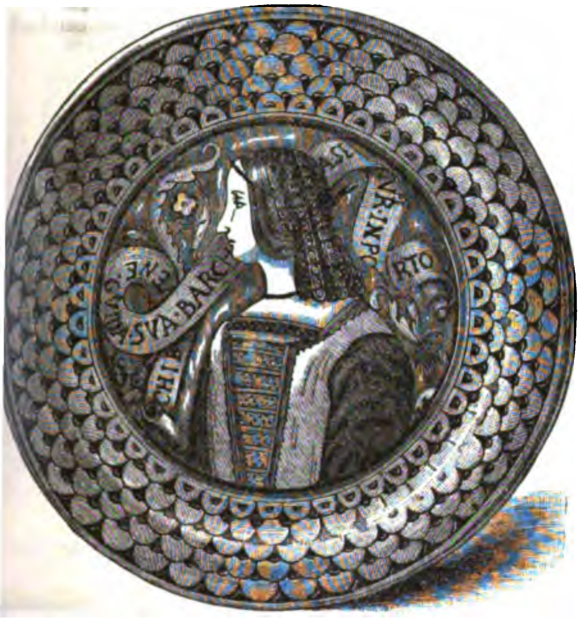
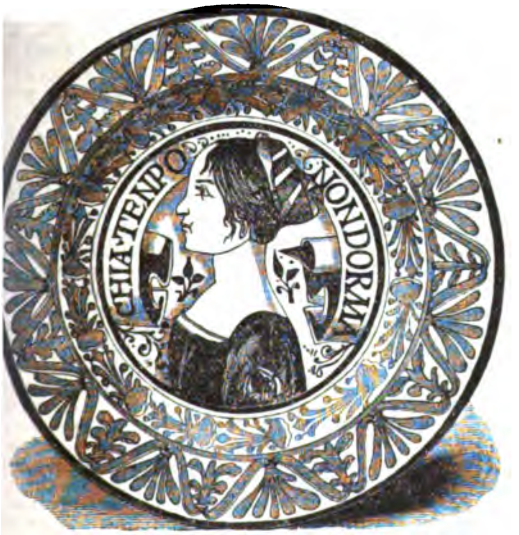


Fig. 56.—Early majolica plate, in blue and yellow lustre only, ide at Pesaro or Gubbio, c. 1500. The motto on the scroll is hi bene guida sua barcha s'entra in porto" (He who steers ll his ship will enter the harbor). (Louvre.)

he design is first drawn in the blue outline, with a tle delicate blue shading over the white flesh and a ue edging on the ground round the outline. The ess and the ornaments on the ground and rim of e plate were finally filled in with the yellow lustre, hich was sufficiently transparent to let all the blue ie details over which it was painted show through. nother rarer sort of early majolica, similar in style, s a deep ruby lustre, employed instead of the golden llow. Fig. 57 shows a fine example of it, probably produced at Gubbio, which had almost a monopoly of this special lustre, afterwards used so largely in the workshop of Maestro Giorgio. Other early varieties of majolica, painted in a simple and unpictorial way, have no lustre colors, but are remarkable for their brilliant and rather harsh green, with a good deal of manganese purple. Plates of this sort with female portraits, not generally in profile, and heraldic animals, frequently occur, as well as slabs or plaques intended for wall-decoration. Faenza and Forlì appear to have been the chief places for their production. The Cluny Museum is very rich in specimens. Cafaggiolo and Faenza also produced, during the early period, some very beautiful and highly-decorative plates, painted without lustre, but with a variety of colors arranged with a most complete harmony of tint. Some have patterns ingeniously devised after a motive suggested by peacocks' feathers (see Fig. 58). The chief colors are yellow and orange, various blues, and occasionally a rich deep red. Amatory plates ("amatorii"), with ladies' portraits, are also painted in this way with more elaboration and detail but not greater decorative beauty than the simple blue and yellow lustre of the early Pesaro and Gubbio ware. Specimens of the later Cafaggiolo ware bear the accompanying mark (see No. 3). Forlì was one of the earliest towns to produce a fine class of majolica; specimens exist dated 1470, of very noble design and firm outline. A fine set of plates and vases was made there (c. 1480–85) for Matthias Corvinus, king of Hungary. The flesh of the figures, like that on the early Pesaro and Deruta ware, is white, delicately shaded with blue; but the early Forlì potters used a greater variety of colors than were employed at most other towns: in addition to the blues they had yellow, bright green, and purple-brown, all non-lustre colors. To Forlì or Faenza must be attributed a very curious and rudely painted plate in the Sèvres Museum, decorated with a youth on horseback in blue outline; it has a date which appears to read 1448; if so, this is the earliest dated specimen of majolica. The enamel is coarse and crackled all over, but the method of execution is that of true majolica.



g. 57.—Gubbio plate, with portrait in ruby lustre and blue outline. (South Kensington Museum.)

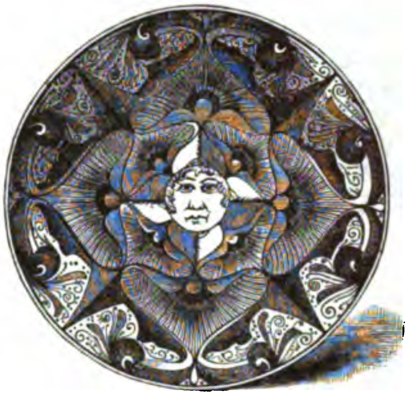
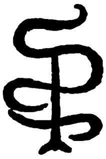


Fig. 58.—Early Faenza plate, with peacock-feather design, in blues, yellow, and orange-red. (South Kensington Museum.)

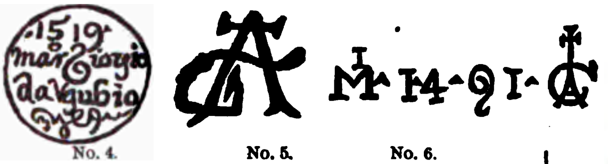


Potter's mark. No. 3.

Majolica of Maestro Giorgio Andreoli of Gubbio.—The workshop of this artist, most of whose dated works fall between 1517 and 1537, was one of the largest and most important of its time. Its productions, as well as those with the signature "M°. G°. da Ugubio," or as in No. 4, are very unequal in merit, and even the best of them are very inferior as specimens of true decorative art compared with the majolica of the earlier classes described above. The mark used

Giorgio of Gubbio's majolica.

most frequently by Giorgio is shown in No. 5. A somewhat similar monogram was used by an earlier potter; an example dated 1491 is shown in No. 6. Though not the inventor of the ruby lustre, which was then so much admired, Giorgio appears to have been the chief potter of his time who used it. The fact is, the process was a difficult one and required special skill, not in the preparation of the oxide of copper pigment but in the firing, so as to expose the color to actual contact with the reducing flame without the pottery itself being shattered to pieces. Even with the best skill of the Gubbio potters a large proportion of the lustred ware perished in the kiln. The majolica potters of many other towns were in the habit of sending their otherwise finished wares to Gubbio for the sake of having the additional brilliance derived from lustre colors. In some cases a space for the lustres was left white; in others rude dabs and splashes of ruby and yellow lustre were applied over completely finished paintings of landscapes or figure-subjects, often in a very coarse and tasteless fashion. Some delicately painted plates are quite spoiled and vulgarized by the heavy touches of lustre that have been put over them. The ruby is in fact rather strong and hard in tone, and needed very careful application to make it harmonize with the quieter non-lustre colors; it is far more salient and metallic-looking than the fine yellow lustre of the early ware. In addition to the ruby, "gold" and "silver" lustres were used at Gubbio. The latter are a deep and a pale yellow. The pale silver lustre was made from oxide of silver; the gold was a mixture of copper and silver oxides. A great deal of the produce of Giorgio's workshop is very rude and of no artistic merit, while the best and most carefully painted wares usually err, in accordance with the rapidly declining taste of his time, in being far too pictorial. Copies of pictures crowded with figures, arranged without regard to the shape of the vessel they were meant to decorate, and painted with all the colors of the potter's palette, were most highly esteemed. Many of them are from designs by Raphael and other great painters, but are really quite unsuited for ceramic decoration. Giorgio's earlier works are, on the whole, in better taste, and some later portrait heads are very good. Fig. 59 shows a fine tazza in the Louvre signed at the back "ex o.[1] Giorg.," which is both nobly drawn and harmonious in color; its date is about 1525. The favorite subjects on the pictured ("istoriata") majolica of Gubbio and elsewhere are scenes from Roman mythology, especially Ovid's *Metamorphoses*, and stories from classical history. Unluckily contemporary history is rare; the British Museum has a good specimen, a plate painted with the defeat of Francis I. at the battle of Pavia.



No. 4. No. 5. No. 6.

Potters' marks.

Urbino pictured wares.

It was at Urbino and Castel Durante that the production of elaborate pictured majolica was mostly carried on, specially between the years 1530 and 1560, under the patronage of the reigning Dukes of the Della Rovere family. Francesco Xanto Avelli, Guido Fontana, and Niccola da Urbino were especially celebrated for this class of work, and often used Marc Antonio Raimondi's engravings from Raphael's designs to decorate their plates and vases.[2] Many of these are painted with great delicacy and richness of effect in spite of their unsuitability for their special purpose and the comparative poverty of the potter's palette, which was, of course limited to colors that would stand the severe heat of the kiln. The pictured wares of Urbino sometimes have the Gubbio lustre colors, but the best are without them. Another class of design was also used at Urbino with much better decorative effect. It consisted of fanciful and graceful arabesques or floral scroll-work mingled with grotesque figures or Cupids, all skilfully arranged to emphasise the main contours of the plate or vase. Branches of the oak tree in flowing and slightly geometrical lines are a frequent motive of design, chosen in compliment to the Della Rovere dukes, who bore an oak on their coat of arms. All these, but especially the pictured wares, were highly paid for, and sometimes were valued as much as silver plate. They were mostly "piatti di pompa,"—meant, that is, to hang on walls or ornament sideboards rather than for actual use. Some of the early productions of one of the Urbino potteries are marked with the graceful monogram No. 7.

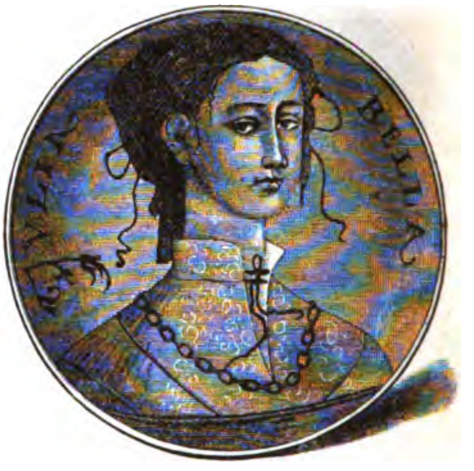
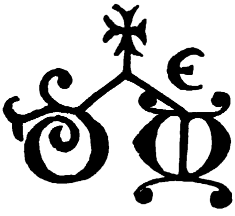


FIG. 59.—Gubbio tazza by Maestro Giorgio, with lady's portrait and inscription "Julia Bella."



Potter's mark. No. 7.

Faenza.

In a short sketch like this it is impossible to give even an outline of the many varieties of majolica produced in such profusion during the 16th century, but a few others of the more important kinds may be mentioned. The Faenza potteries produced one of the most beautiful of the later varieties, chiefly plates with wide flat rims and deep centres, called "tondini," the borders decorated with delicate and minute arabesques, painted in several tints of a deep ultramarine blue of wonderful richness and decorative effect. In the centre is usually a coat of arms or a single figure, with a brilliant jewel-like touch of orange or deep red, which sets off to the utmost the blues of the border (see Fig. 60). One of the most remarkable specimens of majolica painting, treated with the delicate minuteness of an illuminated MS., is on a plate in the British Museum from the Faenza workshops. It is a scene of the death of the Virgin, surrounded by the apostles, copied with slight adaptations from an engraving by the German master Martin Schöngauer. The Italian ceramic painter has slightly but skilfully altered the composition to fit it to the circular form of the plate, and has also given a more graceful cast to the mannered German faces of the original. The execution is wonderfully delicate and miniature-like, almost wholly done in different tints of blue, with a little yellow to suggest

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[1] For *ex officina*, a phrase borrowed from the Roman potters' stamps, see p. 638 *supra*.

[2] A namesake and relation of Raphael's was a skilful painter of *istoriati* pieces; and hence has arisen the tradition that the great painter occasionally decorated majolica (see RAPHAEL).

Siena.

Florence.

flesh color, and high lights touched in with pure white enamel, the main enamel ground being white slightly tinged with pink. It is evidently the work of a very able artist, and is a little picture of gem-like beauty, though in no way specially suited to the requirements of ceramic art, for which a bolder and less realistic style of treatment is really the most suitable. Some fine early plates of Faenza make are signed with No. 8 mark; a common later mark is the monogram FA(enza)—see No. 9. Another plate, also in the British Museum, has a painting copied from a design by Albert Dürer, the Scourging of Christ. This highly-labored and minute style of painting was largely practiced in the potteries of Siena, which produced plates of great beauty, with borders of graceful scroll-work and grotesques in white and different tints of blue, with usually a rich russet-brown or orange ground. Tondini from Siena are often decorated in this way with a central medallion containing a minute landscape, painted with wonderful minuteness and finish. The landscapes are very delicate in color, and, though often not more than an inch and a half in diameter, have a wonderful suggestion of atmosphere and distance which recalls the lovely sunset-lit backgrounds of Perugino's pictures. A very beautiful plate in the British Museum, painted in this minute style with the scene of Scævola before Porsena, is signed on the back, "fata ĩ Siena da Mº Benedetto." Other plates by the same very clever and refined painter are decorated only in blue, with touches of pure white on the creamy enamel ground. The Kensington Museum has a good specimen, with a central painting of a hermit and landscape background, surrounded by a delicate border of arabesques. Little is known of the artist. Another signature which occurs on Siena ware is No. 10, in one case conjoined with the date 1542. Majolica with plain blue enamel is a rare variety, and has been attributed to Luca or Andrea della Robbia, some pieces being marked as in No. 11, apparently for "Luca della Robbia, Florentia." It has no painting, but was partly gilt; in color the enamel resembles the plain blue pottery of Persia mentioned above. It consists mostly of vases moulded with flutings and bosses after a metal design; very few pieces exist. The beautiful sculpture in enamelled terra-cotta made by the Della Robbia family will be treated of under the head of ROBBIA.

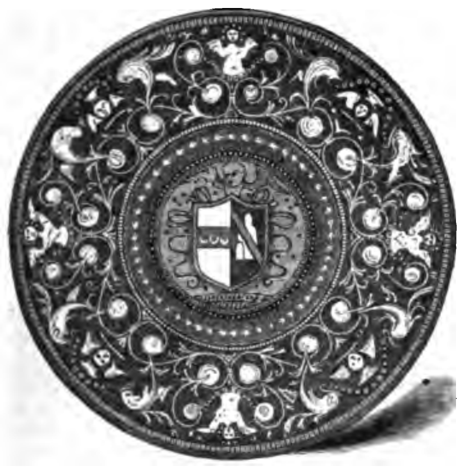
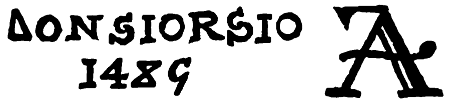
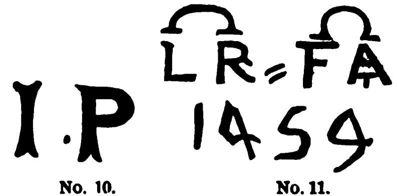


FIG. 60.—Faenza plate (tondino), with border in deep ultramarine blues, and central coat of arms in rich orange and red. (South Kensington Museum.)



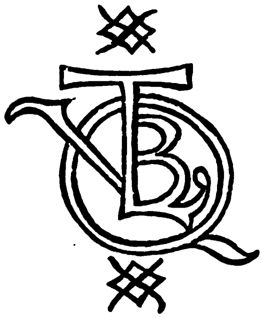
No. 8. No. 9.
Potters' marks.



No. 10. No. 11.
Potters' marks.

Venice.

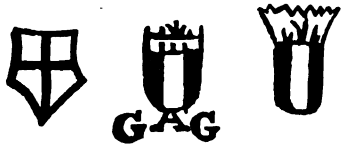
Venetian majolica was not largely produced till towards the second half of the 16th century. In the earlier part of that century the few potters of Venice appear to have chiefly occupied themselves with attempts to produce true porcelain. The earliest dated specimen of Venetian majolica is of the year 1540. Some of this ware is very decorative in effect, and has paintings of graceful and elaborate foliage, scroll-work, and arabesques, designed with great intricacy. It is in blue and white, the main enamel ground being a very pale blue, and the design in deeper shades of blue with high lights in pure white. Others have landscapes in blue and white, with graceful, but too realistic borders of fruit and flowers in yellow, green, and blue, somewhat later in style. Mark No. 12 occurs on some of the finest Venetian majolica. Towards the end of the 16th century there was a rapid falling off in the artistic beauty of majolica paintings, and not solely in the execution: the pigments also became thin and poor, with very often a disagreeable "granular" look. Some effective pottery was produced at Venice, c. 1590–1620, with a deep ultramarine blue enamel ground, on which designs were painted in white, a style of ware which was largely manufactured at Nevers, in France, a few years later (see Fig. 62 below).



Potter's mark. No. 12.

Later majolica.

All through the 17th and 18th centuries majolica in a degraded form was produced at many places in Italy; but most of the old kilns, such as those of Deruta, Gubbio, and Faenza, fell into disuse. The latest kind of majolica, decorated with coarse paintings in blues and yellows of rather harsh tint, was largely produced at Turin, Genoa, Venice, Savona, Castello, Naples, Montelupo, and other cities. The older potteries at Pesaro and Urbino still continued in work, but produced nothing of real merit. A common mark on Turin ware is No. 13; and on Savona majolica one of the two forms in No. 14 often occurs. In the beginning of the 17th century spirited copies were made of the magnificent Rhodian pottery, such as that shown in Fig. 48 above, but with pigments very inferior to those of the originals. At Capo di Monte, near Naples, a manufactory of pottery and porcelain was started under royal patronage in 1736; but it was more celebrated for the production of porcelain than of enamelled wares. Of late years clever imitations of the old majolica have been produced in Italy, especially from the workshop of the marquis Ginori. Even the old lustre colors are successfully reproduced; but most of the modern majolica is marred by a want of spirit and freedom, the natural result of its being a too servile copy of a bygone style.



No. 13. No. 14.
Potters' marks.

Shapes.

Shapes of Majolica.—The most carefully finished and finest paintings are as a rule on plates, which were of various forms, from almost flat disks to the tondini with wide flat rims and deep bowl-like centres. Many of the jugs, vases, and ewers are extremely graceful in form, some suggested by the bronze vessels of ancient Rome, others taken from Greek vases. Piccolpasso gives sketches of the principal shapes, and a long list of special names, not now of much importance, as they varied in different manufactories and even workshops in the same town. The character of the non-pictoral decorations combines many different elements of style. In some of the patterns we see a survival of earlier mediæval and native Italian taste and invention. Others, especially the large ewers of Cafaggiolo and Faenza, have flowers taken from Persian pottery, but treated in a thoroughly original way. Some plates, painted in the silver lustre only, are almost imitations of Hispano-Moorish ware or actual majolica made in the Balearic Islands. In all the scroll-patterns, mingled with grotesques, it is easy to trace the influence of the ancient wall-decorations from the baths of Titus and other buried buildings, the discovery of which at the beginning of the 16th century did so much to destroy the lingering mediæval spirit and substitute a pseudo-classical style, which finally had so fatal an effect on all branches of art in Italy.

Collections.

Collections.—The chief collections of the majolica of Italy are those of the South Kensington Museum (perhaps the most completely representative of all), the Bargello in Florence, the museums of Milan, Venice, Turin, Pesaro, Urbino, and other places in Italy. The Hôtel Cluny and the Louvre in Paris, the Ceramic Museum at Sèvres, as well as Limoges, Berlin, Vienna, Munich, and St. Petersburg, have good collections. The British Museum collection is not large, but it is one of the most important, from the number of "signed" pieces that it contains, and from the fact that nearly all its specimens are remarkable for their exceptional beauty or some point of special interest.[1]

Literature.—For Italian majolica, see Vasari, *Lives of Battista Franco, Buontalenti, and Luca della Robbia* (ed. Milanesi, 1882); Meurer, *Italienische Majolicafliessen*, 1881; Corona, *La Ceramica*, 1879; Vanzolini, *Istorie delle fabbriche di Majoliche*, Pesaro, 1879 (a most valuable reprint of the best old treatises on the subject, including Piccolpasso's illustrated MS.); Darcel and Delange, *Faïences Italiennes*, 1864; Fortnum, *South Kensington Museum Catalogue of Majolica*, 1873; Jacquemart, *Les Majoliques de la collection Campana*, 1862, also article in *Gaz. des Beaux-Arts*, xiii. p. 289; Drake, *Venetian Ceramics*, 1868; Lazari, *Notizia della raccolta Correr*, 1859; Raffaelli, *Maioliche lavorate in Castel Durante*, 1846; Bonghi, *Majoliche di città di Castello*, 1856; Casati, *Les Faïences de Diruta*, 1874; Campori, *Maiolica di Ferrara*, 1871; Delsette, *Maioliche di Pesaro*, 1845; Frati, *Maioliche di Pesaro*, 1844; Torteroli, *La Maiolica Savonese*, 1856; Pungileoni, *Pitture in Maiolica di Urbino*, 1857; Brancaleoni, *Mastro Giorgio di Gubbio*, Pesaro, 1857. For information on the marks on majolica, see Genolini, *Maiol. ital., Marche e Monogrammi*, Milan, 1881; and De Mély, *La Céramique ital., Sigles et Monogrammes*, Paris, 1884. Many valuable articles on majolica are scattered through the volumes of the *Gaz. des Beaux-Arts*.

SECTION XI.—SPANISH AND PORTUGUESE.

Spanish pottery.

Spanish.—Spanish pottery is for the most part a coarse imitation of Italian majolica, chiefly made at Valencia, Triana (Seville), and Talavera. Some of the enamelled ware made at the last-named town is elaborately painted with figure-subjects in blues, yellow, green, and manganese purple, of extremely bad taste and feebleness of drawing.[2] The simpler pottery made at Valencia a little before and after the year 1700, though rudely painted, is very decorative in effect. Large plates often have conventional flowers or profile heads, somewhat after the style of some of the earliest majolica of Italy, and are coarsely painted in blue and yellow. In the 18th century good enamelled pottery was made at Alcora, painted only in blues, often in the Chinese style. Some large vases of Moorish shape have very effective blue and white paintings of animals, flowers, and landscapes.[3] A quite different style of enamelled pottery was made at Puente del Arzobispo in the 16th or 17th century. Specimens are rare; they consist chiefly of plates decorated in a very skilful and effective way, somewhat after the fashion of Moorish wall-tiles, "azulejos" (see TILES). They are made of coarse red clay covered with white enamel, through which (before firing) the outline of the design was scratched down to the red body. The spaces between the incised lines were filled in with colored enamels, rich blue, green, and orange, and the whole glazed with a very fusible lead glaze. The simple and mosaic-like patterns thus formed, either conventional flowers or heraldic animals, are extremely decorative and telling.

Portuguese.

Portuguese.—Little or no enamelled pottery of Portuguese workmanship earlier in date than the 17th century is known to exist. Rato was one of the chief places for the manufacture of enamelled wares, which are coarsely painted, like the latest and poorest kinds of Italian majolica, and are not earlier in date than 1767, when the Rato potteries were first started. Other earlier specimens of unknown make also exist, and are marked with an "R," like the Rato ware, to which they are very superior both in design and execution. The best are in blue and white only; many are marked with various dates during the 17th century.

Biscuit ware.

Biscuit Pottery of Spain and Portugal.—The earliest kinds now existing of Spanish pottery without either enamel or glaze are chiefly large wine-jars, "tinajas," about 3 or 4 feet high, of graceful amphora-like shape, stamped with simple patterns in relief. Some of them date from the time of the Moorish occupation. Both Spain and Portugal have always been remarkable for the fineness and beauty of their potter's clays, and consequently have for long excelled in the production of simple biscuit wares, uncovered by either enamel or glaze. Very graceful pottery of this sort is manufactured even at the present day, the shapes being traditional, handed down from century to century with but little change, many vessels being still modelled after the old Roman forms. Some of this ware is of a white porous clay, like pipeclay, and some is of a fine red, close in texture, with slight surface gloss, almost like the Roman "Samian." One common kind is decorated in a very fanciful and ingenious fashion by the application of simple but rich surface ornaments, modelled by hand in relief, or applied in a state of semi-fluid slip. Other curious water-jars are made double, the outer vessel being pierced with patterns of open-work. A third variety has sparkling particles of quartz stuck on its surface while moist, a very old method of decoration, which was even practiced by the potters of prehistoric times. On the whole, the modern biscuit wares of Spain and Portugal are among the most truly artistic and interesting of any that are now made in Europe. It is still a living art, with simply beauty both in material and shape, not a labored revival of a dead style, or dull copy of the artistic productions of a far-off time when fitness linked with grace came naturally to the humblest workman.

SECTION XII.—FRENCH FROM THE 16TH TO THE 18TH CENTURY.

During the 16th century two very different but equally remarkable sorts of pottery, decorated with great elaboration, were made in France. One was that invented and manufactured by Bernard Palissy, which was a fine earthenware, usually modelled in relief, covered with a white tin enamel, and painted with many bright colors (see PALISSY). The other, Oiron pottery, popularly called "faïence Henri deux," is very different both in design and execution. This rare and curious ware, of which only about forty pieces are known, was made by a potter called François Cherpentier for his patron, a rich and artistic widow lady, named Hélène de Hangest, who established a workshop and kiln at her Château d'Oiron, in the province of Thouars, between the years 1524 and 1537. The manufacture was carried on by Hélène de Hangest's son for some years after her death, but the pieces then produced are inferior in quality, and soon ceased to be made at all. This ware is not enamelled; it is simply a fine white pipeclay, to which a delicate cream tint is given by a very slight tinge of yellow in the lead glaze. Its forms are very elaborate, sometimes extremely graceful, but occasionally too fanciful, and overloaded with ornament. It consists of plates, tazze, holy-water pots, ewers, salt-cellars, and other varieties of shape, generally forms more suited to metal than to clay, ornamented with very graceful interlaced strap-work and arabesques, such as were much used by the great Augsburg and Nuremberg workers in silver. The

Oiron pottery.

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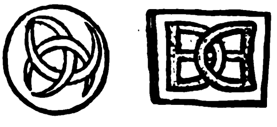
[1] The year 1884 will be memorable in the history of majolica for the sale and dispersal of the important collection formed in the 18th century by Sir Andrew Fountaine of Narford. A few specimens were secured for the South Kensington and British Museums, but some of the finest pieces were bought for France, especially a magnificent Faenza plate, dated 1508, which fetched £966 [$4,694.76]. Several of the Pesaro and Urbino dishes sold for between £200 [$972] and £300 [$1,458].

[2] See Casati, *Les Faïences de Talavera*, 1874.

[3] See Riaño, *Spanish Handbook*, South Kensington Museum, 1879.

method in which many of the ornaments are executed is the chief peculiarity of the ware; they are first incised or stamped into the soft clay of the vessel, and then the sunk patterns are filled up with different clay pastes, tinted with dark brown, soft yellow, or buff. Many of the delicate leaf-ornaments appear to have been formed with a metal stamp; some are exactly the same as those used by contemporary bookbinders. The ornaments are not all done in this laborious manner; some are simply painted under the glaze, especially on the later productions of Oiron. Monograms and emblems occur frequently, the salamander of Francis I., the "H. D." for Henri deux, the royal interlaced crescents, or coats of arms (see No. 15.) Fig. 61 shows a beautiful covered tazza in the Louvre, made during the reign of Francis I. There are eleven pieces of this ware in the Louvre; the Kensington Museum has five; but the greater number of known specimens are in the possession of members of the Rothschild family. It was at one time thought to be the production of a pottery under the patronage of Henry II., and hence the name by which it was formerly known; but its real origin was established from clear documentary evidence published in M. Fillon's valuable monograph on the subject.


Potter's mark. No. 15.

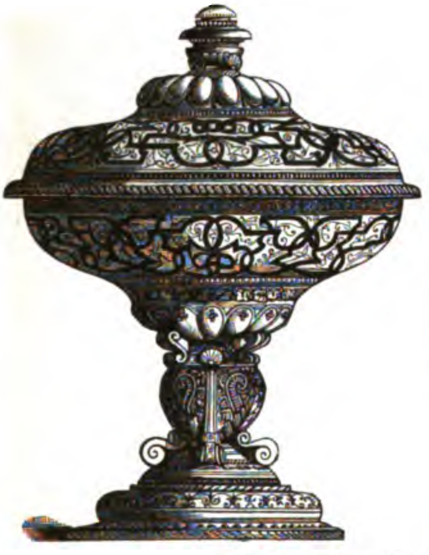


FIG. 61.—Tazza of Oiron pottery. (Louvre.)

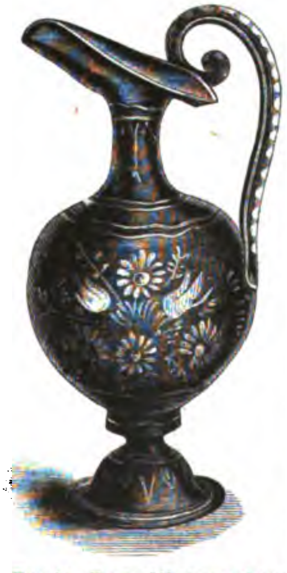


FIG. 62.—Ewer of Nevers pottery; the design in white on dark-blue enamelled ground; Persian style.

Nevers enamelled pottery.

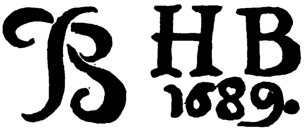
Throughout the period we are now considering enamelled pottery was produced at a very large number of French towns, often with the help of potters from Italy; and the introduction of the tin enamel soon superseded the earlier sort of ware with a bright green or blue glaze which at the end of the 15th and beginning of the 16th century was the chief and most artistic kind of pottery that was made in France. The change was not wholly a gain, as pieces of the older ware were moulded in relief with designs of great beauty—mostly Gothic in feeling—especially those made at Avignon, Savigny, and Beauvais; the reliefs on the older French ware are very delicate and sharp, and often of great decorative effect. Nevers was one of the chief manufactories of enamelled ware; from about 1570 to the end of the 17th century it produced mostly poor copies of the later sort of Italian majolica. After that a strong Oriental influence set in, and a peculiar ware with a deep-blue enamel ground was made, very like that produced by the Venetian potters. Some of this, painted in white enamel only, with Persian designs, is effective and pleasant in color (see Fig. 62). Other pieces have flowers, treated in a more realistic way, painted in harsh yellow, green, and red, quite out of harmony with the rich blue ground. J. Bourdu, a potter working at Nevers from 1602 to 1620, signed his ware with mark No. 16; another, named H. Borne, used No. 17. During the 18th century Nevers chiefly produced pottery of Chinese forms, painted in blue with Chinese figures and flowers, and also a large quantity of pottery painted in many colors with coarse designs, somewhat after the Delft style.

Rouen.

The 17th century enamelled pottery of Rouen is the finest of the later French wares. It is mostly painted in rich red and blue only, with very minute and well-designed arabesques of geometrical form, adapted, not copied, with great skill and taste from Oriental designs (see Fig. 63). Very large plates, wine-coolers, hanging cisterns, and ewers are made of it. One very rare variety has the blue and red pattern on a deep orange ground, but it is very inferior in artistic effect to that on the white ground. The finest specimens were made before 1700; after that time the painting became coarser. Copies of Chinese wares were also made at Rouen in the 18th century, all gaudy in color, and mostly poor in execution. The Rouen Museum has the best collection of its native ware; there are very fine specimens also in the South Kensington Museum.

Moustiers, etc.

During the 18th century Moustiers produced some very decorative pottery, painted in various shades of blue, with delicate wreaths, masks, and arabesques, somewhat after the Rouen fashion. Other colors were also used in very minute patterns, but the simple blue and white is the best. Blue and white pottery with fairly good designs was also manufactured at St. Cloud, Sceaux, and Saint Amand, as well as many other French towns, during the



No. 16. No. 17.
Potters' marks.

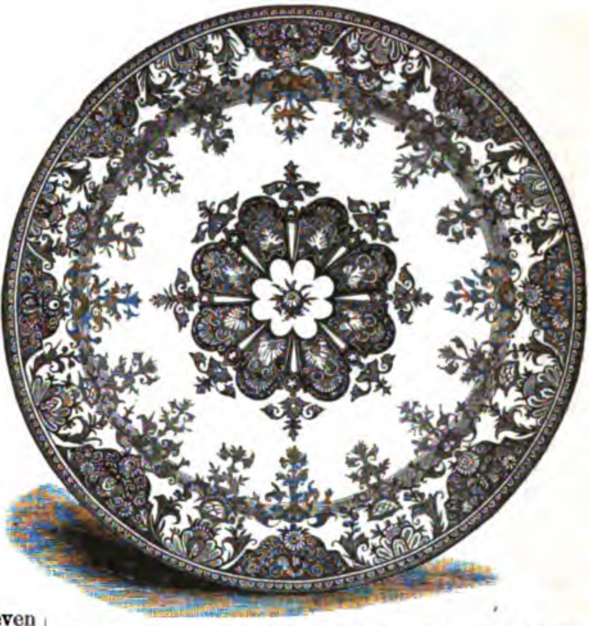


FIG. 63.—Dish of Rouen enamelled pottery, painted in blues and deep red.

first half of the 18th century. Most, however, of the French wares of this date are little better than imitations of porcelain, and their decoration feeble copies of Chinese or Japanese designs.

Literature.—For Oiron ware, see Delange, *Recueil de . . . Faïence . . . dite de Henri II.*, 1861; Fillon, *Les Faïences d'Oiron*, 1863 (best work); Tainturier, *Les Faïences dite de Henri II.*, 1860. For Rouen ware, see Delisle, *Faïence de Rouen*, 1865; Pottier, *Histoire de la Faïence de Rouen*, 1870; Ris-Paquot, *Faïences de Rouen*, 1870. For other French potteries the reader may consult Clement de Ris, *Faïence Francaises, Musée du Louvre*, 1871; Mareschal, *Faïences Anciennes et Modernes*, 1867; Tainturier, *Porcelaine et Faïence* (*Alsace et Lorraine*), 1868; Houdoy, *La Céramique Lilloise*, 1869; Davillier, *Faïence de Moustiers*, 1863; De Segange, *La Faïence de Nevers*, 1863; Pouy, *Les Faïences d'Origine Picarde*, 1874; Fillon, *L'Art de Terre chez les Poitevins*, 1864. The various volumes of the *Gaz. des Beaux-Arts* contain many valuable articles on the whole subject.

SECTION XIII.—MEDIÆVAL GERMAN, DUTCH, ETC.

Use of tin enamel.

Though little is known of the early ceramic history of Germany, it is certain that the application of a tin enamel and enamel colors was known to the potters of that country even in the 13th century. Some plaques, with heads in relief, painted in various colors over a white enamel ground, still exist at Leipsic; they were made for wall-decoration, and are said to be of the year 1207. At Breslau there is a monument of enamelled clay to Henry IV. of Silesia, made about 1300. According to one story the use of a white tin enamel was perfected at Schelestadt by an Alsacian potter who died in 1283. Other examples exist, though few in number, at various places in Germany, sufficient to show an early acquaintance with the method of producing enamelled ware, which, however, seems to have fallen into disuse, and during the 15th and 16th centuries to have been superseded by the fine sorts of stoneware, in the manufacture of which the German potters were so widely celebrated.

Stoneware.

Gray stoneware, richly decorated with delicate stamped patterns in relief, and generally, though not always, covered with a lead glaze, was produced in great quantities in Germany, Flanders, and Holland from the end of the 14th century till quite modern times, and was very largely imported into England and France. Much of this stoneware (called by the French "grès de Flandres") is decorated with great delicacy and taste; its tint, gray, brown, or cream-white, is very soft and agreeable. The earlier specimens have reliefs of a Gothic character, always stamped with great crispness and sharpness, not the least blunted by the process of firing; many have elaborate coats of arms, or branches of simple foliage, which spread gracefully over the surface of the vessel; others have bands of figures, very minutely treated in slight relief. Another method of decoration was by incised patterns, impressed from relief-stamps; sometimes, as was the case with the Oiron ware, book-binders' dies were used for forming such patterns in the soft clay. Some of the cream-white ware is left unglazed, but most kinds have a vitreous lead glaze, either colorless or mixed with oxide of cobalt or manganese. These two colors, indigo-blue and purple-brown, are often used to pick out the relief-patterns, thus making the design more effective. Owing to the use of old stamps and traditional designs much of this pottery has patterns considerably older than the ware itself, the date being frequently introduced among ornaments which look very much earlier than they really are. Fig. 64 shows a common form of jug, called a "graybeard" from the grotesque head modelled on the neck. The body of the jug is covered with very graceful scroll-work of oak branches in low relief.

Imitation metal-work enamel.

Another curious variety of German pottery, consisting chiefly of tankards and jugs, made to imitate enamelled metal-work, was manufactured mostly at Kreussen in Bavaria. The body is of hard red clay, covered with a dark-brown enamel, the designs in slight relief being taken from the Augsburg or Briot style of metal-work, —strap-work, wreaths, grotesques, or human figures. A favorite design has reliefs of the twelve Apostles, little more than an inch high, under flat architectural canopies; a strong Gothic feeling in the treatment of such figures occurs on tankards made as late as the end of the 17th century. The colored decoration of this ware is very brilliant; the minute figures or ornaments are picked out in bright enamel colors—red, green, blue and yellow—altogether producing a very striking but thoroughly unceramic effect.

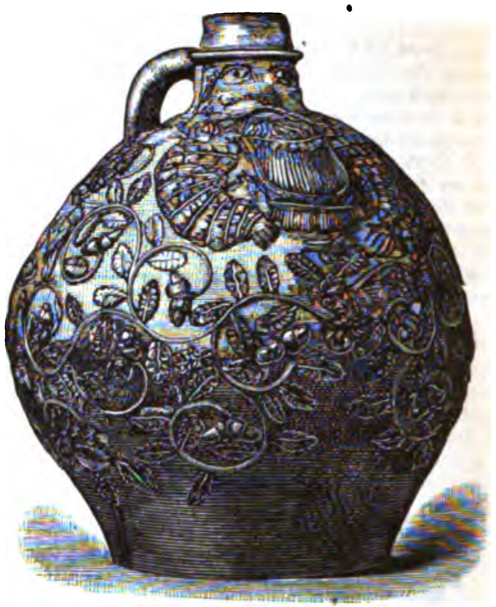


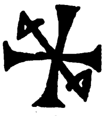
FIG. 64.—Stoneware jug or "graybeard"; Flemish ware, early 17th century. (South Kensington Museum.)

Cologne stone-ware.

A quite plain stoneware, with surface slightly mottled with gray and brown, appears to have been one of the most esteemed varieties during the 16th century, judging from the beauty of the silver rims and lids with which wine-jugs of this kind were usually mounted. The mottling was produced by the brownish glaze running in the kiln into a granular surface, which formed a pleasant texture, something like that on an ostrich's egg. The best qualities were made at Cologne, and largely imported into England under the name of "Cologne" stoneware.

Sgraffiato ware.

A rude kind of sgraffiato ware was also made in Germany and Holland during the 17th and 18th centuries. Coarse red-clay vessels were covered with a slip of white pipeclay, and rude figures, often of saints or kings, were scratched through the white down to the red body. The whole was then glazed with a yellowish lead glaze. Böttger, the first maker of Meissen porcelain, manufactured curious varieties of pottery at the beginning of the 18th century—especially a ware like red jasper, which was so hard that it was cut and polished by the lapidary's wheel. It is usually marked with No. 18.



Potter's mark. No. 18.

Good collections of German pottery are in the museums of Berlin, Dresden, Munich, Löwenberg, Minden and private collections at Nuremberg; the Kensington Museum has also a number of fine specimens.

Holland.

Holland.—Holland, especially the town of Delft,[1] produced very large quantities of pottery covered with a fine white enamel. The early specimens date from the end of the 16th century. Much of this ware is very soft and pleasant in tone, and very decorative in effect, especially that in blue and white only. Designs of great variety occur, some copied from Persian or Chinese originals, others with coats of arms surrounded by graceful borders, formed of medallions and wreaths. A clever arrangement of peacocks' feathers is a common and very effective motive, used especially for plates. Other sorts of very inferior artistic merit have paintings of flowers or human figures, coarsely executed in rather harsh colors—yellow, green and red—mingled with the more harmonious cobalt blues and manganese purple. Many pieces of Delft ware are marked with maker's initials, as No. 19 or No. 20, probably two members of the Kulick family, of about the middle of the 17th century.

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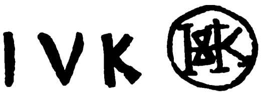
[1] See Havard, *Faïence de Delft*, 1878.



No. 19. No. 20.
Potters' marks.

But little pottery of any real artistic value was produced in any Western country during the 18th century, with the exception of the commoner and cheaper sorts of wares, with little or no ornament, which were still made after the old traditions. The fact is that the increasing introduction of Chinese and Japanese wares and the widely-spread manufacture of porcelain in the West gave the death-blow to the production of pottery designed and decorated after simple and natural methods. The enamelled pottery of the 18th century was mostly little better than a bad imitation of porcelain, a material which has a beauty quite its own, and requires forms and methods of decoration very different from those that are suited even to the most finely-enamelled earthenware.

Literature.—See Menard van Hoorebeke, *Recueil des Antiquités*, 1867; Weckherlin, *Vases en Grès des XVI*^{e} *et XVII*^{e} *Siècles*, 1860; Jouveaux, *Histoire de . . . Böttger*, 1874.

Scandinavian.

Scandinavia.

The pottery of Denmark, Norway and Sweden for the most part resembles that of Germany. Sweden, especially during the 18th century, was very active in the production of enamelled pottery, but little of it possesses any originality either in form or design. Perhaps the best variety is a ware made at Stockholm, covered with bluish white enamel, on which simple patterns are painted in white. The potteries of Marieberg and Rörstrand[1] also turned out large quantities, painted mostly with very weak designs; some are imitations of Oriental wares, while other kinds are decorated in a realistic French style.

SECTION XIV.—ENGLISH FROM THE 16TH CENTURY.

Little except the commonest sort of domestic pottery was made in England during the 16th century. The gray mottled stoneware described above, which was largely used for sack-jugs and tankards, appears to have been wholly a foreign import, mostly from Cologne. A common item in 16th century inventories is—"a stone jugge or pott, garnished with silver and double gylted." The silver-mounted lids were often added by English silver-workers, and are frequently very elaborately embossed and chased.

Stoneware.

It was not till quite the end of the century that certain Dutch potters started in London the making of stoneware. This English-made ware is hardly to be distinguished from that of Cologne or Holland, as it was designed and manufactured in the foreign way. Large globular jugs, stamped in relief with a grotesque bearded face and other ornaments, were one of the favorite forms. Such were called "graybeards" or "bellarmines," from the unpopular cardinal of that name, of whom the bearded face was supposed to be a caricature (see Fig. 64 above). Great numbers were made in the Low Countries and copied by the Dutch potters in London. In 1688 two German potters named Elers settled in Staffordshire, and there produced hard stoneware of very fine quality. Their process, however, soon became known to other potters.

Staffordshire common wares.

The common wares of this time were mainly produced in the Staffordshire potteries; some were decorated in a very rude but effective way by dropping fluid white slip through a quill on to the surface of vessels made of red clay. The whole was then covered with a coarse lead glaze, made from powdered lead ore (sulphide of lead), sprinkled through a sieve on to the soft clay. The process of firing produced a vitreous glaze, composed of silicate of lead, the silica being taken up from the clay body. Thomas and Ralph Toft made a number of large plates, drinking mugs or "tygs," and candlesticks, decorated in this way with rather elaborate designs (see Fig. 65). The potter's name and the date frequently occur among the slip ornaments, which are sometimes in red and brown on a white ground, as well as white on red. About the year 1680 a new sort of glaze was invented, very useful for the common kinds of hard stoneware, and extremely durable, namely, the "salt glaze," applied by throwing common salt (chloride of sodium) into the hot kiln when the process of firing was nearly complete. The salt was volatilized and decomposed; the soda combined with the free silica in the clay, and a coating of hard silicate of soda was formed. A very high temperature is required for this process, which is chiefly used for drain-pipes and vessels to hold corrosive acids, the salt glaze being almost indestructible.

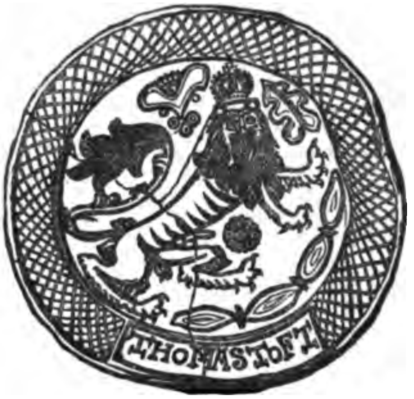


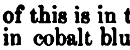
FIG. 65.—Coarse earthenware dish, with decoration in slip, signed by Thomas Toft, c. 1670. (Museum of Geology, London.)

John Dwight.

Towards the end of the 17th century a gentleman named John Dwight spent many years in experiments to improve the manufacture of pottery, and also to discover the secret of true transparent porcelain. He appears to have been an artist of great ability, and not only made domestic pottery of Cologne ware but also modelled figures and large busts in pale-gray glazed stoneware; the British Museum possesses a fine portrait bust of Prince Rupert by him, modelled with great truth and spirit, almost recalling the touch of the old Florentine sculptors in terra-cotta. In 1671 John Dwight took out a patent for his special methods of pottery and porcelain work, and set up kilns at Fulham. Many of his receipts for porcelain exist, and have been published in Jewitt's valuable work on *The Ceramic Art of Great Britain* (1877), but no specimens of this early English porcelain are now known.

Lambeth potteries.

The Lambeth potteries were established at a very early period, but it was not till the 17th century that they produced ware superior to the common biscuit or lead-glazed varieties. Some pieces of about 1660 are marked with No. 21 mark. Certain Dutch potters settled at Lambeth early in the century, and started the manufacture of a finer sort of pottery, covered with a tin enamel. Most of this is in the style of the Delft wares, painted either in cobalt blues alone or with the coarse green, yellow,



Potter's mark.
No. 21.

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[1] See *Céramiques Suédoises du XVIII*^{e} *Siècle*, 1872.

and manganese purple used in the more gaudy kind of Delft. The Lambeth potters also imitated Palissy ware, with high reliefs of human figures or plants and reptiles—very poor copies of Palissy's originals, the modelling being extremely blunt. The enamel ground has a pink tinge, and the reliefs are picked out in various colors. Some specimens of this Lambeth ware are dated on the back in blue with various years during the reigns of Charles I. and Charles II. Another variety has coarse imitations of late Italian majolica, while other pieces have English designs—coarse portraits of Charles II. and his queen, with arabesque borders, all very rudely executed.

The beginning of the 18th century in England saw a great increase of activity in the production of many kinds of pottery. Numbers of patents were taken out and new kilns set up at a great many different places. Though many improvements were made in the preparation and combination of different clays and considerable advances in technical skill were gained, yet little pottery of any artistic value was made.

Wedgwood ware.

Wedgwood Ware.—The Wedgwoods were an old Staffordshire family, and one member at least was a potter in the 17th century. This was John Wedgwood (1654–1705), the great-uncle of Josiah, who in the next century founded the great pottery which he called "Etruria." Only one piece signed by John Wedgwood is known to exist; it is in the interesting historical collection of ceramic wares in the Jermyn Street Museum of Geology, London. It is a "puzzle jug," with three spouts and a hollow handle, made of coarse brown clay, covered with the usual green lead glaze. The potter's name and the date 1691 are incised round the jug.[1]

In the middle of the 18th century, when Josiah Wedgwood was a young man, a great impulse had been given to the study and appreciation of classical art, partly through the discovery of the buried cities of Pompeii and Herculaneum, and also on account of the growing enthusiasm for the beautiful Greek painted vases, which were then being sought for with great avidity in the tombs of Etruria and Magna Græcia. Josiah Wedgwood devoted his life and great talents to an attempt to reproduce the severe beauties of the Greek and Roman pottery. Unfortunately in this not unpraiseworthy aim he neglected the special requirements of fictile work. His productions, delicate and beautiful as they often are, have the characteristics of anything rather than pottery. With great labor and expense he turned out from his workshops imitations, necessarily unsuccessful, of ancient engraved gems and camei, of jasper, basalt, or mottled marbles, of gem-like cut glass, such as the Portland vase, and dull copies, feeble in drawing and hard in texture, of beautiful painted Greek vases. Of natural methods of decoration suitable to pottery, or of the life and freedom of the plastic clay rising into graceful forms under the touch of the thrower's hand aided by the rhythmical movement of the wheel, he knew nothing. Nearly all his pottery is dully scholastic and archæological in style, and therefore must, on the whole, be regarded as a failure, though often a very clever and even beautiful failure.

Wedgwood's most characteristic ware, in the production of which he was aided by Flaxman and other able artists, consists of plaques and vessels, vases, cups, plates and other forms moulded in clay, delicately tinted blue, brown and various colors, on which minute cameo reliefs in white paste were applied while they were soft, and were then fixed by firing. Many of them have very beautiful figures, some copied from Greek and Roman gems or vases, others being specially designed for him; but all are classical in style. Some of his pieces are quite astonishing for their microscopic delicacy of detail; others have wreaths, foliage, and minute diaper ornaments applied in the same way. Wedgwood also produced very fine and porcelain-like varieties of white enamelled pottery, some even decorated with a metallic lustre, purple in color, and mottled to imitate marble; some are cleverly modelled to imitate large sea-shells. Indeed his technical methods were varied with the utmost ingenuity, and would need a treatise to themselves if even a rough outline were given of all the varieties. Towards the end of the 18th century many imitations were made of the Wedgwood cameo ware by different English manufacturers, and even at Sèvres it was copied in porcelain, though with original French designs. None, however are equal to Wedgwood's work, either in beauty of design or delicacy of execution.

Modern work.

Until quite recently little or no pottery of any artistic merit has been produced in England during the present century, partly owing to the absurd notion that pottery is a sort of inferior porcelain, and should be made to resemble it as much as possible, and also very largely on account of the invention in the 18th century of a process (described below) for *printing* patterns under the glaze, so as to avoid the labor of painting them by hand. Other modern so-called improvements of manufacture have done much to destroy all true art in English pottery; such are the too finely ground and artificial mixtures of different materials, the great use of the mould in preference to the potter's wheel, and, most fatal of all, the fact that, when the pottery is thrown on the wheel, it is afterwards handed over to a workman who turns it on a lathe and rubs it down with glass-paper, as if it were a block of wood, thus removing all the surface put on the vessel by the touch of the thrower's hand. Indeed, the great manufactory of Sèvres has now so completely lost all sense of the natural and reasonable treatment of plastic clay that the larger vases are *cast* whole by being poured in a fluid state into a mould, a method reasonable enough for iron or bronze but ludicrously inappropriate to plastic clay. Some few manufacturers have, however, of late tried to produce pottery shaped and decorated in a more natural way. The Lambeth pottery produces a good deal of excellent work, especially ware covered (after the Japanese fashion) with one brilliant enamel color. Mr. William De Morgan of Chelsea and Merton has perhaps made the greatest advances of all, having rediscovered the way to make and use the the beautiful thickly-glazed blues and greens of the old Persian ware, and also the fine silver and copper lustres of Gubbio and Spain. He uses these splendid colors in designs conceived and drawn with the old spirit, but of sufficient originality to make them a real stage in the development of ceramic art, not a mere archæological revival of styles and methods which have long ceased to have a significance and life of their own.

Sad though the confession is, it must be admitted that, to find a class of pottery designed with lines of natural beauty and produced in accordance with the simple requirements of plastic clay, it is, for the most part, necessary to go, not to the centres of our boasted 19th-century civilization with its countless devices for turning out work cheaply and rapidly, but rather to the humble workshops of more primitive races, among whom the commercial spirit has not yet destroyed all inborn feeling for true art and beauty.

Literature.—For English Pottery, see Jewitt, *Ceramic Art of Great Britain*, 1877; Solon, *Old English Potter*, 1883; Owen, *Ceramic Art in Bristol*, 1873; Wallis and Bemrose, *Pottery of Derbyshire*, 1870; Mayer, *Art of Pottery in Liverpool*, 1855; Binns, *Potting in Worcester from* 1751 *to* 1851, 1865; Church, *Catalogue of English Pottery*, 1870; some of these works deal more with porcelain than pottery.

SECTION XV.—ANCIENT MEXICAN, PERUVIAN, ETC.

Mexico and Peru.

The pottery of ancient Mexico and Peru, certainly older than the Spanish conquests in America, and possibly dating from a much more remote age, has many points of interest. Large quantities in good preservation have been discovered in the tombs of chiefs and other important persons of those once powerful and (in a somewhat barbaric way) artistic races. Much of their pottery is grotesque and even hideous in shape, modelled in the forms of semi-human monsters; it is often made of a hard brick clay, well burned, something like the early black wares of Etruria. Another kind is graceful and natural in shape, formed with great taste and skill on the potter's wheel. Many of the forms seem to have been suggested by vessels made of gourds. The decoration is very curious; many of the simple painted patterns with geometrical designs and hatched lines call to mind the earliest type of painted decoration on the archaic pottery of Mycenæ and the Greek islands. The clay is fine in texture and has a slight surface-gloss, apparently the result of mechanical polishing. Fig. 66 shows a typical form.[1] The British Museum has a good collection of this ware. The natives of Arizona and other uncivilized races of America even now make simple pottery decorated with taste and true decorative feeling.

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[1] For a full account of the Wedgwood family and their ware, see Jewitt, *Life of Josiah Wedgwood*, 1865; and Meteyard, *Wedgwood and his Works*, 1873.

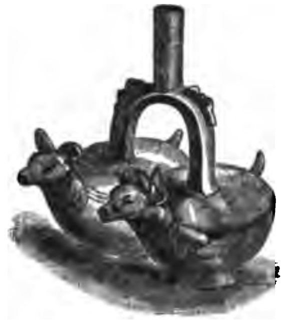

FIG. 66.—Ancient Peruvian vessel. (British Museum.)

SECTION XVI.—POTTERY AND PORCELAIN OF CHINA AND JAPAN.

In the methods of treatment employed in China and Japan the usual distinctions between pottery (earthenware) and porcelain (kaolinic ware) are not always observed. In many cases these two different materials are treated in exactly the same way and decorated after the same fashion. It will therefore be convenient to describe them both together.

History of Chinese porcelain.

History of Chinese Porcelain.—The chronological arrangement of Chinese wares is a matter of great difficulty. Many of the professedly historical records of the Chinese themselves are quite untrustworthy; as with all other arts, they have claimed for the manufacture of porcelain an antiquity far beyond the actual facts of the case. This exaggerated estimate of the antiquity of Chinese porcelain was for a long time supported by the supposed discovery in Egypt of certain small bottles made of real porcelain, and inscribed with Chinese characters, which were said to have been found in tombs at Thebes dating as early as 1800 B.C. The fact, however, that they are inscribed with quotations from Chinese poets of the 8th century A.D., and have characters of a comparatively modern form, shows that the whole story of their discovery is a fraud. The only native work which gives trustworthy information on the development of Chinese porcelain is a *History of the Manufactory of King-te-chin*, compiled from earlier records in 1815 by a native official, which was translated into French by M. Julien, under the title *Histoire de la Fabrication de la Porcelaine Chinoise* (Paris, 1856). According to this work, the manufacture of pottery is said to have commenced in 2697 B.C., and that of porcelain during the Han dynasty, 206 B.C. to 25 A.D. The Tsin dynasty (265–419 A.D.) was remarkable for its blue porcelain, and the Suy dynasty (581–618 A.D.) for its fine green ware. One of the most celebrated kinds of porcelain was that made about 954 A.D., deep sky-blue in color, very glossy in texture, extremely thin and sounding musically when struck. Even small fragments of it are treasured up by the Chinese, and set like jewels. Most dynasties seem to have been famed for a special variety of porcelain. The earlier sorts appear not to have been decorated with painting, but were all of one rich color. Decorative painting did not apparently come into general use before the Yuen dynasty of Mongols (1260–1368), and was brought to great perfection under the Mings (1368–1644). The porcelain of the last-named dynasty is classified in periods, four of which (from 1426 to 1567) were greatly esteemed. Probably few specimens of Chinese porcelain known in Europe are earlier in date than the time of Kang-he, the second emperor of the Tsing dynasty (1661–1722). During all periods Chinese potters were constantly in the habit of copying earlier styles and of forging their marks, so that very little reliance can be placed on internal evidence. Indeed, the forgeries often deceive the Chinese collectors of old porcelain.

Manufacture.

Manufacture of Porcelain.—It is made from two substances, "pe-tun-tse" and "kao-lin"; the latter is a white pasty substance derived from the decomposition of felspathic rocks such as granite. It is a hydrated silicate of alumina ($Al_2O_3.2SiO_2 + 2H_2O$), and derives its name from a hill near King-tih-chin, where it was first found (see KAOLIN). The precise nature of pe-tun-tse is not exactly known, but it appears to resemble kaolin, with the addition of a considerable proportion of free silica. The result of their mixture is shown in the following analysis by M. Laurent of the body of white Chinese porcelain—silica 70.5 per cent., alumina 20.7, potash 6, lime 0.5, protoxide of iron 0.8 per cent., magnesia a trace. The white pastes of which the porcelain is made are very carefully washed, finely ground, and mixed in due proportion. The paste is "thrown" on the potter's wheel in the usual way and set to dry; its colored decoration is then applied, and over that the transparent glaze is laid. This is a very hard and beautiful substance, which requires great heat to fuse it; it is made of almost pure feldspar with an alkaline flux. It is finely ground with water, and either blown with a pipe on to the vessel or the vessel is dipped into it. The porcelain is next packed in clay boxes or "saggers," piled one above another in the kiln, in order to protect it from discoloration from the smoke. After the kiln has been heated for a considerable time to a very high temperature, the fire is withdrawn; and the porcelain is allowed to cool slowly in the clay saggers before the kiln is opened and its contents removed. Additional decoration is frequently added *over* the glaze, generally in enamel colors, applied thickly so as to stand out in perceptible relief; gilding is also added over the glaze. The porcelain is afterwards fired a second time in a more open kiln, and at a lower temperature.

Decoration.

The methods of decoration on Chinese porcelain are extremely varied and are applied with the most skilful hand and wonderful fertility of design, but they are always dainty and feebly pretty rather than artistic, except when there is a Persian element present. The Chinaman is a born maker of graceful toys, full of ingenuity and perfect deftness of touch, but hardly worthy to be classed as a producer of serious works of art. The general forms of the porcelain are mostly feeble and often of extreme ugliness, while the skill in drawing is mostly confined to representations of flowers, some of which, especially the chrysanthemum and the pæony, are painted with great truth and enjoyment. With the beauties of the human form the Chinaman has no acquaintance or sympathy and he never possessed the wonderful skill of the Japanese in the delineation of animals and birds.

Only a few chief examples among the many methods of decorative treatment can be mentioned here. A useful classification has been adopted by Mr. A. W. Franks in his valuable catalogue of his own collection of porcelain, formerly exhibited at Bethnal Green, and now (1885) in the British Museum.

Plain white.

1. *Plain white*, of a delicate ivory color and a rich, satin-like glaze. Some of it is *crackled*, not accidentally, but by a careful process, one of the methods of which is this. Powdered steatite is mixed with the materials of the felspathic glaze and the porcelain vessel or statuette, after the glaze is applied, but before firing, is set in the rays of a hot sun, which causes it to be covered with a network of fine cracks, going

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[1] See Rivero and Von Tschudi, *Antiguedades Peruanas*, 1851.

through the skin of glaze down to the porcelain body. Red pigment or black Chinese ink is then rubbed into the minute cracks, which are thus made more conspicuous and prevented from quite closing up in the heat of the kiln. Many specimens have two sets of crackle, first the colored cracks produced before firing, and secondly an intermediate uncolored set, produced in the glaze by the action of the kiln (see Fig. 67). Most of this white ware is decorated with delicate surface-reliefs of flowers or figures very sharply moulded. Old specimens of it are now highly valued in China. It was frequently copied in the early European porcelain manufactories, such as St. Cloud, Meissen and Chelsea.

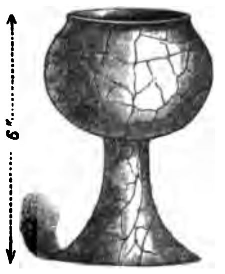

FIG. 67.—Chinese cup with crackle glaze.

One enamel color.

2. *Porcelain covered with one Enamel Color.*—Enamels of many varieties of tint and great brilliance were used; the finest are blue, from copper or cobalt; deep red, another oxide of copper; yellow, antimoniate of lead; and black, oxides of iron and manganese. One of the most beautiful is that sea-green tint called "céladon," which was early exported into England and highly valued in mediæval times from its supposed property of changing color at the contact of poison. New College, Oxford, possesses a bowl of this ware, mounted in silver richly worked, of about 1500 A. D., and presented to the college by Archbishop Warham early in the 16th century. A specimen of this céladon ware is probably referred to among the list of New Year's gifts to Queen Elizabeth as "a cup of grene pursselyne" given by Robert Cecil. The fine old yellow porcelain was only made for the use of the emperor of China, and it is consequently rare; it is very thin and transparent, almost like a vitreous enamel. Some of the Chinese enamelled wares are made of pottery, not of porcelain; earthenware, in many cases, was equally good for the purpose, as the body of the vessel was hidden by the colored enamel.

Several enamels and colors.

3. *Porcelain decorated with several Enamels or Glazes of different Colors.*—This ware is frequently moulded in relief, with dragons, flowers or various animals picked out in different colors, often very harsh and gaudy in effect. Fig. 68 shows a pilgrim-bottle painted in enamel colors. The beauty both of form and of decoration for which this piece is very remarkable is mainly due to Persian influence.

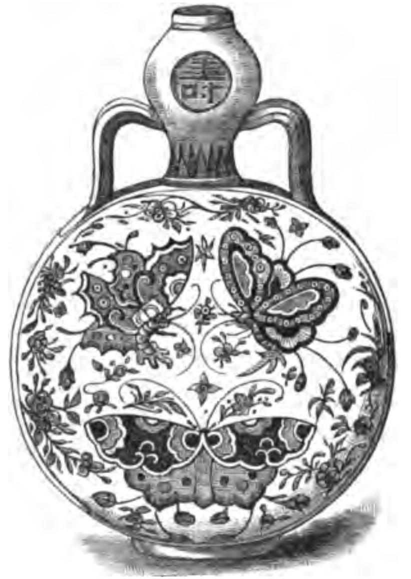

FIG. 68.—Chinese pilgrim-flask, painted with enamel colors; Persian style.

White on colored enamel.

4. *Porcelain painted in White Enamel over a Ground of Colored Enamel.*—This is a very decorative sort of ware; the designs, such as flowers, birds and insects, are applied thickly in the white pigment and are sometimes carefully modelled in low relief. The method was largely imitated by the Persians (see p. 639 above).

Blue.

5. *Porcelain painted only in Blue.*—This is really the most artistic and highly decorative of all the varieties of Chinese painted wares. Some of the large plates and jars have very good designs, treated in a not too realistic manner. Much of the finest porcelain of this class both in form and decoration shows a strong Persian influence, the result of the intercourse between China and Persia and the visit of Chinese potters to Ispahan mentioned above in the account of Persian pottery. Nanking porcelain, painted with the so-called "hawthorn pattern," really a kind of *Prunus* which produces its blossoms before its leaves, was largely imported into England during the last century and now fetches very exorbitant prices. Unluckily during the 18th century a great deal of the fine blue and white china brought into England was painted over the glaze with harsh, gaudy colors in English and French porcelain manufactories, to please the degraded taste of the time, and was thus completely spoiled. Other combinations of Chinese and European work occur. Sets of porcelain were painted in China with French or English designs to suit the European market; or plain white porcelain was sent from China to be decorated at Chelsea or Bow. Very ludicrous results were produced in some cases by this mixture of style; engravings were sent from Europe to be copied on porcelain by the Chinese potters, who have in many cases laboriously painted an exact fac-simile of the copper-plate lines with all their hatchings and scratchy look. Some of these were done for Jesuit missionaries in China, and Chinese plates with Catholic sacred subjects and figures of saints exist in considerable quantities. Statuettes of the Madonna were also made in China for the missionaries, carefully modelled in white porcelain after European originals; some appear to be copies from 14th-century French ivory figures, and (even in the hands of the Chinese potter) have preserved a strong resemblance to their mediæval original. The type of the Holy Mother thus introduced appears to have been adopted by the Chinese Buddhists as a fitting representation of their goddess Kwan-lin, many figures of whom were made with but little alteration from the statuettes of the Catholic Madonna.[1]

Polychrome under glaze.

6. *Porcelain painted in Many Colors under the Glaze.*—This very large class includes all varieties of form and decoration. The colors are often harsh and inharmonious and the more elaborate figure-subjects are nearly always grotesque and ugly. Additional richness of effect is often given by the over-glaze colors, added by a second firing. Many other varieties might be mentioned, but the student must be referred for further information to the list of works on this subject given below.

Both pottery and porcelain have been used on a large scale for architectural purposes in China. The so-called "porcelain tower" of Nanking was the most prominent example. It was a very elaborate structure (see NANKING), mostly constructed of pottery covered with enamels of different colors. The usual name is misleading, as only the white portions were of real porcelain. The Jermyn Street and British Museums have specimens of its bricks and elaborate architectural features.

Japanese pottery.

Japanese Pottery and Porcelain.—In the main the technical methods used in Japan and the styles of painted ornament were introduced from China, and also to a less extent from the adjacent peninsula of Corea. Glazed pottery was first made at Seto about 1230 A.D. by a potter who had visited China. Porcelain manufacture was introduced in a similar way into the province of Hizen about 1513. On the whole the Japanese are more remarkable for their skill and almost endless methods in the production of pottery than of porcelain. No people ever approached them for marvellous fertility of invention and skill in the manipulation of all sorts of clay, pastes, enamels, and pigments. One of the most remarkable characteristics of Japanese pottery is its wonderful success in the imitation of all kinds of materials and texture of surface, one great object apparently being to make it resemble anything rather than what it really is. Wood, with its varying colors and delicate grain, ivory, bronze, lac, marble, basket-work, fruits, and countless other substances are imitated in Japanese pottery with the most perfectly deceptive effects. The utmost amount of labor and patience is often spent with this one object, any notions of real artistic beauty being apparently never even considered.

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[1] See Watkins Old, *Indo-European Porcelain* (Hereford, 1882).

A great deal of Japanese ceramic ware is simply copied from Chinese porcelain, and often has forged Chinese marks. It is very difficult to find out what notions the Japanese themselves really have as to what is admirable in pottery. A purely archæological interest in old sorts of ware appears to affect them strongly, and they often put the highest value on what appears a very ordinary and rudely-made kind of pottery. As Mr. A. W. Franks has pointed out in his introduction to a native report on Japanese pottery, published by the Science and Art Department, 1880, the high value which they put on rude specimens of glazed pottery is partly kept up by the existence of certain curious old tea-drinking ceremonies, solemnly performed as if they were religious rites. Everything used and every detail of the performance were strictly prescribed by rule. The bowl or cup out of which the tea was drunk by the guests was to be an archæological curiosity remarkable for its age, not for any intrinsic merit. Some of these cups which have been brought to Europe are of coarse clay, ill-formed, thick, highly glazed, and quite without ornament. One in the Sèvres Museum, said to be Seto ware of the 14th century, is made of mottled yellowish brown clay, with a thick vitreous glaze. It looks quite worthless, but has evidently been highly valued by its Japanese owner, for it has a beautifully made ivory lid, and is protected by three cases,—first, fine white silk with gold cord; second, a box of polished bamboo; and, outside of all, a case of figured linen lined with silk. Others of these precious tea-bowls are red, purple, black, or gray, all very thick and coarse, but highly glazed, and carefully fitted into silk cases.

Some of the Japanese methods for the decoration of pottery are simple and effective, especially a ware made of gray clay with incised patterns—birds, flowers, and the like—filled in with white paste, and the whole glazed,—similar in method to the 16th-century Oiron ware.

Satsuma ware.

The most magnificent sort of pottery is the Satsuma ware, originally introduced from Corea. It was at first manufactured in a private factory belonging to the prince of Satsuma, but afterwards produced for public sale. The most highly-decorated kinds with many colors were not made till the end of the 18th century. In minute richness it is probably the most elaborate ware ever produced. The body is a fine ivory-white clay, covered with a minutely crackled glaze. Over this, miniature-like paintings of human figures or flowers are executed in brilliant enamel colors, some of which stand out like jewelled reliefs. It is further decorated with delicately moulded patterns in gold, and, though very weak in real decorative effect, is a marvel of rich workmanship. Most of the so-called Satsuma now sold is a poor imitation of the ware, and is made in great quantities at Awata and Ota.

Decoration.

It should be observed that nearly all the very elaborate and magnificent methods of ceramic decoration now so much employed by the Japanese are of quite modern origin; before the present century the simpler methods of China were almost exclusively followed in Japan. During the last century great quantities of porcelain, chiefly decorated in gold, green, and a rich red, were made expressly for export, and largely brought into Europe, where they were frequently copied, especially in the porcelain works of Dresden and the early china manufactories of England.

The Japanese have little or no sense of the best kind of decorative art; their paintings of flowers or birds, beautiful as they are, are mostly, as it were, flung across the vessel they are meant to ornament without any regard to its shape or the space to be occupied. Like the Chinese, they have no feeling for the beauty of the human form, or even of some of the nobler animals, such as the horse. The figures most frequently represented on their ceramic wares—the seven gods of good fortune—are all grotesquely hideous; and downright ugliness of the most repulsive sort is often selected and treated with wonderful ingenuity. Many of the paintings have a symbolical meaning; emblems of longevity (considered by the Japanese the chief of all blessings) are perhaps the favorite, such as the sacred tortoise, the crane, or the combination of three trees—the fir, the plum, and the bamboo—all of which have this special meaning.

Within the present century a new and elaborate method of decorating porcelain has been practiced in Japan, the chief object of which seems to be to make a porcelain vessel look like a metal one. Brass cloisonné enamel is applied to the outer surface of porcelain vases or bowls; the strips of brass set on edge which form the outline of the design, instead of being soldered to a metal plate, are fixed in some almost incomprehensible fashion to the surface of the porcelain, and then the compartments are filled in with colored enamels and fired in the usual way,—a marvel of technical skill and wasted ingenuity.

Collections.

Collections of Chinese and Japanese Porcelain.—The Dresden collection is the most important historically, having been formed chiefly between 1694 and 1705. The British Museum is rich through the recent munificence of Mr. A. W. Franks, who has presented to it the whole of his fine collection. The South Kensington Museum and the museums at Leyden, The Hague, and Sèvres are rich in these wares, as are also those at Vienna, Berlin, and St. Petersburg.

Literature.—For Chinese and Japanese porcelain, see Jacquemart and Le Blant, *Histoire de la Porcelaine*, 1861–62; Jacquemart, *Histoire de la Ceramique*, 1873; Audsley and Bowes, *Keramic Art of Japan*, 1875–80; Du Sartel, *La Porcelaine de Chine*, 1881; Graesse, *Catalog der k. Porzellan-und Gefäss-Sammlung zue Dresden*, 1873; Stanilas Julien, *Historie de la Porcelaine de Chine*, 1856; Franks, *Cat. of Coll. of Oriental Porcelain*, 1878, and "Japanese Pottery," in South Kensington Museum *Handbook*, 1880.

SECTION XVII.—PORCELAIN IN EUROPE.

Early Development.

In various places in Europe, especially in Italy and France, attempts to produce translucent porcelain like that produced by the Chinese were almost continually being made from the end of the 15th century down to the beginning of the 18th. The word "porcelain" is usually derived from the Italian "porcellana," a white shell, to the smooth polished surface of which the Chinese wares bear some resemblance. Hence it should be observed that in mediæval inventories "a cup of porcelain" often means one made of shell or mother-of-pearl. In Italy the finer sorts of majolica were often called "porcellana," and a plate decorated "alla porcellana" meant one with a special style of painting, and did not refer to its material. During mediæval times, when real Eastern porcelain is meant, some other word expressing where it came from was frequently added, *e.g.*, in French 15th-century inventories "porcelaine de Sinant" is sometimes mentioned. From the 13th to the 15th century Chinese porcelain was very sparingly brought into Europe, and generally occurs among royal possessions or gifts as an object of great value. The name "china," from the country where porcelain was made, was given to it not later than the 16th century, and perhaps earlier, having been used by the Arabs long before: "china dishes" are mentioned by Shakespeare (*Measure for Measure*, act ii., scene i.) as being things of value.

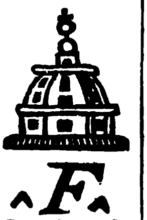
The main reason of the very slight success gained for so many years in the attempts to make porcelain in Europe was the fact that it was regarded as a highly artificial substance, something between pottery and glass; the many beds of kaolinic clays which exist in Europe were never thought of as being the true material of which to make it, or, if used at all, were only employed partially and in an accidental way. The

Early Venetian porcelain.

earliest attempts at the production of translucent porcelain which had any practical success took place at Venice about 1470.[1] An alchemist named Antuonio succeeded in making and firing in a kiln at San Simone, near Venice, "porcelane trasperenti e vaghissime," described in a document dated 1470, as being as beautiful in glaze and color as "the porcelain from barbarous countries." Difficulties, however, seem to have arisen, and the manufacture was not proceeded with till 1504, when a few sample specimens were made in Venice, and others again in a spasmodic way in 1518 and 1519. No specimens of the early Venetian porcelain are now known, nor any pieces of the porcelain made at Ferrara for Duke Alphonso II. about 1565–67 by Giulio da Urbino, and mentioned with high praise by Vasari.[2] The composition of this earliest European porcelain is not known, but it probably was partly made of the white clay of Vicenza—a true kaolinic paste—often used by the majolica potters to give whiteness and fine grain to their clay.

Medici porcelain.

Medici Porcelain. — The earliest manufactory of porcelain of which known specimens exist is that started in Florence, for Francesco I. de' Medici, about the years 1575–80 by Bernardo Buontalenti (see Vasari). Francesco de' Medici took the greatest interest in the manufacture, and, as is recorded by Galluzzi (*Istoria di Toscana*, 1781), moulded some of the vessels with his own hands, as complimentary presents to other princes. According to Galluzzi, Buontalenti did little more than improve on the method invented a few years earlier by the majolica potters Camillo da Urbino and Orazio Fontana, assisted by a Greek who had learned the secret of true porcelain in China. The discovery of the existing specimens of Medici porcelain is due to Allessandro Foresi, who observed its peculiar texture and in some cases, slight transparency, and found pieces marked at the back in a way that quite confirmed his theory.[3] These marks are the Medici arms, with its "palle" or balls, inscribed with "F. M. M. E. D. II." for Franciscus Medici Magnus Etruriæ Dux II." Some pieces have a rude representation of the great dome of the Florentine cathedral, and the letter "F." for "Florentia" (see No. 22). Scarcely forty specimens of the ware are known, which are mostly in the possession of the Rothschilds and Mr. Drury Fortnum, in the royal collection at Lisbon, and the museums of South Kensington and Sèvres. They are all of a slightly creamy white, with a beautiful pearly texture, due to the rich glaze and the slight transparency of their paste; the glaze varies in thickness, and in some instances is slightly crackled. Nearly all are simply decorated in cobalt blue, under the glaze; the designs are of various styles, some purely Italian, other Persian or Chinese in character; a few have one flower painted in the middle of the space in a graceful and almost realistic way. A plate at Lisbon has a figure of St. John with his eagle. Their forms are pilgrim-flasks, plates, ewers, and vases of different shapes, some very graceful and original.

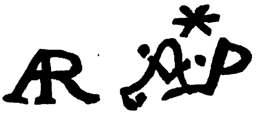


Potter's mark.
No. 22.

The earliest dated example is among the five specimens in the Sèvres Museum; it is a square bottle with the arms of Spain painted in blue and a few touches of manganese purple; the date 1581 is introduced among the ornaments at a corner of the bottle; it was probably a gift from Francesco I. to the king of Spain. The composition of this porcelain has recently been discovered from a contemporary MS. in the Magliabecchian Library at Florence. The paste consisted of 24 parts of white sand, 16 of a crystalline frit (powdered rock-crystal 10, and soda 8), and Faenza white earth 12 parts. To 12 parts of this mixture 3 of the kaolinic clay of Vicenza were to be added. Probably to secure greater whiteness, the vessels were covered, under the glaze, with a white enamel; but this addition appears needless. They were then glazed with an ordinary silicious lead glaze. Though the final result has the beauty and some of the special qualities of the Chinese natural porcelain, yet it will be observed that this end was gained in a very difficult and elaborate manner, which must have been very costly. This, no doubt, is the reason why so few pieces were made, and why its manufacture ceased altogether with the death of Francesco de' Medici, in 1587.

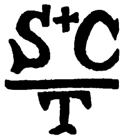
French porcelain.

After the Medici ware ceased to be made there is a blank of nearly a century in the history of European porcelain. In 1664 a patent was granted to Claude Reverend, a citizen of Paris, which gave him the privilege of making "imitation porcelain, as fine as that from the East Indies." No known specimens can be attributed with certainty to his workshop, though some pieces which bear mark No. 23 may have come from his hands. In 1673 another patent was conceded to Louis Poterat, who certainly did produce artificial porcelain at Rouen. Some small pieces, salt-cellars and mustard pots, in the museums of Rouen and Sèvres, are attributed to him, and are therefore the earliest undoubted examples of French porcelain. They are of a pearly white color, with rich glaze, not unlike the Medici porcelain in softness of texture. The ornaments, simple and delicate arabesques, are painted under the glaze in cobalt blue only. Some pieces are signed with No. 24.



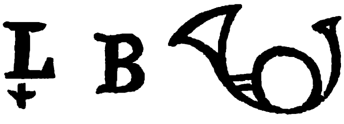
No. 23. No. 24.
Potters' marks.

Saint Cloud was the next place in France where porcelain was produced, the manufactory being carried on by the Chicanneau family, to whom a privilege was granted in 1695. The patent mentions that they had made porcelain since 1693. This early Saint-Cloud porcelain is fine in texture and glaze, and is decorated in many different styles; it is pure white, moulded with slight reliefs copied from the Chinese; or painted in many bright colors and gold with Chinese designs; or thirdly, with paintings in blues only of flowery scroll-work and grotesques. It is marked either with a sun, or with "S. C." combined with "T." (see No. 25), and other makers' initials. Martin Lister, physician to Queen Anne, in an account of his travels in France during 1698, mentions a visit which he paid to the Saint-Cloud porcelain works, and speaks with great admiration of their productions. The privilege was frequently renewed during the first-half of the 18th century, and the Saint-Cloud manufactory continued to be the most important in France till the establishment of the royal manufactory at Sèvres.



Potter's mark.
No. 25.

Other places in France during this period, from 1700 to 1745, produced a certain quantity of artificial porcelain. These were Lille, from 1711, marked with No. 26; Paris, 1722, a branch of the Saint-Cloud works; and Chantilly, from 1725. The porcelain of Chantilly, was specially intended to imitate old Japanese ware. Like the Medici porcelain, it has a white tin enamel over the paste. It is marked with a hunting-horn (see No. 27) and painter's initials. Porce-



No. 26. No. 27.
Potters' marks.

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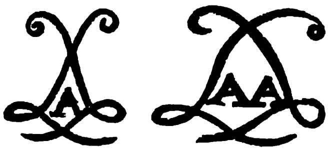
[1] See Davillier, *Les Origines de la Porcelaine en Europe*, 1822.
[2] *Lives of Artists*, last section.
[3] See Foresi, *Sulle Porcellane Medicee*, 1869.

lain of every variety of style was also made at Mennecy-Villeroy from 1735, under the patronage of the duke of Villeroy, with whose initials, "D. V.," all the productions of the manufactory are marked. All these early varieties of porcelain were of the artificial or soft kind, called by the French "porcelaine à pâte tendre."

Sèvres.

Royal manufactory.

The increasing success and popularity of the porcelain produced in Germany and England induced Louis XV. to establish a private royal manufactory of porcelain, which was first started at Vincennes, with a privilege granted to Charles Adam and others in 1745. In 1753 the king himself became a partner in the works, with a third share in the property. The seat of the manufactory was then transferred to Sèvres, and the official title was assumed of "manufacture royale de porcelaine de France." Before 1753 the royal porcelain was simply marked with two crossed L's for Louis, but from that year a date-letter was made compulsory,—A for 1753 (see No. 28), B for 1754, and so on till 1777, after which a new doubled alphabet was started AA (see No. 29), BB etc.; this lasted down to RR (1793), and then a less regular series of marks came into use. Till 1792 the date-letter was put between the crossed L's, but in that year the republic substituted the letter R. Later various royal monograms and marks were used.



No. 28. No. 29.
Potters' marks.

Soft and hard porcelain.

Till about 1770 all French porcelain was artificial or "soft" (*pâte tendre*); the discovery of kaolinic clays in France then brought about the manufacture of natural hard porcelain (*pâte dure*) like that made in China and Japan. This gradually superseded the soft kind, which ceased to be made at the end of the 18th century. Its manufacture has recently been revived at Sèvres to some slight extent. M. Brongniart, the director of the Sèvres porcelain works from 1800 to 1847, in his most valuable *Traité des Arts Céramiques* (1854), gives a full account of the materials and methods used at Sèvres during all periods. The soft porcelain was composed of white sand 60 per cent., nitre 22, common salt 7.2, alum 3.6, soda 3.6, and gypsum 3.6 per cent. This compound was roasted at a high temperature, then ground to a fine powder, and washed with boiling water. To nine parts of this mixture or frit two parts of white chalk and one of a sort of pipe-clay were added. The whole was again ground, and passed several times through a fine silk sieve. Water was added to make the powder into a paste, and it was then fit for the thrower on the wheel or the moulder. Owing to the very unplastic nature of this elaborate mixture, black soap and size or glue made from parchment were added to bind the paste together under the moulder's hands. The glaze used for the *pâte tendre* was an ordinary silico-alkaline glass, made fusible by oxide of lead. The colored decorations and gilding were added after the firing of the glaze. The hard porcelain is made of natural kaolinic clays, and is glazed with almost pure felspar,—both substances very hard and infusible. The superior softness and richness of effect possessed by the *pâte tendre* are due to the fact that the paintings on the softer and more fusible glaze sink slightly into it under the heat of the kiln, and are, though almost imperceptibly, blended one with another. It is easy to distinguish the two plates and glazes: pieces of the one kind can be scratched by a knife, while those of the other resist it. Nevertheless the difference in beauty between the two kinds of porcelain has been much exaggerated, and the extravagant prices which are given for the *pâte tendre* are greatly due to its rarity, and to its having been produced earlier than the other. The whole question, in fact, of the value of Sèvres porcelain is a highly artificial and conventional one, which can hardly be considered in accordance with the ordinary rules or canons of art. Certain special qualities were aimed at, such as brilliant colors, with absolute smoothness of surface, microscopic delicacy of painting, and the most perfect accuracy and neatness of execution throughout; and it must be admitted that the porcelain-makers gained their object with the help of ingenuity, technical skill, and unwearied patience, which must command our respect and even admiration, whatever may be our verdict as to the artistic result of their labors. Still with all possible allowances, there is no doubt that rarity, the necessary result of the slow and laborious processes employed, is the chief reason for the extraordinary value now set on this porcelain. The £10,000 which three flower-vases of *pâte tendre* fetched at a public auction a few years ago can be accounted for on no other hypothesis. The colors of Sèvres porcelain are generally harsh, and out of harmony with the pictures they surround; the forms of the various vessels too are frequently very ungraceful, and utterly unsuited to any plastic substance.

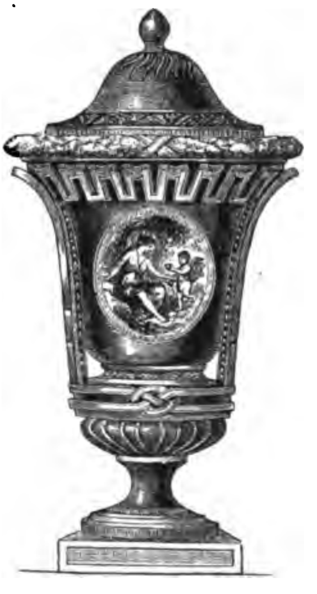


FIG. 69.—Sèvres vase, *pâte tendre;* green body and gilt imitation mounting. (South Kensington Museum.)

The whole of this porcelain ware, in fact, labors under the serious artistic disadvantage of being designed and decorated with no regard to suitability of material or method; the elaborate picture-subjects would have been far more fit for ivory miniature-work, and are quite without breadth of decorative effect, while the shapes of the more elaborate vases are often deliberate imitations of gold and "or moulu," which in no way suggest the special properties of a fictile material (see Fig. 69). It is difficult to realize the amount of thought and labor that was spent on the production of Sèvres porcelain. The chief chemists of France devoted their energies to the invention of brilliant and varied pigments which would stand the severe test of the kiln. The works of the best painters were used for reproduction among the painted decorations of the porcelain, and many artists of real talent spent their lives in painting these gaudy toys—on the whole a sad waste of labor and skill.

Decoration.

Sèvres porcelain made for actual use, such as tea-sets and dessert-services, are usually painted with flowers or figure-subjects, often in many tints, and enriched with gilding, but on a plain white ground. It is the purely decorative pieces, such as vases and flower-vessels, that are ornamented with the greatest splendor. They generally have panels with pictures on a white ground surrounded by frames of gold scroll-work; the main body of the piece is covered with one deep or brilliant color. The chief colors are *gros bleu*, a very dark blue; *bleu du roi*, a deep ultramarine; a brilliant turquoise blue; a bright pink, the favorite color of Madame Pompadour, but generally called "rose Du Barry;" a bright yellow, a violet, and three shades of green were also used. These brilliant colors are often further decorated with gold; a ground with circular groups of gold spots scattered over it is called "œil de perdrix"; other kinds of diaper were also used. The most gorgeous variety of all is the *jewelled Sèvres*, not made till about 1780, and generally having a ground of *bleu du roi* or ultramarine. It is richly set with imitation jewels, chiefly turquoises, pearls, and transparent rubies, made of colored enamel pastes, hardly to be distinguished in effect from real stones. They are set in gold, slightly modelled in actual relief, like the gilt ornaments on the richest sort of Japanese Satsuma ware.

Forms.

The forms of Sèvres porcelain are very varied, and, in spite of the great use of plaster moulds, many reproductions of the same design were rarely produced. Clocks, barometers, and various other objects were made of porcelain and richly decorated, and also painted panels or plaques used for furniture,—always, however, with most discordant effect. Beautifully modelled statuettes in white biscuit porcelain were made by some of the ablest sculptors of the 18th century; these usually have pedestals elaborately gilt and painted. Perhaps the worst taste of all is shown in some of the vases which have scrolls and sham metal work moulded and gilded to produce the effect of a porcelain vase set in or moulu mounts,—a method of so-called decoration which was much imitated at Chelsea and other porcelain works. The recent "Jones bequest" to the South Kensington Museum contains a large variety of the most costly specimens of the *pâte tendre* of Sèvres.

Modern Processes of Porcelain-making at Sèvres.—Since the Franco-Prussian war a large new building has been constructed for this manufacture, with improved kilns, arranged in the most commodious way. It is near the Seine, at the entrance to the park of Saint Cloud. In the same building is the important Ceramic Museum, which contains the finest collection of French porcelain of all periods, and also a large series of showrooms for the exhibition of the modern productions of the manufactory. About 250 hands (men and women) are employed in the work; many of the painters and modellers are, as of old, artists of real ability.

Mixing and moulding the paste.

The *pâte dure*, now mainly used, is composed of kaolinic clay, mostly from Limousin, but also imported from Cornwall; with it is mixed a proportion of white chalk and fine sand (silica). Each material is finely ground between mill-stones, and carefully washed by being agitated with water. The powder is allowed to settle, and the lighter impurities are carried off by decantation. The various ingredients are then mixed thoroughly together with enough water to bring them to the consistence of cream. When the mixing process is complete the cream-like fluid is run off into absorbent plaster troughs, which take up the superfluous water and leave the compound in a pasty state. The paste is next turned over frequently on a floor so as to expose the whole of it to the air, and it is thoroughly kneaded like baker's dough by men's feet and hands to make it more plastic for the wheel or mould. The wheel turned by the thrower's foot is exactly like that used in Egypt under the Ptolemies, or by the majolica potters, as shown in Fig. 55. While moulding his vessel the thrower keeps dipping his hands into a basin of fluid paste ("barbotine" or slip). He also increases the smoothness of surface on the revolving vessel by holding a sponge soaked in the slip between his fingers. Vessels of which a number are required all exactly alike, such as a set of plates, are partly shaped in a mould and partly formed by a steel "template" or gauge. The thrower forces a thin disk of paste over a convex mould shaped to give the inside of the plate; he then sets it, mould and all, on the revolving wheel, and a steel knife-like gauge shuts down upon it, thus forming the outside or back of the plate, which, as it revolves against the edge, has all superfluous paste scraped from it and is accurately formed into the required shape. When the plate or other vessel has been shaped it is allowed to dry, and is finished by being turned on a lathe and rubbed smooth with sand-paper. The handles and all projecting ornaments are moulded, or rather cast, by pouring the paste in a fluid state into piece-moulds made of plaster of Paris, which take to pieces and set free the casting, which is then fixed on the vessel it belongs to with a little more fluid slip used as a "lute." The moulded ornaments are afterwards carefully finished by hand with ordinary modelling tools. Even statuettes and groups of figures are cast and finished in this way. The vase with its attached ornaments, after being thoroughly dried, is ready for the first firing.

Firing.

The kilns are like tall circular towers tapering towards the top, about 10 feet in diameter at the base inside; they are divided into four stories, with perforated brick vaults between them. The fire, fed either with white wood or coke, is in the lowest story; the chamber next to the fire is of course the hottest, and the top one the least hot of the three. These different degrees of heat are utilized according to the temperature required for each firing. Thus the "raw" vessels fresh from the wheel, which only require a moderate heat to prepare them for being glazed, are piled in the highest chamber, and those that are being glazed in the lowest. In order to keep the white paste from being discolored by the smoke the porcelain is packed in round porcelain boxes (called in English "saggers"), which fit closely one upon another and are arranged in high piles. The various chambers of the kilns have small openings, closed with transparent talc, through which the progress of the baking can be watched, and test-bits of porcelain painted with carmine, a color that changes tint according to the heat it is subjected to, are withdrawn from time to time to show what temperature has been reached. As a rule the fire is kept up for about thirty-six hours, and the kiln with its contents is allowed from four to six days to cool before being opened.

Glazing and decorating.

After the first firing the porcelain is in the biscuit state, and is then ready for the glaze, which is made of felspar and quartz crystals (pure silica); it is finely ground with water, and the porcelain is dipped into it, until sufficient of the fluid mixture adheres to the absorbent biscuit to form a coat of glaze. When dry it is fired for the second time, but in the lowest and hottest compartment of the kiln, this natural rock-glaze being very infusible. About 1600° C. is the usual temperature for this process.

The painted decoration is always applied *over* the glaze; but within recent years a new method of under-glaze ornament has been much used, called "pâte sur pâte," similar in method to the "slip decoration" mentioned above under several different heads. The biscuit ground of the vase is first tinted a uniform color, and then the same white paste of which the porcelain is made is mixed with water and applied in successive layers with a brush, thus producing delicate cameo-like reliefs. Very beautiful designs of figure-subjects or flowers are put on in this way, and additional effect is gained by the colored ground shining through the thinner parts of the semi-transparent white reliefs. The whole is then glazed in the usual way. To return to the painted porcelain, when it has come from the second firing in a white highly glazed state it is ready for the painter. Almost endless varieties of colored pigments are gained by the use of elaborately prepared chemical compounds, all different salts of metals. In the main the blues are from cobalt, the turquoise color from copper, the rose-pink from gold, the green from chrome and copper, and the violets from manganese. A far greater variety and brilliance of color can be gained in over-glaze painting than in under-glaze pigments. But the over-glaze colors are very inferior in softness and decorative beauty, and are frequently very harsh and gaudy. Different pigments require different temperatures, and three distinct firings are used at Sèvres for the painting only: they are called "grand feu," "demi-grand feu," and "feu de moufle." Pure gold for the gilt parts in a very finely divided state is obtained by chemical solution and precipitation. The gold requires a special kiln, and firing at a higher temperature than the color-pigments, and therefore, in the case of *pâte dure*, is applied first. The colors have to be put on and fired in order according to the degree of heat they require, thus very much adding to the painter's difficulties, which are also increased by the fact that all the colors alter in the kiln, the unfired pigments often bearing no resemblance to their fired state. Thus an elaborately painted and gilt Sèvres vase passes through six separate firings, and often a seventh when it needs final retouching.

The porcelain *à pâte tendre* is now made in small quantities at Sèvres. Its materials have been described above. In most respects it goes through the same process as the *pâte dure*, but the gold is applied after the painting, as it requires a less degree of heat to fix it on the more fusible glaze used for *pâte tendre*.

Marks.

Modern Sèvres porcelain has two marks—first, the mark of the paste or undecorated vase, painted in green; second, a mark in red or gold to show that it has been painted at Sèvres. Slightly defective pieces in the white glazed state are sometimes sold and decorated elsewhere. In this case the green mark is cancelled by the cut of a lapidary's wheel before it leaves the manufactory.

Newer processes.

M. Brongniart, in his *Arts Céramiques*, has given a complete set of plates, showing all the processes, the machinery, and the kilns used at Sèvres in his time,—that is, from 1800 to 1847. Other processes are now practiced. One is for making very thin cups and saucers, like Eastern "egg-shell china," which are formed by merely rinsing out a plaster mould with fluid paste, when sufficient of the paste to make the thin walls of the cup adheres to the absorbent mould; and thus porcelain is made much thinner than it could be by use of the wheel and lathe. Another recent invention is of great importance in the forming of large vases with bodies thin in proportion to their size. Such would be liable to collapse from their own weight while the paste was soft. To prevent this, the vase is set in an air-tight chamber, its mouth being carefully closed, and the air in the chamber round it is exhausted, so that the soft vase is kept in shape by the expansive pressure of the air within it. The converse method is also used in some cases, by compressed air being forced into the vase. When the paste is sufficiently dry all fear of failure from this cause is over. In this way vases as much as 12 feet in height have been successfully made and fired.

In addition to porcelain shaped and painted after the 18th century fashions, and the new *pâte sur pâte* process, the present manufactory produces a great deal of fine porcelain copied exactly from the fanciful and elaborate wares of China and Japan, such as the delicate double cups and vases, with outer shells of minute open work pierced through, and many other varieties requiring great technical skill and patience. Unhappily the old faults and misdirected aims still prevent the labored products of this great factory from having much real artistic value, or even strong decorative effect. The paintings on the porcelain are still pictures like miniatures on ivory, and the treatment and forms of the most elaborate vases are not such as would arise from a natural and rational treatment of plastic clay. The ingenious resources of modern chemistry have produced pigments of countless variety of tint, but they are mostly over-gaudy and harsh in combination; and the modern habit, not peculiar to Sèvres, of applying paintings *over* the glaze, wilfully rejects the special soft richness of effect which a vitreous coating gives to the pigments under it.

Literature.—On French porcelain, consult Jacquemart, *Histoire de la Céramique*, 1873; Davillier, *Les Porcelaines de Sèvres*, 1870, and *Les Faïences et Porcelaines de Moustiers, etc.*, 1863; Jacquemart and Le Blant, *Histoire de la Porcelaine*, 1861–62; Lejeal, *Recherches sur la Porcelaine de Valenciennes*, 1868; Milet, *L'Invention de la Porcelaine à Rouen*, 1867; *Guide du Visiteur*, Sèvres, 1874; Cool, *Peinture sur Porcelaine*, 1866; Bastenaire-Daudenart, *L'Art de fabriquer la Porcelaine*, 1827. See also the general list of works on ceramic art.

German and Austrian.

Böttger.

The porcelain of Germany was, from the first, composed of a hard natural paste, a true kaolinic clay. Its successful production was the result of a single, almost accidental, act of discovery, and not, like that of the French, of a long series of experiments with different materials, ending in the invention of a highly artificial imitation of true porcelain. In the year 1700 a young chemist, or rather alchemist, of great ability, called Frederick Böttger (1682–1719), a native of Saxony, fled to Dresden under the accusation of practicing magical arts and searching for the "philosopher's stone." He was there taken under the protection of Augustus II., elector of Saxony, who employed him to make experiments, at first connected with medical chemistry and afterwards with the composition of pastes and clays for ceramic ware. From 1701 he worked for his royal patron, partly at Dresden and partly at the castle of Meissen, carefully guarded, and kept in seclusion almost like a prisoner, in order that his discoveries might remain secret, and also to prevent his leaving the country. For nine years Böttger only produced stoneware, though of a finer and harder quality than had hitherto been made (see pp. 651–52); but in 1710 he seems to have been in some way set on the track of the secret of porcelain manufacture. His first attempts were unsuccessful: the paste is gray and defective, and there is little or no glaze. So far no real progress had been made towards the discovery of true porcelain. But in 1710 a lucky accident, combined with the young chemist's ready powers of observation, revealed the true nature of the required paste. Having noticed the unusual weight of some new hair-powder with which his wig was dressed, he inquired what it was made of, and, finding that it was a finely powdered white clay from Aue, near Schneeberg in Saxony, he procured some of the clay. He made vessels of it and fired them, and found that he had discovered the material of true hard porcelain, like that from China and Japan. When Augustus II. learned the importance of the discovery he established the porcelain manufactory at Meissen with Böttger as its director. This establishment, 5 miles from Dresden, was more like a prison than a factory, being surrounded by high walls and shut in by portcullises: none except workmen were ever admitted, and they were sworn to secrecy under pain of penal servitude for life. The kaolin from Aue was dug out, packed in sealed bags, and brought to Meissen with every care possible to avoid betraying the secret of its importance; no possible precaution was omitted, and yet, in one case at least, all attempts to keep the monopoly were in vain (see below, "Vienna porcelain").

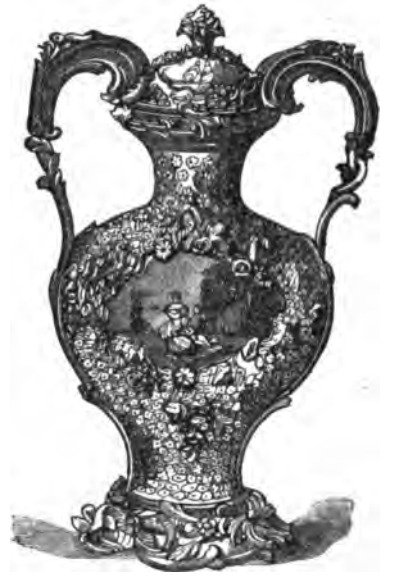


FIG. 70.—Dresden vase *pâte dure;* may-flower pattern in relief, colored blue and gold. (South Kensington Museum.)

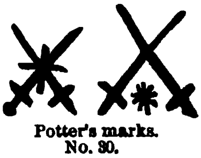
Decorations of Dresden porcelain.

The earliest productions of the Meissen (Dresden) porcelain-works are copies from the Chinese and Japanese. Some are plain white, with flowers or fruit in low relief; others have painted under-glaze in blues only, like the celebrated blue and white china of Nanking. The first pieces painted with other colors are imitations of old Japanese china in green and red with enrichments in gold. Böttger died in 1719, and was succeeded in his directorship by George Höroldt, who introduced certain improvements in the processes of the manufacture, and increased the quantity of its annual production. In his time Chinese designs were still copied, mostly very ugly figure-subjects on white panels, the rest of the vase being colored yellow, green, or gray, and decorated with elaborate gilt scroll-work in the worst possible taste.

After about 1725 the Eastern style of design was superseded by elaborate miniature paintings of flowers and insects, or copies from Dutch and Flemish painters. All notion of true ceramic decoration was gone, and the porcelain was only regarded as a ground on which to paint an imitation of an oil-painting. Another style of decoration soon came into fashion: china was decorated in relief with the "honeycomb" or "mayflower" pattern. In the latter kind (see Fig. 70) the vessel is closely studded with blossoms of the may,[1] moulded in a realistic way, with thin crisp edges, and then colored and gilded, very laborious to execute, and extremely disagreeable in effect. Perhaps the chief specialty of Dresden porcelain consists in its statuettes and groups of figures, the best of which were made between 1731 and 1756 under the superintendence of a sculptor named Kändler. Some of these, especially the Watteau-like shepherds and shepherdesses, have a sort of feeble prettiness; but most have only little merit, and some are grotesque and wilfully ugly. They are generally decorated with colors and gilding; the best, however, are in plain glazed white. Elaborate candelabra, clocks, and other objects were largely made, into the designs of which figures in the round, flowers realistically modelled, and rococo scroll-work were introduced, generally in a feeble and ungraceful way. For some years after 1774 designs of more classical form, purer in outline and less crowded with clumsy ornament, came into fashion. Since then nothing of any real value has been produced in the Dresden china-works. Of late years, since the increase of prices given for old Dresden, the directors of the manufactory have begun to reproduce their old designs, and even to use some of the worn-out moulds; the result is that the china thus produced is very blunt and spiritless, quite devoid of merit.

Marks.

The old Dresden porcelain is of a fine paste, and has a good glaze, but its white is of a rather cold tint, occasionally even having a bluish shade. It is, however, both in quality of material and in design, the best porcelain that Germany has produced. During the early period the monogram "AR" interlaced (for Augustus Rex) marks the pieces made either for the king's use or from his design. Between 1712 and 1715 pieces made for sale were marked with a rudely-sketched snake twining round a stick. Since 1721 two crossed swords have been used as a general mark; the addition of a dot or star marks special periods (see No. 30). The swords were the arms of the elector of Saxony as arch-marshal of the empire. Some pieces have "MPM" for "Meissenen Porzellan Manufactur." As at Sèvres, china from Dresden, if sold undecorated, has the cross-swords mark cancelled by the cut of a wheel. In 1863 the china-works were moved from the fortress of Meissen and established in a new and more convenient building.

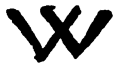

Potter's marks. No. 30.

Vienna porcelain.

Vienna Porcelain.—In 1720 one of the workmen escaped from the prison-like manufactory of Meissen and brought the secrets of the Porcelain clay to Vienna, where he set up kilns and workshops in partnership with a Frenchman named Du Pasquier. They obtained a special patent, but had little practical success; and the Vienna porcelain was not made in large quantities till after 1744, when the manufactory was carried on under the patronage of Maria Theresa and the emperor Joseph. In 1785 there were thirty-five kilns in working order, and 500 work-people were employed. Vienna porcelain is not of a pure white, but is grayish in tint; its paintings are very poor, and it depends for its effect chiefly on gilt-moulded scroll-work in delicate relief. Its manufacture was suspended in 1864 on account of the heavy expense it entailed on the Austrian Government.

Berlin porcelain.

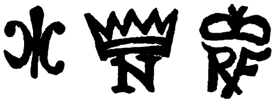
Berlin porcelain was first made in 1751 by a potter named Wegely, who marked his ware with No. 31. It was not, however, a commercial success till Frederick the Great took it in hand. He sent a number of skilled workmen from the Meissen (Dresden) china-works to Berlin, and also ordered the manufactory to be supplied with the kaolinic clay from Aue, of which Meissen hitherto had preserved the monopoly. In quality the Berlin porcelain comes next to that of Dresden; it is often decorated with a bright rose-pink, the favorite color of Frederick, which was unknown at the Meissen works. Large quantities of porcelain are still made at Berlin.


Potter's mark. No. 31.

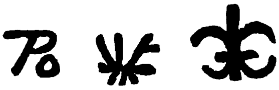
Other Continental Porcelain of the 18*th Century.*

A very large number of other places in Germany produced hard natural porcelain during the 18th century, but none of their work is of any special interest or beauty. It became, in fact, the fashion for every king or reigning prince to be the patron of a porcelain manufactory. Porcelain was produced at Amsterdam and The Hague; at Brussels, Copenhagen, and Zurich; and in Russia at St. Petersburg and Moscow.

In Italy also fine soft porcelain was made,—at Doccia as early as 1735, some of which, ornamented in under-glaze blues only, is very decorative and in good taste. Venice produced clever copies of Japanese porcelain, painted with chrysanthemums and other flowers in enamel. The royal manufactory at Capo di Monte, close to Naples, founded in 1736 by Charles III., produced a great deal of porcelain decorated in many styles, mostly in very bad taste. The best are Oriental designs painted in blues only. The accompanying marks (No. 32) were used, the fleur-de-lis in 1736, the crowned N after 1759, and the RF after 1780. All the Italian porcelain is of the soft artificial sort.


Potter's marks. No. 32.

The porcelain-works in the Buen-Retiro gardens at Madrid were also established by Charles III. after he succeeded to the throne of Spain. Much of this (soft) porcelain is classical in form, and is decorated with miniature paintings in colors or monochrome. Charles III. transferred thirty-two workmen and painters from Capo di Monte when he founded the Buen-Retiro manufactory, and hence the productions of the two factories are very similar in style. One of the marks used, the lis, was common to both; the usual forms on the Buen-Retiro porcelain were those in No. 33.


Potter's marks. No. 33.

Literature.—See Falka, *Geschichte der k. Porzellan-Fabrik in Wien*, 1867; Graesse, *Geschichte der Gefässbildnerei, Porzellan-Fabrication*, etc., 1853; Kärner, *Die Porzellan-Malerei*, etc., 1870; Kolbe, *Geschichte der Porcellanmanufactur zu Berlin*, 1863; Klemm, *Die k. sächsische Porzellan- und Gefäss-Sammlung*, 1833; Krünig, *Cyclopedia*, *s.v.* "Porzellan."

English.

The early history of English porcelain is rather obscure. John Dwight (see p. 651 above) was apparently the first English manufacturer who took out a patent for the production of transparent porcelain; but no specimens made by him are now known.

Chelsea factory.

Chelsea Porcelain.—According to Jewitt (*Ceramic Art of Great Britain*), John Dwight probably founded the porcelain-works at Chelsea, which rank first among English manufactories both in date and importance. In 1745 they were in full activity; and the popularity in France of English porcelain was one of the causes which led to the establishment of the royal manufactory of Sèvres. The owner of the Chelsea works was a Frenchman called Nicholas Spremont, who continued to manufacture fine porcelain till his retirement from business in 1764.

This porcelain is very varied in style, as was the case with most of the 18th-century makes. Some of it is simply imitated from Eastern china, either in blue and white, or in the old Japanese style, which was then so popular, chiefly painted in rich red and green, with a good deal of gilding. Other pieces, more elaborate and costly, resemble Sèvres porcelain, and have miniature paintings on white panels, the rest of the vase being colored with one uniform tint, such as the

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[1] [Hawthorn.—AM. ED.]

French *bleu du roi* or "rose Pompadour." One color, peculiar to Chelsea, is a deep claret-red. Most of the vases have a great deal of gilding, both applied in patterns on the body of the vase, and also used solidly to decorate the elaborate moulded scroll-work which was fixed on the sides of the porcelain. The writhing masses of gold on Chelsea ware are probably the most meaningless and stupid attempts at decoration that have ever been produced. Many of them are designed with apparently not even an attempt at beauty of form or gracefulness of curve, and are quite without the vigor that is often possessed by the grotesques of China or Japan. Chelsea vases of this elaborate sort are rare, as their production was slow, and they now fetch very high prices: £2000 has been given for a single vase such as that shown in Fig. 71.

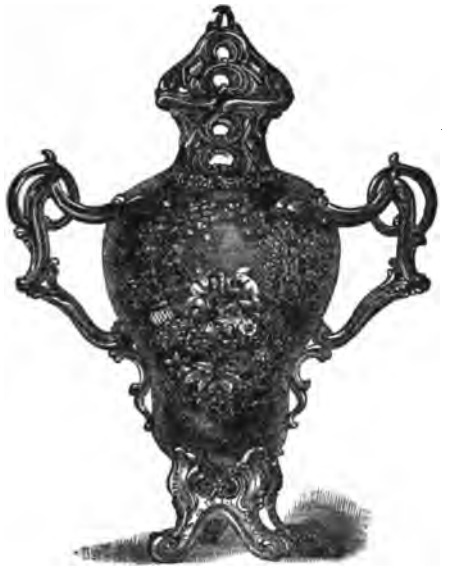
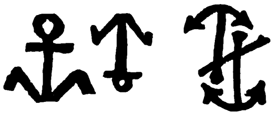


FIG. 71.—Early Chelsea vase, dark-blue body, with gilt scroll-work at the sides. (South Kensington Museum.)

It should be observed that, till the discovery of the half-decomposed kaolinic clay of Cornwall about 1755 by Cookworthy, all English porcelain was of the soft variety (*à pâte tendre*), and was really an artificial compound with an ordinary vitreous lead glaze. The painted decoration, like that of Sèvres, was applied *over* the glaze, with the exception of a fine cobalt blue, which was painted on the china in a biscuit state. This color is much the finest and most truly decorative of any of the pigments, very superior in richness of effect to the much brighter over-glaze colors. That used at the Derby porcelain-works is the most beautiful in tint.

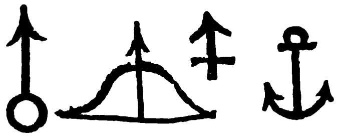
The early success of the Chelsea porcelain was partly due to the patronage of George II., who, following the royal fashion of the age, took a great interest in the manufactory, and not only bought large quantities of its productions but also aided it by importing kaolinic clay, models, and even skilled workmen from Saxony. In 1769 the Chelsea porcelain-works were put up to auction, and bought by William Duesbury, the owner of the Derby china-factory. Till 1784 he carried on the manufacture of porcelain at both places, but in that year he pulled down the Chelsea kilns and transferred all the movable plant and the workmen to Derby. The Chelsea mark is usually an anchor either painted in red or gold, or moulded in relief; the anchor is often double (see No. 34), and in some cases has the addition of one or more daggers. Some specimens first noted by Mr. Jewitt[1] have quite different marks, incised on the paste before glazing, which are of special interest as being the earliest dated specimens of English porcelain. Such marks are a triangle, with the addition "Chelsea, 1745."



Potter's marks. No. 34.

Bow porcelain.

Bow Porcelain (Stratford-le-Bow).—In 1744 Edward Heylyn and Thomas Frye, the latter a painter of some repute, took out a patent for the manufacture of porcelain at Bow. The composition they used was a curious one, being almost a hard porcelain. The clay, which was called "unaker," was brought from America, and was probably an impure kind of kaolin. It was ground and washed to separate the sand and mica; and to it was added pounded glass—a pure alkaline silicate—varying in proportion from equal parts of clay and glass to one-fifth of glass. The glaze was a similar mixture, with less of the American kaolinic clay. This paste and glaze must have been difficult to manage, since in 1748 the partners took out a fresh patent for a more artificial and softer kind of porcelain, with a more fusible lead glaze. In 1750 the Bow works came into the hands of Messrs. Weatherby and Crowther, and were then called "New Canton." For some time the manufactory was successful, and employed 300 hands; but before long one of the partners died, and the survivor, "John Crowther, *chinaman*," was gazetted bankrupt in 1763, and the whole stock was sold off. Crowther, however, in spite of his failure, carried on the works till 1775, when they were bought by William Duesbury, the owner of the Chelsea, Derby, and other china-factories; he pulled down the Bow kilns and transferred the plant to Derby, as he did afterwards in the case of the Chelsea manufactory. The Bow porcelain is of a fine soft milky white; many of the imitations of Chinese figures are hardly to be distinguished from the originals. Some of the Bow china, decorated only in the rich unglazed blue, with Eastern designs, is very effective. A good many pieces are painted in the Dresden style, and colored statuettes or groups of figures, also after German models, were largely produced. The Bow marks are very numerous, some not distinguishable from those of Chelsea; No. 35 shows four varieties.



Potter's marks. No. 35.

Derby factory.

Derby porcelain is supposed to have been made as early as 1750, possibly by Andrew Planché, a clever French refugee, who in 1756 entered into partnership with Heath and Duesbury, the last of whom afterwards became the chief china-manufacturer of England. The purchase by Duesbury of the Bow and Chelsea works has already been mentioned. The Derby porcelain is often very large, elaborately moulded, and profusely decorated, generally rather in the Dresden style, weak in form and gaudy in color. The Derby under-glaze blue was remarkably fine, and many of the plain blue and white pieces, with Chinese patterns, are highly decorative, as are also, though in a less degree, those porcelain services that were painted in the "old Japanese style." One of the chief specialties of the Derby works was the production of delicate white figures in biscuit china, often modelled with great skill and refinement. Unfortunately the practice of *printing* the under-glaze patterns, instead of painting them by hand, was introduced at Derby about 1764, and did much to destroy all the artistic value of the work (see below). The marks used were these,—first a "D" combined with an anchor (No. 36), or a crowned anchor (No. 37), used during the earlier part of the time when Duesbury was carrying on both the Chelsea and the Derby factories, 1769–84; next the crown was used, either over the "D" only (No. 38), or, more usually, with a saltire or crossed swords immediately under it. Another variety has crossed lines under the crown (No. 39). The Derby works continued in the possession of the Duesbury family till 1814 or 1815, when Robert Bloor became the lessee and finally the owner of the place.

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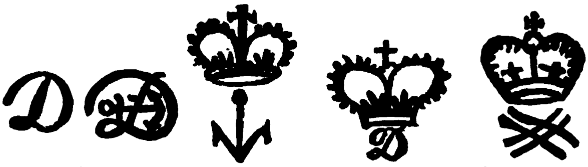
[1] See "History of Chelsea China," in *Art Journal* for 1868.

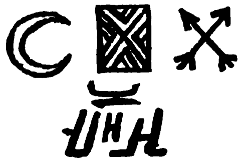

No. 36. No. 37. No. 38. No. 39.

Potter's marks.

He soon realized a large fortune, though to some extent at the expense of the credit and high reputation for excellence of work which had been gained and kept up by the various members of the Duesbury family. He gained a great deal of money by selling off the stock, accumulated during many years, of slightly defective pieces of porcelain, which the Duesbury family would not allow to go into the market.[1]

Worcester porcelain.

Worcester Porcelain.—The china-works at Worcester were founded by a very remarkable man—Dr. Wall, who appears to have possessed unusual skill as a physician, artist, and chemist. After some years spent in attempts to discover a fine artificial porcelain, he, in conjunction with other practical men and capitalists, started the Worcester Porcelain Company in 1751. The early productions of this factory are very artistic; they are chiefly copies of the fine Nanking porcelain, painted underglaze in blues only, with very boldly decorative designs. Old Japanese ware was also successfully imitated. After that the most ambitious pieces of Worcester porcelain were mostly dull reproductions of the elaborately painted wares of Sèvres and Chelsea. Transfer printing was first used at Worcester for designs on china in 1756, though it had been invented and employed some years earlier for the decoration of the Battersea enamelled copper. This process was no less injurious at Worcester than elsewhere to the artistic value of the paintings. Dr. Wall died in 1776, and after that the porcelain-works passed through various hands. A great impetus was given to its success by George III., who visited the factory in 1788 and granted it the title of "The Royal Porcelain Works." The earliest marks are a "W" or a crescent; others used are crossed arrows or varieties of sham Chinese marks (see No. 40).[2] The manufacture of china at Worcester is still continued with great activity; the fineness of the paste and the skilful processes employed leave nothing to be desired. Unfortunately the old fault of a too realistically pictorial style of painted decoration still prevails, and an immense amount of artistic skill and patient labor is practically wasted in producing minute but not truly decorative work. Some of the modern Worcester copies of Eastern porcelain and enamels are very delicate and beautiful, and the cameo-like method of *pâte sur pâte* decoration is practiced with great skill and often good effect.

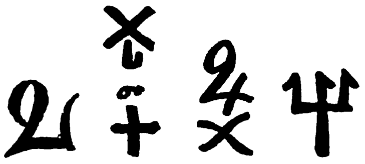

Potter's marks. No. 40.

Bristol porcelain.

Bristol porcelain is of interest as being the first hard natural porcelain made in England. As early as 1766 attempts were made by Richard Champion to make an artificial paste, with the help of the American "unaker" or kaolinic clay, which was being used successfully at Bow, but no results of any importance seem to have followed his experiments. The successful production of Bristol porcelain was due to the discovery in Cornwall of large beds of kaolinic "growan" stone or "china" stone, first brought into use by William Cookworthy, a Plymouth potter. This discovery and the succeeding one of similar beds in Devonshire were of great commercial importance to England, and the beds have ever since produced enormous quantities of material for the manufacture of fine hard porcelain both in England and abroad.

This china stone (see Cock, *Treatise on China Clay*, 1880) is not a pure kaolinic clay like that found in China, but is simply a granitic rock, partially decomposed, and soft and friable, but still retaining both quartz and mica in addition to the felspar, which is the essential base of kaolin. In China the processes of nature have carried the decomposition and sorting of the different component parts of granite to a further stage. There the decomposed felspar has, by the action of rain and running streams, been deposited in an almost pure and finely-divided state in beds by itself, almost free from quartz and flakes of mica. In using the Cornish China stone, therefore, various natural processes have to be artificially performed before the paste is sufficiently white and pure for use; but when this is done it is little if any inferior to the Chinese kaolin. The stone when dug out is white with gray specks, and is so friable as to be easily reduced to powder between mill-stones. It is agitated with water, and run through a series of settling troughs; thus the lighter flakes of mica, which are very injurious to the paste, are washed away, and the pure felspathic kaolin is deposited free from impurities. Free silica is added in a fixed proportion; it is usually obtained from flints, first calcined and then finely ground to powder, which are an important ingredient in the composition of both fine pottery and porcelain. The Jermyn Street Museum has a complete collection of all the materials used in china manufacture

William Cookworthy at once recognized the value of his discovery, and set up china-works both at Plymouth and at Bristol. No. 41 shows the mark of the Plymouth porcelain, and No. 42 those that were used at Bristol. In 1774 he sold the Bristol factory to Richard Champion, still retaining a large royalty on the china stone. Champion signed his ware with No. 43. The production of Bristol porcelain continued till 1781, when the works were sold to a Staffordshire company, and the manufacture of hard porcelain was no longer carried on there. Though fine in paste and unusually transparent, the Bristol porcelain has no special artistic merits. As with most other English wares, the best in color and design are copies, with more or less adaptation from Eastern china; some of them are very large and magnificent. The figures and flower-reliefs in biscuit porcelain are also delicate, and often cleverly modelled, with wonderful realism.


No. 41. No. 42. No. 43. No. 44.

Potters' marks.

Other china-works.

Some fine blue and white china was produced towards the end of the last century at Lowestoft, and at Liverpool as early as 1756; and many other china-works were established in various parts of England. In the beginning of the present century Swansea and Nantgarw in South Wales produced porcelain which was highly esteemed, but the delicate shades of difference in the paste, glazes, and styles of decoration of these numerous varieties of British porcelain are not such as can be described in a few words; nothing but careful examination of the wares themselves will enable the student to distinguish between the productions of the different manufactories. Swansea ware bears various marks, of which No. 44 is one example.

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[1] See Haslem, *Old Derby China Factory*, 1876.

[2] For fuller information, see Binns, *Potting in Worcester*, 1865.

Manufacture.

Modern Methods of Manufacture.—The methods and materials now employed at Sèvres in the production of porcelain are in all essential points much the same as those practiced elsewhere (see above). The chief centre in England of the manufacture of pottery or non-translucent earthenware is in Staffordshire, near the borders of Cheshire, where a large district devoted to this industry goes by the name of "The Potteries." Worcester, Lambeth, and many other places in England also turn out annually large quantities of pottery. The processes employed may be divided under the following heads: (1) choice and mixture of clays; (2) washing and grinding the materials; (3) throwing on the wheel and moulding; (4) kilns and methods of firing; (5) glazes; (6) pigments and methods of decoration.

Mixture of clays.

1. *Choice and Mixture of Clays.*—The extensive beds of fine Dorset or Poole clay supply the chief ingredient in the manufacture of English pottery. This is too fat a clay to be used alone, and is therefore mixed with a certain proportion of free silica to prevent it from twisting or cracking in the kiln. Another ingredient is added to the mixture for the finer wares, namely, the Cornish or Devonian china stone, a kaolinic substance used in the manufacture of porcelain (see above), which makes the paste finer in texture, whiter, harder, and less brittle. These three substances are mixed in various proportions. The following makes a fine cream-colored ware,—Dorset clay 56 to 66 parts, silica (flint) 14 to 20, china stone 17 to 30 parts.

Preparation of materials.

2. *Washing and Grinding the Materials.*—The Dorset or Poole clay is finely ground between mill-stones, mixed with water to the consistency of cream or slip, and then passed through fine silk sieves to strain out all grit or palpable particles. The china stone is treated in the same way, with the additional precaution of washing away all the flakes of mica, which come from the decomposition of the granitic rock from which the china stone is derived. The silica is obtained from flints, which are easily ground to fine powder after being heated red-hot and thrown into water. These three substances, brought into the state of fluid slip, are repeatedly pumped up from vats and passed through the sieves; they are then easily mixed in due proportion by being pumped into graduated vats. The water is next evaporated from the fluid mixture in large boilers heated by a complicated arrangement of flues, and the compound is left in a soft pasty state, full of air bubbles, which have to be got rid of by constantly turning over and beating the paste till it is quite smooth and compact, and sufficiently plastic to be thrown on the wheel. Colored earthenware, such as that Wedgwood used to make, was prepared by the addition of various substances to the fluid slip. A black color was given by protoxide of iron and manganese, red by red ochres or red oxide of iron, blue by oxide of cobalt, and green by protoxide of chrome. These colored pastes are but little used now.

Throwing and moulding.

3. *Throwing and Moulding.*—After sufficient kneading, the clay is made up into balls of a convenient size for the thrower to mould into shape upon his wheel. The methods both of throwing and of moulding are the same for porcelain as for pottery (see p. 658 above). Unfortunately in England, as at Sèvres, the thrown vessels are usually finished on the lathe; only the commonest kinds of ware escape this process, which takes away all life and spirit from the wheel-formed pottery. Consequently it is the cheapest and commonest wares that now, as a rule, have most natural beauty of form and really artistic spirit. Handles and other parts which are shaped in piece-moulds are either cast by pouring fluid slip into the plaster-moulds, or are formed by pressing and dabbing thinly-rolled pieces of soft clay into moulds made in two parts. The moulded halves of the spout or handle are fastened together while still wet, and the edges at the junction pared down and trimmed with a modelling tool. Plates, basins, and the like are formed by the combination of a mould and a shaped gauge as described above (Sèvres).

Kilns and firing.

4. *Kilns and Firing.*—After the vessel with its moulded handles or spout is thoroughly dry it is ready for the first firing. The usual Staffordshire biscuit-kiln is a circular building, about 18 feet in internal diameter at the base, narrowing towards the top. It is about 18 to 20 feet high, and is very carefully built of refractory fire-bricks, strengthened by rings of wrought-iron which clasp the outside. It is surrounded by eight to ten furnace openings, with flues arranged to distribute the heat equally throughout the kiln. The pottery is fired in drum-shaped "saggers" or boxes made of fire-clay, which are piled one above the other, as in the case of the Sèvres porcelain. The fire is kept up from thirty to fifty hours, and is then allowed to die out. Several days are allowed for cooling before the kiln is opened and the saggers with their contents withdrawn.

Glazes.

5. *Glazes.*—The composition of glazes for pottery varies very much according to the custom of each manufacturer. For the most part they are transparent silicates of alumina, rendered fusible by oxide of lead; this compound is made by a mixture of Cornish china stone, flint and white lead. The best quality of glazes have borax and some alkali added as a flux, in which case the proportion of lead is reduced. Those glazes that contain much lead are easily scratched, and can be decomposed by many acids; thus there is always a risk of lead-poisoning if vessels coated in this way are used for cooking purposes. The materials for the glaze are finely ground with water and made into a thin white fluid. The biscuit pottery is rapidly dipped into vats of the milky mixture, and sufficient to form the glaze adheres to the absorbent clay in an even coating all over the surface. After being dried the pottery is ready for the second firing in the glazing kiln, which is very similar in construction to the biscuit-kiln, only, as a rule, rather smaller. It is packed in clay saggers, as in the first firing, but a stronger heat is required to fuse the finer kinds of glaze than was necessary for the baking of the raw pottery. Salt-glazing has been described above (p. 651), and is only used for the coarser sorts of ware.

Decoration.

6. *Methods of Decoration.*—In the case of pottery decoration is usually applied on the biscuit-ware *before* it is glazed by the transfer-printing process. The required design is engraved on copper plates; the pigment is ground fine and mixed with a tenacious compound of oil and gums. An ordinary rolling press is used to print the engraved patterns in the oily pigment upon strips of tissue-paper, which are carefully applied and pressed face downwards on the biscuit-ware while the oil is yet wet; and so the pattern is transferred to the absorbent clay. This requires great dexterity from the difficulty there is in fitting the printed strips neatly on to curved surfaces. The paper is then washed off, and the printed ware is baked at a moderate temperature in what is called the "hardening" kiln, which is done before the glaze is applied, in order to drive off the oily medium with which the pigment was mixed. The transfer process is quite fatal to all artistic beauty in the designs; it is hard, clumsy, and mechanical, the very opposite of a rational method for the decoration of pottery, which above all things demands freedom of hand and a spirited touch. Painted decoration which is executed by hand is now usually applied *over* the glaze, both because it is easier to do, not requiring so certain a touch, and also because the soft subdued colors of the under-glaze pigments do not suit the modern taste for what is bright and showy. The pigments used are necessarily oxides and salts of metals which will stand the heat of the kiln. Only those few which can stand the very high temperature of the glazing kiln can be used under the glaze. The over-glaze colors, on the other hand, only need sufficient heat to fix them on the surface of the already fired glaze; and this is often done in a very slight and imperfect way. These colors not only lose in effect from want of the softening vitreous coat through which under-glaze colors are seen, but they are also very inferior through being unprotected, and therefore easily injured by scratches and ordinary wear. In old times the value of a protecting coat of glaze was so strongly felt that even paintings on enamel, like those on Persian pottery and Italian majolica, usually had a thin vitreous glaze added *over* the smooth enamel, with the double object of protecting the painting and increasing its soft richness of effect.

Pigments.

The discoveries of modern chemistry have added very greatly to the number of metallic salts which are available for the decoration of pottery. Almost every possible tint can be produced for over-glaze painting. Oxides of cobalt are used for various shades of blue and gray up to black; antimony, usually combined with lead, gives yellow; oxides of copper give deep red or brilliant blues and greens according to the proportion of oxygen that they contain; oxide of chromium gives a good quiet green; manganese gives violet and even black; gold gives a fine ruby red; and uranium a rich orange. The various oxides of iron give a great variety of colors—reds, yellows, and browns. Oxide of zinc is largely used, not as a pigment in itself but in combination, to modify other colors. The oxides of iron, cobalt, and chromium give very stable colors, capable of bearing a very high temperature, and can therefore be used for under-glaze painting; most of the others can only be employed for over-glaze work. Over-glaze pigments cannot be used alone, but require a flux to make them combine with the glaze. Oxide of lead, borax, nitre, carbonates of potash or soda, and other substances are used for this purpose.

Literature.—English porcelain: Nightingale, *Early English Porcelain*, 1881; Binns, *Potting in Worcester*, 2d ed., 1877; Owen, *Ceramic Art in Bristol*, etc., 1873; Porter, *Manufacture of Porcelain*, etc., 1832; Tiffin, *Chronograph of Bow, Chelsea, and Derby Porcelain*, 1875; Wallis and Bemrose, *Pottery and Porcelain of Derbyshire*, 1870; Jewitt, *Ceramic Art of Great Britain*, 1877—the most complete and comprehensive work.

Museums.

Museums illustrative of the General History of Pottery.—The Musée Céramique of Sèvres is the best and most complete for the student of all kinds of pottery. In England the Jermyn Street Museum of Geology has a small but very widely-illustrative collection of pottery and the various materials used in its manufacture. The South Kensington Museum is rich in almost all kinds of mediæval and modern pottery, but it is unfortunately very badly arranged. The British Museum possesses a very large number of specimens of prehistoric pottery, Greek vases, mediæval English, and very choice examples of Persian and majolica wares. The other chief European museums are mostly each rich in some special department of ceramic art.

General Literature on Pottery.—Brongniart, *Traité des Arts Céramiques*, 1854; Jacquemart, *Histoire de la Céramique*, 1873; Marryat, *Pottery and Porcelain*, 3d ed., 1868; Birch, *Ancient Pottery*, 1873; *Catalogue of Pottery*, Museum of Geology, Jermyn Street, 1876 (a very useful and well-illustrated work); Bonneville and Jaunez, *Les Arts Céramiques*, 1873; Brongniart and Riocreux, *Musée de Sèvres*, [illegible]; Figuier, *Les Merveilles de l'Industrie*, 1873–75; Greslou, *Recherches sur la Céramique*, 1864; Guillery, *Les Arts Céramiques*, 1854; Jacquemart, *Les Merveilles de la Céramique*, 1866–69; Magnier, *Manuel du Porcelainier, Faïencier*, etc., 1864; Mareschal, *Les Faïences Anciennes et Modernes*, 1867; Maze, *Recherches sur la Céramique*, 1870; Ris-Paquot, *Histoire de la Faïence Ancienne*, 1873–74; Salvetat, *Leçons de Céramique*, 1857; Waring, *Ceramic Art in Remote Ages*, 1875; Ziegler, *Études Céramiques*, 1850; Jännicke, *Grundriss der Keramik*, Stuttgart, 1879; Champfleury, *Bibliographie Céramique*, Paris, [illegible] (gives a very large and complete list of works on pottery and porcelain, in all languages); Soden Smith, *List of Works on Pottery and Porcelain in the Kensington Art Library*, 1875.

On Pottery and Porcelain Marks the reader may consult Barth, *Porzellan-Marken und Monogramme*, 1873; Chaffers, *Handbook of Marks and Monograms*, 1874; Demmin, *Guide de l'Amateur de Faïences et Porcelaines*, 1873; Graesse, *Guide de l'Amateur de Porcelaine*, etc., 1873; Palliser, *The China Collector's Companion*, 1874–75; Ris-Paquot, *Dictionnaire des Marques et Monogrammes*, 1874; Hooper and Phillips, *Manual of Marks*, 1876; Bowes, *Japanese Marks*, [illegible]. Many other lists of ceramic marks occur also in the various works mentioned under previous heads. (J. H. M.)

POTTSTOWN, a borough of Montgomery county, Pennsylvania, United States, is picturesquely situated on the Schuylkill river, in a plain surrounded by hills. It is 18 miles east-southeast of Reading and 40 miles west-northwest of Philadelphia, at the junction of the Philadelphia and Reading (main line) and the Colebrookdale Railroads, and has communication also by the Schuylkill Valley branch of the Pennsylvania Railroad. There are in and near Pottstown six rolling-mills, two blast-furnaces, three iron and brass foundries, two nail-factories, and large bridge works, besides minor industries. The population of Pottstown was 4125 in 1870, and 5305 in 1880.

POTTSVILLE, a city of the United States, capital of Schuylkill county, Pennsylvania, lies 35 miles northwest of Reading, on the north side of the Schuylkill river, in the gap by which it breaks through Sharp Mountain. It is the terminus of the main line of the Philadelphia and Reading Railroad, and the great emporium of the Schuylkill coal region, which extends north and east and west, and has an annual yield of about 6,000,000 tons. Furnaces, rolling-mills, machine-shops, planing-mills, a spike-mill, a pottery, etc., are among the industrial establishments; and the public institutions include a court-house, a jail, a town-hall, a union hall, an opera-house, a children's home, a lyceum, and a free reading-room. The German and Welsh elements in the population are strong enough to be represented each by several churches. Pottsville as a city dates from 1825. In 1850 it had 7515 inhabitants, 12,384 in 1870, and 13,253 in 1880.

POUGHKEEPSIE, a city of the United States, capital of Duchess county, New York, lies on the east bank of the Hudson river, 73 miles north of New York. It is on the New York Central and Hudson River Railroad, and communicates with the New York, West Shore, and Buffalo Railway by ferry from Highland, and with the Hartford and Connecticut Western Railroad by the Poughkeepsie, Hartford, and Boston Railroad (37 miles). The site consists for the most part of a tableland which rises from 150 to 200 feet above the river, and is backed towards the east by College hill, 300 feet in height. Well laid out with regular and shaded streets and abundantly supplied with water (pumped from the river to a reservoir on College Hill), Poughkeepsie is a pleasant place of residence, and it enjoys a special reputation for its educational institutions. Vassar College (2 miles east of the city), the earliest and one of the greatest women's colleges in the world, was founded and endowed in 1861 by Matthew Vassar, a wealthy Poughkeepsie brewer; in 1884 it had 300 students, and possessed a library of 14,150 volumes, together with collections of water-colors and of American birds, both of great value, an astronomical observatory, and a chemical laboratory. Two miles north of the city, on an eminence above the Hudson, stands the Hudson River State Hospital for the Insane, an immense building erected between 1867 and 1871, with 300 acres of ground attached. Within the city are an opera-house, a free public library, a large young men's Christian association building with a free reading-room, St. Barnabas and Vassar Brothers Hospital, and homes for aged men and women. It also contains iron-furnaces, breweries, manufactories of shoes, glass, mowing machines, pottery, hardware, and various minor industries. The population was 14,726 in 1860, 20,080 in 1870, and 20,207 in 1880.

Poughkeepsie (forty-two different spellings of the name are said to be found in old records) was settled by the Dutch about 1698–1700. Two sessions of the State legislature were held in the place in 1777 and 1778; the former gave assent to the articles of confederation, and the latter ratified the national constitution. The city charter dates from 1854.

POULPE, or OCTOPUS. See CUTTLE-FISH, vol. vi. p. 648, and MOLLUSCA, vol. xvi. p. 694 *sq.*

POULTRY. The term "poultry" (Fr. *oiseaux de basse cour*) is usually regarded as including the whole of the domesticated birds reclaimed by man for the sake of their flesh and their eggs.[1] The most important are the Common Fowl, which is remarkable as having no distinctive English name, the Turkey, and the Guinea-fowl, all members of the family of birds known as *Phasianidæ*. The Pheasants themselves, belonging to the restricted genus *Phasianus*, are not capable of being domesticated, and the Peacock is to be regarded rather as an ornamental than as a poultry bird. The aquatic birds which are strictly entitled to be considered domesticated poultry are the Duck and the Goose, two species of the latter having been perfectly reclaimed.

The common fowl belongs to the restricted genus *Gallus*, of which four wild species are known,—the Bankiva Jungle fowl (*G. ferrugineus*), the Sonnerat Jungle fowl (*G. sonnerati*), the Ceylon Jungle fowl (*G. stanleyi*), and the Forked-tailed Jungle fowl (*G. furcatus*). The range of these species is given under FOWL (vol. ix. p. 433). The origin of the domesticated breeds is ascribed by Darwin, Blyth, and other naturalists to the Bankiva fowl, much stress being laid on the comparative want of fertility in the hybrids produced between this species or the domesticated breeds and the other three forms of wild *Galli*, but it is probable that this want of fertility was due in great part to the unnatural conditions under which the parent and offspring were placed, as, if bred under more natural conditions, there is no difficulty in rearing these hybrids or in breeding from them with the domesticated varieties. The number of distinctive breeds of the domesticated fowl has very greatly increased of late years, owing to the emulation excited by poultry shows. Darwin, in his *Variation of Animals, etc., under Domestication*, enumerated thirteen principal breeds with numerous sub-varieties, but several very distinctive races have come into notice during the last ten years, varieties having been formed by careful selection that may be relied on for reproducing their own distinctive peculiarities in the descendants, and hence constituting what are regarded by fanciers as pure breeds. The classification of the known varieties is not an easy task; each is capable of interbreeding with every other, and so great an intermixture of local races has taken place that the arrangement of the breeds is as difficult in poultry as in dogs.

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[1] Although pigeons are not generally included among poultry, yet, on account of their close connection, it has been deemed advisable to add a short section on them to this article.

Game Fowls.—Game fowls differ less from the wild Bankiva than any other variety; they are, however, considerably larger, and carry the tail more erect than the wild birds. In some parts of India sportsmen find it not easy to distinguish between the wild and the domesticated birds. Game fowls in England have been long cultivated not only as useful poultry but on account of their combative tendencies, which have become so intensified by careful selection that they have extended even to the other sex, and hens have been not unfrequently fought in the cock-pit. The comb in the Game is single, the beak massive, the spurs strong and very sharp. There is a tendency towards the assumption of the female plumage by the males, and distinct breeds of "henny" Game are known. The peculiarity is not associated with any loss of combativeness, the birds being highly valued for their courage and endurance in the pit. Economically considered, Game are highly esteemed for the table on account of their plumpness, the amount of the breast-meat, owing to the size of the pectoral muscles being very great, from which cause, combined with their hardihood, they are most valuable for crossing with other breeds, as the Dorking. English-bred Game have been reared of many varieties of color, retaining in all cases their distinctive peculiarities of form. Within the last few years Game fowls have been reduced in size by selective breeding, and the exceedingly minute Game bantams have been produced with the distinguishing characters of the larger breed. During the last twenty years Game fowls have been considerably altered in form, owing to the influence of poultry shows,—the legs and necks having been greatly lengthened. This has been accomplished by careful selection in breeding and not by crossing with any other breed.

Malayan Fowls.—The Malayan type has been long recognized as of Eastern origin. The birds are of large size, close and scant in plumage, with very long legs and necks. The *Gallus giganteus* of Temminck, which he regarded erroneously as a distinct species, belonged to this group, as did the Kulm fowl and the Gray Chittagong of the United States. The Malays are of savage disposition. Several smaller breeds of a somewhat similar type are known as Indian Game; some of these, as the Aseels, are of indomitable courage. Until the arrival of the so-called Cochin breeds from the north of China, Malays were the largest fowls known in Europe and were employed to impart size to other varieties by crossing.

Cochins.—This type, which must be regarded as including not only the birds generally so called but also the Brahmas and Langshans, is of very large size, some of the males reaching the great weight of 16 or 17 lb. They are distinguished by a profusion of downy plumage, with small wings and tails; they are incapable of long flight, and the pectoral muscles are consequently but feebly developed. The Cochins originally imported from Shanghai were of several colors; some of the gray birds in America were crossed with the gray Chittagong, the Brahmas being the result of the cross, and they have been long since established as a pure breed, faithfully reproducing their own type. The Langshans are a more recent importation; since their introduction they have been bred by careful selection for eating, and have fuller breasts and less abundant plumage than the older-known Cochins and Brahmas. Recently a sub-variety of Cochin has been raised in America by crossing with a cuckoo-colored breed long known as Dominiques. These have become fashionable under the name of Plymouth Rocks. They are cuckoo-colored, viz., each feather is marked with transverse gray stripes on a lighter ground, and, as in all cuckoo-colored breeds, the cocks are of the same color as the hens; their legs are not feathered, and the plumage is not so loose as that of the more typical Cochins. They are admirable layers, but the intense yellow of the skin lessens their value for the table.

Spanish.—The Spanish or Mediterranean type is well marked. The birds are of moderate size, with large single erect combs and white ear-lobes. In the black Spanish the whiteness of the ear-lobe extends over the face, and its size has been so greatly developed by cultivation that in some specimens it is 6 or 7 inches in length and several in breadth. Closely related to the Spanish, differing only in color of plumage and extent of white face and ear-lobe, are the white and brown Leghorns, the slaty-blue Andalusians, the black Minorcas, etc. All are non-incubators, the desire to sit having been lost in the tendency to the increased production of eggs, which has been developed by the persistent and long-continued selection of the most fertile layers.

Hamburghs.—The Hamburghs, erroneously so called from a name given them in the classification adopted at the early Birmingham shows, are chiefly breeds of English origin. They have double combs and small white ear-lobes. There are various sub-varieties. Those with a dark crescent-like mark on the end of each feather of the hen are termed Spangled Hamburghs. Others are of uniform black plumage. A somewhat similar breed of smaller size, with each feather of the hens marked with transverse bands of black on a white or bay ground, is termed Pencilled Hamburghs; they were formerly known as Dutch everyday Layers. These breeds are all non-sitters and lay a remarkably large number of eggs.

Crested Fowls.—The crested breeds have long been cultivated on the Continent, and are admirably delineated in the pictures by Hondekoeter and other early Dutch artists. In Great Britain they are erroneously termed Polish. The development of the feathered crest is accompanied by a great diminution in the size of the comb, which is sometimes entirely wanting. The wattles also are absent in some breeds, their place being occupied by a large tuft of feathers, forming what is termed the "beard." In all the crested breeds there is a remarkable alteration of the cranium, the anterior part of the skull forming a prominent hollow tuberosity which contains a very large part of the brain. This portion of the brain-case is rarely entirely ossified. There are numerous sub-varieties of crested fowls. The best-known breeds in England are the spangled, with a dark mark at the end of each feather. This mark often assumes a crescent shape, the horns of the crescent sometimes running up each margin of the feather so as to form a black border; feathers so marked are termed "laced" by poultry-fanciers. There are also white Polish and a buff variety. A very distinct sub-variety is the black breed with a white crest on the head and large pendent wattles. A variety with the arrangement of these colors reversed was formerly known, but it has now become extinct. Some of the larger breeds of the west of Europe are closely related to the Polish. The Crève-cœur is a crested breed of uniform black color; it is of large size and of great value for the table and for egg-production. The Houdan is a black and white breed of very similar character. In some breeds the form of the body and structure of bones of the face closely resemble those of the Polish, but there is an absence of the feathered crest, the crescent-shaped comb becoming more largely developed; such are those known as Guelders, Bredas, and La Flèche, the latter being the best French fowl for eating. A small white-crested variety, profusely feathered on the legs, was received some twenty years since (1864) from Turkey;

they are now known as Sultans. The crested breeds are all non-incubating.

Dorkings.—The Dorking type includes fowls that have for many generations been bred for the supply of the London markets. They are all fleshy on the breast and of fine quality. The Dorkings have an extra toe, a monstrosity which leads to disease of the feet. The Surrey and Sussex fowls are four-toed. The colored Dorkings were greatly increased in size some few years since by crossing with an Indian breed of the Malay type. The birds of the Dorking type are fair layers and good sitters. They are rather delicate in constitution and are chiefly bred in the south of England. Crossed with the Game breed they furnish a hardy fowl, plumper than the Dorking and larger than the Game, which is of unsurpassed excellence for the table. Mating a Dorking cock with large Game hens is found to be the most advantageous.

Silk Fowls.—These constitute a singular variety, in which the barbs of the feathers are not connected by barbules and the entire plumage has a loose fibrous appearance; similar variations are found amongst other species of birds, but are soon lost in a wild state. The silk fowl best known is that in which the plumage is perfectly white, whilst the skin, cellular tissue between the muscles, and the periosteum covering the bones are a deep blue-black, the comb and wattles being a dark leaden blue. The birds are admirable sitters and mothers, and are much valued for rearing pheasants, being of somewhat small size. Though of remarkable appearance when cooked, they are of good quality. In crosses with other breeds the silky character of the plumage is generally lost, but the dark skin and intermuscular cellular tissue remain and greatly lessen the value of the birds in the market.

Frizzled fowls are birds in which each feather curls outwards away from the body. They are common in India, but are not adapted to the climate of Britain, as the plumage offers an imperfect protection against wet.

Rumpless fowls are those in which the coccygeal vertebræ are absent; there is consequently no tail. By crossing, rumpless breeds of any variety may be produced. They are not desirable to cultivate, as, from the structural peculiarities, the eggs are very apt to escape being fertilized.

Dumpies or *Creepers* are birds in which the bones of the legs are so short that their progression is considerably interfered with. The best known are the Scotch dumpies.

Long-tailed fowls, under the various names of Yokohama or Phœnix fowls, or Shinotawaro fowls, are singular varieties recently introduced from Japan, in which the sickle-feathers of the tail are 6 or 7 feet long. In Japan they are said to assume a much greater length. One bird in the museum at Tokio is stated to have sickle-feathers 17 feet long; but examination is not permitted. In other respects the fowls are not peculiar, resembling the birds of the Game type.

Bantam.—This term is applied to fowls of a diminutive size without any reference to the particular breed. By careful selection and crossing with small specimens any variety can be reduced to the desired size. The Chinese had in the summer palace at Peking small Cochins weighing not more than 1 ℔ each. Game bantams of less size have been established during the past twenty-five years. The Malays have been reduced to bantam size within a very few years, as have the crested breeds. The Japanese have long possessed a dwarf breed with enormous tail and comb, and with very short legs. One of the most artificial breeds is the Sebright bantam, named after its originator. This bird has the laced or marginal feather of the Polish combined with the absence of male plumage in the cocks, so that it may be described as a hen-feathered breed with a laced plumage. When perfect in marking it is of singular beauty, but is not remarkable for fertility.

In breeding the domestic fowl for useful purposes it is desirable to follow to a greater extent than is usual the natural habits and instincts of the bird. The wild fowl is a resident in forests, coming out to feed in the open; in addition to green vegetables and fruit it lives on grain, seeds, worms, grubs, and insects, which it obtains by scratching in the soil; it roosts in the higher branches of trees, and the hen deposits her eggs on the ground, usually in a concealed situation, laying one egg every other day until the number is completed, when she sits for twenty-one days. On the chickens being hatched they do not leave the nest for twenty-four or thirty hours, being nourished by the absorption of the yolk into the intestinal canal. When they are sufficiently strong to run after the hen she takes them in search of food, which she obtains by scratching in the ground or amongst decaying vegetable matter.

A domesticated hen allowed to make her own nest in a hedge or coppice always brings out a much larger, stronger, and healthier brood than one that sits in the dry, close atmosphere of a hen-house. Wherever the nest is placed it should always be made of damp earth so as to supply the requisite moisture and cool the under surface of the eggs as compared with the upper. When hatched the chicken should not be removed for twenty-four hours, feeding not being required. The first food should be egg and milk—equal parts—beaten together and heated until it sets into a soft mass; this may be given with a little canary seed for the first day or two, or millet or wheat; newly-ground sweet oatmeal is good, but pungent rancid meal very injurious. The chickens do much better if the hen is allowed to scratch for them than when she is shut up in a coop. If a coop must be used it should be so constructed as to include a plot of grass and be moved daily. The perches in a hen-house should be on one level, or the fowls fight for the highest. All should be low, so that in flying down the breast-bone and feet may not be injured by coming violently in contact with the ground.

Keeping poultry without an extended range in which they can obtain a large portion of their own food is not desirable, nor has the establishment of poultry-farms, in which large numbers of birds are kept in one locality, ever under any conditions been attended with success. In all cases in which a large number of fowls are congregated together the ground becomes contaminated by the excrement of the birds; the food is eaten off the soiled surface; disease breaks out amongst the adults; and rearing chickens successfully is out of the question. There are no poultry-farms in France, the eggs and chickens being produced by the peasant-proprietors. In England many poultry-farms have been started, but none have ever proved successful. Poultry-rearing is an industry adapted to the small holder, to the rearer for home consumption, or as an adjunct to the work of a large farm, but as an industry of its own it is never likely to be worked to advantage. There is no difficulty whatever in hatching any number of chickens, but when the young birds are crowded together and are living on tainted soil they invariably become diseased and die with extreme rapidity. The conditions of a crowded poultry-run necessarily resemble those of an army encamped without due sanitary precautions, which cannot be adopted in the case of the birds. The inevitable result is that they perish of diseases of a typhoid character which are quite beyond the power of the owners to control or alleviate.

Turkeys.—The origin of the domesticated turkey is probably of a composite character; by Mr. Gould and other naturalists this bird is generally regarded as having been derived from the Mexican species *Meleagris mexicana;* but this has recently been crossed with the North-American *M. gallo-pavo*, with great advantage as to size and hardihood. The varieties of the turkey differ chiefly as to color. The principal English breeds are the bronze or Cambridgeshire, the black or Norfolk, the fawn, and the white. Of these the first, especially when crossed with the American, is the largest and most desirable.

Turkeys are not so extensively raised in Great Britain as in France, from a prevalent opinion that they are very delicate and difficult to rear: this idea arises in great part from errors in their management and feeding. The chicks, when hatched after twenty-eight days' incubation, should be left undisturbed for twenty-four or thirty hours, during which time they are digesting the yolk that is absorbed into the intestinal canal at birth. No attempt should be made to cram them; their first food should consist of sweet, fresh meal, soft custard made with equal parts of egg and milk set by a gentle heat, and, above all, abundance of some bitter, milky herb, as dandelion, or, much better, lettuce running to seed, on which they can be reared successfully with very little food of any other description. The young turkeys progress much better if the hen has the range of a small enclosure from the first than if she is confined to a coop; thus reared they are much hardier than when cooped and corn-fed, and not so susceptible to injury from slight showers; but a damp locality should be avoided. Turkey-hens are most persevering sitters, and are employed in France to hatch successions of sittings of hen's eggs. Turkeys can often be most advantageously reared by cottagers, as one or two hens only can be kept, one visit to the male being sufficient to fertilize the entire batch of eggs. The young turkeys find a larger proportion of their own food than fowls, and with a good free range cost but little until they are ready for fattening for the table. In places where the opportunity serves they may be allowed to roost in the trees with great advantage. Some wild flocks treated like pheasants are to be found in several of the large parks in Scotland as well as in England.

Guinea-fowls.—The common guinea-fowl (*Numida meleagris*) is a native of eastern Africa, from whence it has been carried to many parts of the world, in some of which, as the West Indian Islands, it has become wild. It has also been reared in a half-wild state in many English preserves; under these conditions it flourishes exceedingly, but has the disadvantage of driving away the pheasants. In any dry locality guinea-fowls may be successfully reared, provided they have a good range and trees in which they can roost. The hen lays an abundance of eggs, which are generally hidden. The birds are useful as furnishing a supply of poultry for the table in the interval that ensues between the time when game are out of season and that before chickens arrive at maturity. On a dry, sandy, and chalky soil and in a warm situation they are reared with ease, but are quite unsuited to damp cold localities. The continued vociferation of the hen-birds renders their maintenance near a house very objectionable, as the cry is continued throughout great part of the night. Several variations of color exist, but they do not require any detailed description.

Ducks.—All the varieties of the domesticated duck are descended from the Common Mallard or Wild Duck, *Anas boschas*, a species which, though timid in its wild state, is easily domesticated, and suffers changes of form and color in a few generations. The most important breeds are: the Rouen, which, retaining the color of the original species, grows to a large size; the Aylesbury, a large white breed with an expanded lemon-colored bill; the Pekin, a white breed with a pale yellowish tint in the plumage, and a very bright orange bill; two breeds which are entirely black. The smaller of these, which has been bred down to a very diminutive size, is remarkable for the extreme lustre of its feathers and the fact that its eggs are covered with a dark black pigment, which becomes less in quantity as each successive egg is deposited. It is known by the equally absurd names of East Indian, Labrador, or Buenos Ayres duck. The larger black variety, the Cayuga duck, has been recently introduced into England. Decoy or call ducks are small breeds of a very loquacious character, which were originally bred for the purpose of attracting the wild birds to the decoys. Some are of the natural color, others are white. Amongst the less known breeds are the Duclair ducks of France, evidently the result of crossing white and colored varieties. Among the breeds differing in structure may be mentioned the Penguin duck, so called from its erect attitude, the Hook-billed and the Tufted ducks, etc., but these are not of practical importance. For table and market purposes no breed surpasses the Aylesbury; its large size, great prolificacy, early maturity, and white skin and plumage cause it to be reared in immense numbers for the London markets. By good feeding the ducks are caused to lay in the winter months, when the eggs are hatched under Cochin or Brahma hens, the young ducklings being reared in artificially-warmed buildings or in the laborers' cottages; they are fed most liberally on soft food, soaked grits, boiled rice with tallow-melters' greaves, and in ten or twelve weeks are fit for the market; if killed before moulting their quills, which they do when about twelve weeks old, they are heavier than afterwards and much better eating. When ducklings are required for the early spring markets the old birds must be fed most freely to cause the production of eggs in cold weather, corn being given in vessels of water, and the birds must be shut up at night, or the eggs will be laid in the water, where they sink and become putrid. Duck-rearing is a very profitable industry, very high prices being paid for ducklings in the early months of the year. The so-called Muscovy duck is a Brazilian species, *Cairina moschata*, which is not reared for the market, although the young birds are edible. The drake not unfrequently mates with the common duck, and large but sterile hybrids are the result.

Geese.—The domestic goose of Europe is undoubtedly the descendant of the migratory Gray Lag Goose, *Anser cinereus*, from which it differs chiefly by its increased size. Although domesticated since the time of the Romans, it has not been subject to much variation. The most important breeds are the large gray variety known as the Toulouse, the white breed known as the Embden, and the common variety frequently marked with dark feathers on the back, and hence termed "saddlebacks." There has also been introduced from the Crimea since the Russian war a variety in which the feathers are singularly elongated, and even curled and twisted; this breed which is termed the Sebastopol, is of small size and more important as a fanciers' breed than from a practical point of view. In some countries a second species is domesticated; it is usually termed the Chinese knob-fronted, or swan goose, *Anser cygnoides*. Though perfectly distinct as a species, having a different number of vertebræ in the neck and a loud clanging voice, it breeds freely with the common goose, and the hybrids produced are perfectly fertile, the late Mr. Blyth asserting that over a large tract of country in the East no other geese except these cross-breds are ever seen. Geese are much more exclusively vegetable-feeders than ducks, and can only be kept to profit where they can obtain a large proportion of their food by grazing. The old birds should not be killed off, as they continue fertile to a great age. Geese are readily fattened on oats thrown into water, and the young, when brought rapidly forward for the markets, afford a very good profit. The Chinese, if well fed, lay at a much earlier date than the common species, and, if their eggs are hatched under large Cochin hens, giving three or four to each bird, the young are ready for the table at a very early period. The nest, as in all cases of ground-nesting birds, should be made on the earth and not in boxes, which become too dry and overheated. In breeding for the market or for the sake of profit, the very large exhibition birds should be avoided, as many are barren from over-fatness, and none are so prolific as birds of fair average size.

In this article the Pea-fowl (see PEACOCK, vol. xviii. p. 454) has not been included, as, although long since domesticated, it is to be regarded rather as an ornamental than as a useful bird, and in congenial localities, in which it can avail itself of the shelter of trees it requires no management whatever beyond feeding, nor should the slightest interference with the sitting hen be practiced.

Pigeons.—All the different breeds of pigeons which are known to the fancier have descended from the wild blue Rock-dove, *Columba livia*, and return to the coloration and form of the wild original if allowed to interbreed without interference. When reared as articles of food pigeons are generally treated most disadvantageously; with due care and proper management six or seven couples of young can be raised from each old pair during the year, and a continuous supply of young birds for the table can be depended on. The ordinary pigeons' houses are most objectionable, the birds being exposed to rain and extremes of temperature at all seasons. To be reared successfully pigeons should be housed in a room or loft, with shelves 9 or 10 inches in width running round the walls about 10 inches apart; each shelf should be divided into compartments not less than 16 inches long; this arrangement gives room for a nest at each end and enables the old birds to go to nest again before the young are able to fly. If coarse earthen saucers or nest-pans are used the young will be kept out of the dung, which is ejected over the sides and can be easily removed. They are first fed with a secretion from the crops of the parents, and afterwards with disgorged corn; when required for the table they should be killed before the old birds cease to feed them, as when they begin to feed themselves they lose weight, become thin, and are much less marketable. To obtain a continuous supply of young pigeons the old birds must be well fed with grain and pulse; clean water and a supply of old mortar rubbish mixed with salt should be always accessible; the loft and nest should be kept clean and well ventilated, and the birds have free access to the open air. The breed should be of fair size, the blue rocks being too small to be of full market value as dead birds, though in great request for pigeon-shooting, and unless a considerable number are kept so as to prevent close interbreeding, some birds from other lofts should be introduced occasionally. The numerous fancy breeds and those employed for conveying messages (see vol. xiii. p. 166) do not fall within the scope of this article.

(W. B. T.)

POUND, an enclosure in which cattle or other animals found straying are retained until they are redeemed by the owners, or when taken in distraint until replevined, such retention being in the nature of a pledge or security to compel the performance of satisfaction for debt or damage done. A pound belongs to the township or village and should be kept in repair by the parish. The pound-keeper is obliged to receive everything offered to his custody and is not answerable if the thing offered be illegally impounded. By the statute 1 and 2 Phil. and Mary c. 12 (1554), no distress of cattle can be driven out of the hundred where taken unless to a pound within 3 miles of the place of seizure. Where cattle are impounded the impounder is bound to supply them with sufficient food and water (12 and 13 Vict. c. 92, and 17 and 18 Vict. c. 60); any person, moreover, is authorized to enter a place where animals are impounded without food and water more than twelve hours and supply them without being liable to an action for such entry, and the cost of such food is to be paid by the owner of the animal before it is removed. The statute 2 Will. and Mary, sess. 1, c. 5 (1690), gives treble damages and costs against persons guilty of *pound breach*, and by 6 and 7 Vict. c. 30 (1843) persons releasing or attempting to release cattle impounded or damaging any pound are liable to a fine not exceeding £5, awardable to the person on whose behalf the cattle were distrained, with imprisonment with hard labor not exceeding three months in default. In the old law books a distinction is drawn between a common pound, an open pound, and a close pound; these terms have now, however, lost much of, if not all, their significance. By statute 11 George II. c. 19 (1738), which was passed for the benefit of landlords, any person distraining for rent may turn any part of the premises upon which a distress is taken into a pound *pro hac vice* for securing of such distress.

POUSHKIN, ALEXANDER (1799–1837), the most celebrated of Russian poets, was born at Moscow, 7th June, 1799. He belonged to an ancient family of boyars, and in a clever poem, many of the sallies of which were too trenchant to pass the censorship, he has sketched some of the more important of his progenitors. A strange ancestor was his maternal great-grandfather, a favorite Negro ennobled by Peter the Great, who bequeathed to him the curly hair of his race and a somewhat darker complexion than falls to the lot of the ordinary Russian.

In 1811 the poet entered the newly-founded lyceum of Tzarskoe Selo, situated near St. Petersburg. To his stay in this college Poushkin has alluded in many of his poems. On quitting the lyceum in 1817 he was attached to the ministry of foreign affairs, and in this year he began the composition of his *Ruslan and Ly'udmila*, a poem which was completed in 1820. The scene is laid at Kieff, in the time of Vladimir, the "bright sun" of the old Russian legends. Meanwhile Poushkin mixed in all the gayest society of the capital, and it seemed as if he would turn out a mere man of fashion instead of a poet. But an event occurred which, however disastrous it might appear to him at first sight, was fraught with the happiest consequences to his muse. A very daring *Ode to Liberty* written by him had been circulated in manuscript in St. Petersburg. This production having been brought to the notice of the governor, the young author only escaped a journey to Siberia by accepting an official position at Kishineff in Bessarabia, in southern Russia. Here he found himself surrounded by a world of new associations. If we follow the chronological order of his poems, we can trace with what enthusiasm he greeted the ever-changing prospects of the sea and the regions of the Danube and the Crimea. In some elegant lines he sang the *Fountain of Bakhchisarai*, the old palace of the khans near Simpheropol. This fountain and the legend connected with it he afterwards made the subject of a longer poem.

At this time Poushkin was, or affected to be, overpowered by the Byronic "Weltschmerz." Having visited the baths of the Caucasus for the re-establishment of his health in 1822, he felt the inspiration of its magnificent scenery and composed his next production of any considerable length, *The Prisoner of the Caucasus*, narrating the story of the love of a Circassian girl for a youthful Russian officer who has been taken prisoner. This was followed by the *Fountain of Bakhchisarai*, which tells of the detention of a young Polish captive, a Countess Potocka, in the palace of the khans of the Crimea. About the same time he composed some interesting lines on Ovid, whose place of banishment, Tomi, was not far distant. To this period belongs also the *Ode to Napoleon*, which is far inferior to the fine poems of Byron and Manzoni or indeed of Lermontoff, on the same subject. In the *Lay concerning the Wise Oleg* we see how the influence of Karamzin's *History* had led the Russians to take a greater interest in the early records of their country. The next long poem was the *Gipsies* (Tzuigani), an Oriental tale of love and vengeance, in which Poushkin has admirably delineated these nomads, whose strange mode of life fascinated him. During his stay in southern Russia he allowed himself to get mixed up with the secret societies then rife throughout the country. He also became embroiled with his chief, Count Vorontzoff, who sent him to report upon the damages which had been committed by locusts in the southern part of Bessarabia. Poushkin took this as a premeditated insult and sent in his resignation, and Count Vorontzoff in his official report requested the government to remove the poet, "as he was surrounded by a society of political and literary fanatics, whose praises might turn his head and make him believe that he was a great writer, whereas he was only a feeble imitator of Lord Byron, an original not much to be commended." The poet quitted Odessa in 1824, and on leaving wrote a fine *Ode to the Sea*. Before the close of the year he had returned to his father's seat at Mikhailovskoe, near Pskoff, where he soon became embroiled with his relatives, but grew more at ease when the veteran, who led the life of reckless expenditure of the old-fashioned Russian boyar, betook himself to the capital. The father survived his celebrated son, and it was to him that Zhukovski addressed a pathetic letter, giving him an account of his death. His mother died a year before her son, and Poushkin, when choosing a burial-place for her, marked out a spot for himself and expressed a presentiment that he had not long to live. He had now involved himself in trouble on all sides, for so obnoxious had he become to the authorities, even during his retreat in the country, that he was put under the supervision of the governor, the marshal of the nobility, and the archimandrite of the neighboring monastery of Svyatogorski. In his retirement he devoted a great deal of time to the study of the old Russian popular poetry, the *builinas*, of which he became a great admirer. Recollections of Byron and André Chenier gave the inspiration to some fine lines consecrated to the latter, in which Poushkin appeared more conservative than was his wont and wrote in a spirit antagonistic to the French Revolution. In 1825 he published his tragedy *Boris Godunoff*, a bold effort to imitate the style of Shakespeare. Up to this time the traditions of the Russian stage, such as it was, had been French. Plays of all kinds had appeared—translations of Molière, Corneille, and Racine, or adaptations of them, and even glimpses of Shakespeare conveyed through the medium of the paltry versions of Ducis.

In 1825 the unfortunate conspiracy of the Dekabrists broke out, the ostensible aim of which was to defend the claims of the grand-duke Constantine against his brother Nicholas, but the real purpose was to set up a republican form of government in Russia, for which the country was not by any means prepared. Many of the conspirators were personal friends of Poushkin, especially Küchelbecker and Pustchin. The poet himself was to a certain extent compromised, but he succeeded in getting to his house at Mikhailovskoe and burning all the papers which might have been prejudicial to him. He had resolved to go to St. Petersburg, possibly to throw in his lot with his friends there, but was stopped by what are considered portents by the Russian people. As soon as he had left the gates of his house he met a priest, and he had not gone a verst before three hares crossed his path. These were such bad omens that there was nothing for him to do, as a genuine Russian and at all times a superstitious man, but to return home at once. Through influential friends he succeeded in making his peace with the emperor, to whom he was presented at Moscow soon after his coronation. The story goes that Nicholas said to Count Bludoff on the same evening, "I have just been conversing with the most witty man in Russia." In 1828 appeared *Poltava*, a spirited narrative poem, in which the expedition of Charles XII. against Peter, and the treachery of the hetman Mazeppa were described. The best part of the poem is the picture of the battle itself, where the colors are laid on very boldly. In 1829 Poushkin again visited the Caucasus, on this occasion accompanying the expedition of Prince Paskewitch. He wrote a pleasing account of the tour; many of the short lyrical pieces suggested by the scenery and associations of his visit are delightful, especially the lines on the Don and the Caucasus. In 1831 Poushkin married Mademoiselle Natalia Goncharoff, and in the following year was again attached to the ministry of foreign affairs, with a salary of 5000 roubles. He now busied himself with an historical work, an account of the revolt of the Cossack Pugacheff, who almost overthrew the empire of Catherine and was executed at Moscow in the latter part of the 18th century. While engaged upon this he wrote *The Captain's Daughter*, one of the best of his prose works. In 1832 was completed the poem *Eugene Onyegin*, in which the author attempted a completely new style, moulding his production upon the lighter sketches of Byron in the Italian manner. The poem is, on the whole, very successful. The metre is graceful and sprightly and well adapted for seriocomic verse. The characters of Lenski, Onyegin, Tatiana, and Olga are drawn with a vigorous hand, and each is a type. No one can accuse Poushkin of want of nationalism in this poem: it is Russian in every fibre.

In 1837 the poet, who had been long growing in literary reputation, fell mortally wounded in a duel with Baron George Heckeren d'Anthès, the adopted son of the Dutch minister then resident at the court of St. Petersburg. D'Anthès, a vain and frivolous young man, had married a sister of the poet's wife. Notwithstanding this he aroused Poushkin's jealousy by some attentions which he paid Natalia; but the grounds for the poet's anger, it must be confessed, do not appear very great. Poushkin died, after two days' suffering, on the afternoon of Friday, 10th February. D'Anthès was tried by court-martial and expelled the country. In the year 1880 a statue of the poet was erected at the Tver Barrier at Moscow, and fêtes were held in his honor, on which occasion many interesting memorials of him were exhibited to his admiring countrymen and a few foreigners who had congregated for the festivities. The poet left four children; his widow was afterwards married to an officer in the army named Lanskoi; she died in 1863.

Poushkin remains as yet the greatest poet whom Russia has produced. The most celebrated names before him were those of Lomonosoff and Dershavin; the former was a composer of merely scholastic verses, and the latter, in spite of great merits, was too much wedded to the pedantries of the classical school. Since Poushkin's death, Lermontoff and Nekrasoff have appeared, both distinctly writers of genius, but they are confessedly inferior to him. His poetical tales are spirited and full of dramatic power. The influence of Byron is undoubtedly seen in them, but they are not imitations, still less is anything in them plagiarized. *Boris Godunoff* is a fine tragedy; on the whole *Eugene Onyegin* must be considered Poushkin's masterpiece. Here we have a great variety of styles—satire, pathos, and humor mixed together. The character-painting is good, and the descriptions of scenery introduced faithful to nature. The poem in many places reminds us of Byron, who himself in his mixture of the pathetic and the humorous was a disciple of the Italian school. Poushkin also wrote a great many lyrical pieces. Interspersed among the poet's minor works will be found many epigrams, but some of the best composed by him were not so fortunate as to pass the censorship, and must be read in a supplementary volume published at Berlin. As a prose writer Poushkin has considerable merits. Besides his *History of the Revolt of Pugacheff*, which is perhaps too much of a compilation, he published a small volume of tales under the *nom de plume* of Ivan Byelkin. These all show considerable dramatic power; the best are *The Captain's Daughter*, a tale of the times of Catherine II., *The Undertaker*, a very ghostly story, which will remind the English reader of some of the tales of Edgar Poe; *The Pistol Shot*; and *The Queen of Spades*. Of the letters of Poushkin, which originally were to be found scattered over many magazines and literary journals, a fairly complete collection was published in the new edition of his works which appeared at Moscow under the editorship of M. Yefrimoff. (W. R. M.)

POUSSIN, Nicolas (1594–1665), French painter, was born at Les Andelys (Eure) in June, 1594. Early sketches, made when he should have been learning Latin, attracted the notice of Quentin Varin, a local painter, whose pupil Poussin became, till he went to Paris, where he entered the studio of Ferdinand Elle, a Fleming, and then of the Lorrainer L'Allemand. He found French art in a stage of transition: the old apprenticeship system was disturbed, and the academical schools destined to supplant it were not yet established; but, having been brought into relations with Courtois the mathematician, Poussin was fired by the study of his collection of engravings after Italian masters, and resolved to go to Italy. After two abortive attempts to reach Rome, and when he was again on the road, he fell in with the chevalier Marini at Lyons. Marini employed him on illustrations to his poems, took him into his household, and in 1624 enabled Poussin (who had been detained by commissions in Lyons and Paris) to rejoin him at Rome. There, his patron having died, Poussin fell into great distress; but his high qualities had won him friends amongst his brother artists, and on his falling ill he was received into the house of his compatriot Dughet and tenderly nursed by his daughter Anna Maria, to whom in 1629, when his affairs were easier, Poussin was married. Amongst his first patrons were Cardinal Barberini, for whom was painted the death of Germanicus (Barberini Palace); Cardinal Omodei, for whom he produced, in 1630, the Triumphs of Flora (Louvre); Cardinal de Richelieu, who commissioned a Bacchanal (Louvre); Vicenzo Giustiniani, for whom was executed the Massacre of the Innocents, of which there is a first sketch in the British Museum; Cassiano del Pozzo, who became the owner of the first series of the Seven Sacraments (Belvoir Castle); and Fiéart de Chanteloup, with whom in 1640 Poussin, at the call of Sublet De Noyers, returned to France. He was well received by Louis XIII., who conferred on him the title of "first painter in ordinary," and in two years at Paris he produced not only several pictures for the royal chapels (the Last Supper, painted for Versailles, now in the Louvre) but eight cartoons for the Gobelins, the series of the Labors of Hercules for the Louvre, the Triumph of Truth for Cardinal Richelieu (Louvre), and much minor work; but in 1643, annoyed and disgusted by the intrigues of Simon Vouët, Feuquières, and the architect Lemercier, Poussin withdrew to Rome. There, in 1648, he finished for De Chanteloup the second series of the Seven Sacraments (Bridgewater Gallery), and also his noble landscape with Diogenes throwing away his Scoop (Louvre); in 1649 he painted the Vision of St. Paul (Louvre) for the comic poet Scarron, and in 1651 the Holy Family (Louvre) for the duke of Créqui. Year by year he continued to produce an enormous variety of works, many of which are included in the list given by Félibien, in which we find the names of Pointel the banker, Cardinal Manimo, Madame Mouroi, and others. He is said to have settled in a house on the Pincio, but in 1656, the year of the plague, he is entered in the census as living with his wife in the Via Paolina. He died in November, 1665, and was buried in the church of St. Lawrence in Lucina, his wife having predeceased him.

The finest collection of Poussin's paintings as well as of his drawings is possessed by the Louvre; but, besides the pictures in the National Gallery and at Dulwich, England possesses several of his most considerable works; the Triumph of Pan is at Basildon (Berkshire), and his great allegorical painting of the Arts at Knowsley. At Rome, in the Colonna and Valentini Palaces, are notable works by him, and one of the private apartments of Prince Doria is decorated by a great series of landscapes in distemper, which are little known. Throughout his life he stood aloof from the popular movement of his native school. French art in his day was purely decorative, but in Poussin we find a survival of the impulses of the Renaissance coupled with conscious reference to classic work as the standard of excellence. In general we see his paintings at a great disadvantage, for the color, even of the best preserved, has changed in parts, so that the keeping is disturbed; and the noble construction of his designs can be better seen in engravings than in the original. Amongst the many who have reproduced his works the two Audrans, Claudine Stella, Picart, and Pesne are the most successful.

Poussin left no children, but he adopted as his son Gaspar Dughet, his wife's brother, who took the name of Poussin. **Gaspar Poussin** (1613-1675) devoted himself to landscape painting and rendered admirably the severer beauties of the Roman Campagna; a noteworthy series of works in tempera representing various sites near Rome is to be seen in the Colonna Palace, but one of his finest easel-pictures, the Sacrifice of Abraham, formerly the property of the Colonna, is now, with other works by the same painter, in the English National Gallery. The frescos executed by Gaspar Poussin in S. Martino di Monti are in a bad state of preservation. The Louvre does not possess a single work by his hand. Gaspar died at Rome in 1675.

Sandrart, *Acad. nob. art. pict.*; *Lettres de Nicolas Poussin* (Paris, 1824); Félibien, *Entretiens*; Gault de St. Germain, *Vie de Nicolas Poussin*; D'Argenville, *Abrégé de la Vie des Peintres*; Bouchitté, *Poussin et son Œuvre*; Emilia F. S. Pattison, "Documents inédits, Le Poussin," in *L'Art* (1882).

POUT, also **Whiting-Pout** or **Bib** (*Gadus luscus*), a small species of cod-fish locally abundant on the coast of northern and western Europe, but less so in the Mediterranean. It is distinguished from other species of the genus *Gadus* by having a deep short body; a short and obtuse snout, not longer than the eye; the upper jaw the longer; and a long barbel at the chin. The three dorsal fins are composed of respectively twelve, twenty, or twenty-two, and nineteen or twenty rays, the two anal fins of from twenty-nine to thirty-two and nineteen or twenty. A black spot occupies the upper part of the base of the pectoral fin. Pout affect certain localities of limited extent, where a number may be caught with hook and line. They are excellent food, but must be eaten soon after capture and do not bear carriage. A pout of 5 lb is considered a very large specimen.

POWAN, or **Powen** (*Coregonus clupeoides*), a species of the Salmonoid genus *Coregonus*, which seems to be peculiar to Loch Lomond in Scotland, the great lakes of Cumberland, where it is called "schelly," and Lake Bala in Wales, the Welsh name of the fish being "gwyniad." It is not found in other European waters; but of the numerous Continental species of this genus the lavaret of the Swiss lakes resembles it most. Powan, or, as they are sometimes called, freshwater herrings, live in the deepest parts of the lakes mentioned and come to the surface only occasionally, either in the winter time in order to spawn, or at certain times of the day during summer, approaching, it is said, the shores in search of food. Large numbers may then be taken with nets, and are mostly consumed on the spot. The powan rarely exceeds a length of 14 inches; it has been fully described and figured by Parnell (*Annals of Natural History*, 1838, vol. i. p. 162) under the names of *Coregonus lacepedei* and *Coregonus microcephalus*; the specimens to which the latter name was given are, however, not specifically different from the typical powan.

POWERS, Hiram (1807-1873), American sculptor, was the son of a farmer, and was born at Woodstock, Vermont, on 29th June, 1807. In 1819 his father removed to a farm in Ohio, about six miles from Cincinnati, where the son attended school for about a year, staying meanwhile with his brother, a lawyer in Cincinnati. After leaving school he found employment in superintending a reading-room in connection with the chief hotel of the town, but, being, in his own words, "forced at last to leave that place as his clothes and shoes were fast leaving him," he became a clerk in a general store. His second employer in this line of business having invested his capital in a clock and organ factory, Powers set himself to master the construction of the instruments, displaying an aptitude which in a short time enabled him to become the first mechanic in the factory. In 1826 he began to frequent the studio of Mr. Eckstein, and at once conceived a strong passion for the art of sculpture. His proficiency in modelling secured him the situation of general assistant and artist of the Western Museum, kept by a Frenchman, M. Dorfeuille, where his ingenious representation of the infernal regions to illustrate the more striking scenes in the poem of Dante met with extraordinary success. After studying thoroughly the art of modelling and casting, he in the end of 1834 went to Washington, and a friend having secured for him as sitters the president and some of the leading statesmen his remarkable gifts soon awakened general attention. In 1837 he settled in Florence, where he remained till his death. While from pecuniary considerations he found it necessary to devote the greater part of his time to busts, his best efforts were bestowed on ideal work. In 1838 his statue of Eve excited the warm admiration of Thorwaldsen, and in 1839 he produced his celebrated Greek Slave, which at once gave him a place among the greatest sculptors of his time. Among the best known of his other ideal statues are the Fisher Boy, Il Penseroso, Proserpine, California, America (modelled for the Crystal Palace, Sydenham), and the Last of his Tribe. Among the eminent men whose busts he modelled are many of the leading contemporary statesmen of America. His genius was strikingly realistic and unconventional, a quality doubtless in some degree attributable to the nature of his early training, but it was the close and thorough study of the works of the great masters which finally disciplined his powers to their highest perfection of purity and refinement. He died on 27th June, 1873.

Among various obituary notices of Powers one of the most interesting is that by his intimate friend T. A. Trollope in *Lippincott's Magazine* for February, 1875.

POZZO DI BORGO, CARLO ANDREA (1764–1842), Russian diplomatist, was descended from an old Corsican family, and was born at Alata near Ajaccio on 8th March, 1764. After completing his legal studies at Pisa he became advocate at Ajaccio, where in 1790 he joined the party of Paoli, to whom the Buonaparte family was strongly opposed. In his early years he had been on terms of the closest intimacy with Napoleon, but from this time a feeling of enmity sprang up between them, which on the part of Pozzo di Borgo increased as the career of Napoleon developed, until it became the ruling passion of his life. Ultimately his hatred of Napoleon knew no bounds, and, regarding him as the "scourge of the world," he sought to compass his ruin with a pertinacity which discouragements and difficulties served only to whet and kindle into redoubled ardor. In 1794 he was chosen president of the Board of Council, under the English viceroy, and when the British were expelled from the island in 1797 he went to London, where he carried on a secret mission on behalf of the Bourbons. At Vienna in 1798 he assisted in effecting a coalition between Austria and Russia against France, and in 1803 he entered the Russian service, where he became councillor of state, and was employed by the czar in all his most important diplomatic negotiations. He attempted in vain to form a new coalition after the battle of Jena, and retired, first to Austria, then to England. Recalled to Russia in 1812, he exerted all his influence to urge a continuance of the war with France till the power of Napoleon should be broken. In addition to this he secured the alliance of the Swedish crown prince Bernadotte, and also went to London to secure the active co-operation of England. He it was who counselled the allies to bring matters to a crisis by marching on Paris, and it was he who penned the famous declaration that they waged war against Napoleon, not against the French people. He gave warning to the congress of Vienna of the possibility of Napoleon returning from Elba, was present at the battle of Waterloo, where the power of Napoleon was finally crushed, and on 20th November, 1815, enjoyed the supreme satisfaction of signing the treaty of Paris as Russian ambassador. In 1826 he was appointed to represent Russia at Paris. He retired from public life in 1835, and died at Paris on 15th February, 1842.

Stein et Pozzo di Borgo, 1846, English trans., 1847; Vuhrer, *Notice biographique sur le Comte Pozzo di Borgo*, 1842.

POZZUOLI, the ancient PUTEOLI, a city of Italy, on the northern shore of the Bay of Pozzuoli (Sinus Puteolanus or Cumanus),—the western portion of the Gulf of Naples, separated from the larger eastern portion by the promontory of Posillipo and from the open sea on the west by the peninsula which terminates in Cape Miseno. It is a place of 11,967 inhabitants (1881), and the centre of a commune, which, including Bacoli (3130; the ancient Bauli) and Nisida (1202), numbers 17,269. Its small flat-roofed houses cluster picturesquely on a tongue of land projecting southwest into the bay. The cathedral of St. Proculus occupies the site of a temple erected to Augustus by L. Calpurnius and contains the tomb of Pergolesi. The harbor is still visited by 500 or 600 sailing vessels in the course of the year. But the true riches of Pozzuoli are its ruins. First in point of interest is the Serapeum or temple of Serapis. This consisted of a rectangular court enclosed by forty-eight massive columns and having in the centre a round temple with sixteen Corinthian pillars of African marble. The three great columns of the portico, about 40 feet high, still stand. The perforations of a boring mollusc show that they must for a time have been submerged 13 feet in the sea. The new upheaval of the ground appears to have begun before 1530 and to have been hastened by the great Monte Nuovo eruption of 1538. A gradual subsidence has again been observed since the beginning of the 19th century. The pillars of the round temple are now in Caserta, and the statue of Serapis is in the National Museum at Naples. The amphitheatre (482 feet long by 383 broad), erected in the time of the Flavian dynasty on the hill behind the town, was seated for 30,000 spectators, and had an arena 286 feet long and 138 feet broad. Among the populace the building is known as the Prison of St. Januarius, because, according to the legend, that saint and his companions were here condemned to fight with wild beasts. At an earlier date it had been the scene of the spectacle in which Nero, in presence of King Tiridates of Armenia, displayed his personal prowess. To the west of the Serapeum lie traces of various minor ruins, a temple of Neptune, etc., and especially the site of Cicero's villa (Puteolanum or Academia), which was afterwards occupied by a temple in honor of the emperor Hadrian. The whole neighborhood has proved rich in epigraphic remains.

Puteoli first appears under the name of Dicæarchia as a port of the people of Cumæ. The statement made by Stephanus of Byzantium and Eusebius, that the city was founded by a colony of Samians, probably refers to some secondary accession of population from that quarter. The Romans in 215 B.C. introduced a garrison of 6000 men to protect the town from Hannibal; and in 194 B.C. a Roman colony was established. In the Civil War the citizens sided first with Pompey and afterwards with Brutus and Cassius. Augustus strengthened the colony with a body of his veterans (hence *Colonia Augusta*), and Nero admitted the old inhabitants into it. The remains of Hadrian, who died at the neighboring town of Baiæ, were burned at Puteoli, and Antoninus Pius, besides erecting the temple to his memory already mentioned, instituted sacred games to be held in the city every five years. It was mainly, however, as a great commercial port that Puteoli was famous in ancient times. It was one of the two places in Italy (Rome was the other) where the Tyrian merchants had a regular trading station; it trafficked with Syria (merchants from Berytus are mentioned among its residents), Egypt, Africa, and Spain, and spices from the East, corn from Alexandria, iron from Populonium were stored in its warehouses. Like Ostia, Puteoli was considered a special port of Rome, and, on account of the great safeness and convenience of its harbor, it was preferred to Ostia for the landing of the more costly and delicate wares. Like Ostia, consequently, it was treated as practically part of Rome, and with it enjoyed the peculiar distinction of being enrolled in the Palatine tribe. The artificial mole was probably of earlier date than the reign of Augustus; and by that time there were docks large enough to contain the vessels employed in bringing the obelisks from Egypt. Remains of the piles of the mole still exist, and are popularly known as Caligula's Bridge, from the mistaken idea that they belong to the temporary structure which that emperor flung across the bay from the mole at Puteoli to the shore at Baiæ. Alaric (410) Genseric (455), and Totila (545) successively laid Puteoli in ruins. The restoration effected by the Byzantines was partial and short-lived. Sacked by Grimoald of Beneventum in 715, harassed by the Saracens in the 10th century, captured by John duke of Naples in 1014, and again sacked by the Turks in 1550, the city could hardly have continued prosperous even apart from the earthquakes of 1198 and 1538.

Works on Puteoli have been written by Mazzella (1594), Capaccio (1604), Sarnellius (1691), Parrino (1709), Jorio (1817 and 1830). See the bibliography in *Corp. Inscr. Lat.*, vol. x. part ii. pp. 182, 817.

PRADIER, James, French sculptor, was born at Geneva in 1790 and died in Paris on 5th June, 1852. He was a member of the Academy and a brilliant and popular sculptor of the pre-Romantic period, representing in France the drawing-room classicism which Canova illustrated at Rome. His chief works are the Son of Niobe, Atalanta, Psyche, Sappho (all in the Louvre), Prometheus (Tuileries Gardens), a bas-relief on the triumphal arch of the Carrousel, the figures of Fame on the Arc de l'Étoile, and a statue of J. J. Rousseau for Geneva.

See *Magazin pittoresque*, iii., vi., and xi.; Barbet de Jouy, *Sculptures modernes du Louvre*.

PRAED, Winthrop Mackworth (1802–1839), one of the most illustrious English writers of *vers de société*, was the third and youngest son of William Mackworth Praed, serjeant at law. The name of his father's family had been originally Mackworth, and the circumstances under which the additional title of Praed was adopted are set out in the *Parochial History of Cornwall* (iii. 101). Winthrop, a cognomen famous across the Atlantic as borne by the governor of Massachusetts, was his mother's maiden name, and the union of these three consonantal names in the person of Winthrop Mackworth Praed formed the combination over which Miss Mitford expressed righteous indignation. He was born at 35 John Street, Bedford Row, London, 26th July, 1802, and almost as soon as he could read was taught by his father to "lisp in numbers." His mother died in 1809, whereupon the child was sent to the preparatory school of Langley Broom near Colnbrook, where he remained until he was removed (28th March, 1814) to Eton. Towards the close of his schoolboy days he started a manuscript periodical called *Apis Matina*. This was succeeded in October, 1820, by the *Etonian*, a paper projected and edited by Praed and Walter Blunt, which appeared every month until July, 1821, when the chief editor left the "glade" of Eton and the paper died. Henry Nelson Coleridge, William Sidney Walker, and John Moultrie were the three best known of his coadjutors in this periodical, which was published by Charles Knight, and of which many interesting particulars are set out in Knight's *Autobiography* and in Maxwell Lyte's *Eton College*. Before Praed left school he succeeded in establishing over a shop at Eton a "boy's library" for the use of the higher Etonians, the books of which are now amalgamated in the official "boy's library" in the new buildings. His career at Cambridge, where he matriculated at Trinity College, October, 1821, was marked by exceptional brilliancy. Thrice he gained the Browne medal and twice the chancellor's medal for English verse. He was bracketed third in the classical tripos in 1825, won a fellowship at his college in 1827, and three years later carried off the Seatonian prizes. At the Union his speeches attracted the admiration of his fellow-undergraduates; he struggled, and not unequally, with Macaulay and Austin. The character of Praed during his university life is described by Bulwer Lytton in the first volume of his *Life* (pp. 227–239, 244–246). At Cambridge, as at Eton, the poet was drawn by Charles Knight into the pleasures of magazine-writing. *Knight's Quarterly Magazine* was started in 1822 with Praed as one of the principal contributors, and, after languishing for some time, it expired when three octavo volumes had been issued. For two years (1825–27) he resided at Eton as private tutor to Lord Ernest Bruce, a younger son of the marquis of Aylesbury. During part of this time he was occupied in preparing himself for the profession of the law, and on 29th May, 1829, he was called to the bar at the Middle Temple. He travelled on the Norfolk circuit, where his prospects of advancement were bright, but the bias of his feelings inclined him towards politics, and after a year or two he devoted himself entirely to political life. Whilst at Cambridge he leaned to Whiggism, and even to the autumn of 1829 his feelings were bent towards the same side but with the dawning of the Reform Bill he passed into the opposite ranks, and when he was returned to parliament for St. Germans (17th December, 1830) his election was due to the kindness of Mr. Herries, a zealous member of the Tory party. He sat for that borough until December, 1832, and on its extinction contested the borough of St. Ives, within the limits of which the Cornish estates of the Praeds are situated. The squibs which he wrote on this occasion were collected in a volume printed at Penzance in 1833 and entitled *Trash, dedicated without respect to James Halse, Esq., M.P.*, his successful competitor. Praed subsequently sat for Great Yarmouth from 1835 to 1837, and for Aylesbury from the latter year until his death. During the progress of the Reform Bill he advocated the creation of three-cornered constituencies, in which each voter should have the power of giving two votes only, and maintained that freeholds within boroughs should confer votes for the boroughs and not for the county. Neither of these suggestions was then adopted, but the former ultimately formed part of the Reform Bill of 1866. Praed was for a few months (December, 1834, to April, 1835), secretary to the Board of Control, and he was much gratified at receiving the appointment of deputy high steward of his beloved university of Cambridge. The last years of his life were racked by the pains of phthisis, though all that sympathy and devotion could effect to alleviate his sufferings was accomplished by his wife, Helen, daughter of Mr. George Bogle, whom he had married in 1835. He died at Chester Square, London, on 15th July, 1839, and was buried at Kensal Green on 23d July.

Praed's lighter poetry was the perfection of ease. It abounded in allusions to the characters and follies of the day and passed with playful touch from puns to politics. In his humorous effusions he was the chief of a school which in these latter days has found numerous imitators. Many of his poems were marked by much pathetic feeling, for his talents were by no means limited to puns and jests. Several American issues of his works appeared before the comprehensive English edition of his *Poems*, "with a memoir by Rev. Derwent Coleridge," was published in 1864. At a later date a selection from his poems by Sir George Young was given to the world.

PRÆFECT (*præfectus*) was the title of various Roman officials, both civil and military. A præfect was not one of the magistrates proper; he was, strictly speaking, only the deputy or lieutenant of a superior magistrate or commander. The following were the most important classes of præfects.

1. The city præfect (*præfectus urbi*) acted at Rome as the deputy of the chief magistrate or magistrates during his or their absence from the city. Thus he represented in the earliest times the king and in later times the consul or consuls when he or they were absent on a campaign or on other public duties, such as the celebration of the annual Latin festival on the Alban Mount. The absence of the chief magistrate for more than a single day rendered the appointment of a præfect obligatory; but the obligation only arose when *all* the higher magistrates were absent. Hence so long as the consuls were the only higher magistrates their frequent absence often rendered the appointment of a præfect necessary, but after the institution of the prætorship (367 B.C.) the necessity only arose exceptionally, as it rarely happened that both the consuls and the prætor were absent simultaneously. But a præfect continued to be regularly appointed, even under the empire, during the enforced absence of all the higher magistrates at the Latin festival. The right and duty of appointing a præfect belonged to the magistrate (king, dictator, or consul) whose deputy he was, but it seems to have been withdrawn from the consuls by the Licinian law (367 B.C.), except that they still nominated præfects for the time of the festival. No formalities in the appointment and no legal qualifications on the part of the præfect were required. The præfect had all the powers of the

magistrate whose deputy he was, except that he could not nominate a deputy to himself. His office expired on the return of his superior. There could only be one city præfect at a time, though the dictator Cæsar broke the rule by appointing six or eight præfects simultaneously.

Under the empire there was introduced a city prefecture which differed essentially from the above. Augustus occasionally appointed a city præfect to represent him in his absence from Italy, although the prætors or even one of the consuls remained in the capital. In the absence of Tiberius from Rome during the last eleven years of his reign (26–37 A.D.) the city prefecture, hitherto an exceptional and temporary office, became a regular and permanent magistracy; in all subsequent reigns the præfect held office even during the presence of the emperor in Rome. He was always chosen by the emperor and usually from men who had held the consulship; his office was regarded, like the censorship under the republic, as the crowning honor of a long political career. It was not conferred for any definite length of time, but might be held for years or for life. As under the republic, the præfect was not allowed to quit the city for more than a day at a time. His duty was the preservation of peace in the capital; he was, in fact, the chief of the police, being charged with the superintendence of the streets, markets, and public buildings. He was further entrusted by Augustus with a summary criminal jurisdiction over slaves and rioters, which was, however, gradually extended, till in the time of Severus or even earlier it embraced all offences by whomsoever committed. Further he had the power of dealing with civil cases where his interference seemed requisite in the interests of the public safety, but such occasions were naturally few. By the beginning of the 3d century, and perhaps earlier, appeals to the emperor in civil cases were handed over by him to be dealt with by the præfect. Except where special restrictions interfered, an appeal lay from the præfect to the emperor. Though not a military officer, the præfect commanded the city cohorts (*cohortes urbanæ*), which formed part of the garrison of Rome and ranked above the line regiments, though below the guards (see PRÆTORIANS). The military power thus placed in the hands of the chief of the police was one of the most sorely-felt innovations of the empire. The constitutional changes of Diocletian and Constantine extended still farther the power of the præfect, in whom, after the disbanding of the guards and the removal from Rome of the highest officials, the whole military, administrative, and judicial powers were centered.

2. Under the republic judicial præfects (*præfecti juri dicundo*) were sent annually from Rome as deputies of the prætors to administer justice in certain towns of the Italian allies. These towns were called "prefectures" (*præfecturæ*). After the Social War (90–89 B.C.), when all Italy had received the Roman franchise, such prefectures ceased to exist in fact, though the name was sometimes retained.

3. Under the empire the prætorians or imperial guards were commanded by one, two or even three præfects (*præfecti prætorio*), who were chosen by the emperor from among the knights and held office at his pleasure. From the time of Alexander Severus the post was open to senators also, and if a knight was appointed he was at the same time raised to the senate. The position was one of great influence and importance; the prætorian præfect stood under the immediate orders of the emperor, of whom he was the natural representative and sometimes the rival. Down to the time of Constantine, who deprived the office of its military character, the prefecture of the guards was regularly held by tried soldiers, often by men who had fought their way up from the ranks. In course of time the command seems to have been enlarged so as to include all the troops in Italy except the corps commanded by the city præfect (*cohortes urbanæ*). Further, the prætorian præfect acquired in addition to his military functions, a criminal jurisdiction, which he exercised not as the delegate but as the representative of the emperor, and hence it was decreed by Constantine (331) that from the sentence of the prætorian præfect there should be no appeal. A similar jurisdiction in civil cases was acquired by him not later than the time of Severus. Hence a knowledge of law became a qualification for the post, which under Marcus Antonius and Commodus, but especially from the time of Severus, was held by the first jurists of the age (*e.g.*, Papinian, Ulpian, and Paullus), while the military qualification fell more and more into the background. Under Constantine the institution of the *magistri militum* deprived the prætorian prefecture altogether of its military character, but left it the highest civil office of the empire.

The title of "præfect" was borne by various other Roman officials, of whom we may mention the following:

4. *Præfectus Socium* (*sociorum*).—Under the republic the contingents furnished to the Roman armies by the Italian allies were commanded by Roman officers called *præfecti socium* (*sociorum*), who were nominated by the consuls and corresponded to the tribunes in the legions.

5. *Præfectus Classium.*—Down to near the close of the republic a naval command was never held independently but only in connection with the command of an army, and when the general appointed an officer to command the fleet in his room, this lieutenant was styled "præfect of the fleet" (*præfectus classium*). When in 311 B.C. the people took the appointment of these lieutenants into their own hands the title was changed from "præfects" to *duo viri navales*, or "two naval men"; but under the empire the admirals went by their old name of præfects.

6. *Præfectus Fabrum.*—The colonel of the engineer and artillery corps (*fabri*) in a Roman army was called a præfect; he did not belong to the legion, but was directly subordinate to the general in command.

7. *Præfectus Annonæ.*—The important duty of provisioning Rome was committed by Augustus (between 8 and 14 A.D.) to a præfect, who was appointed by the emperor from among the knights and held office at the imperial pleasure.

8. *Præfectus Ægypti* (afterwards *Præfectus Augustalis*).—Under the empire the government of Egypt was entrusted to a viceroy with the title of "præfect," who was selected from the knights, and was surrounded by royal pomp instead of the usual insignia of a Roman magistrate. He stood under the immediate orders of the emperor. The exceptional position thus accorded to Egypt was due to a regard on the part of the emperors to the peculiar character of the population, the strategic strength of the country, and its political importance as the granary of Rome. (J. G. FR.)

PRÆMONSTRATENSIANS. See ABBEY, vol. i. p. 25, and MONACHISM, vol. xvi. p. 735.

PRÆMUNIRE, the name given to a writ originating in the 14th century in the attempt to put restraint on the action of the papal authority in regard to the disposal of ecclesiastical beneficies in England before the same became vacant, and subsequently, to the prejudice of the rightful patron, and also in the encouragement of resort to the Roman curia rather than to the courts of the country, in disregard of the authority of the crown, leading thereby to the creation of an *imperium in imperio* and the paying that obedience to papal process which constitutionally belonged to the king alone. The word "præmunire"[1] is applied also to the offence for which the writ is granted, and furthermore to the penalty it incurs. The range and description of offences made liable to the penalties of præmunire became greatly widened subsequently to the Reformation, so that acts of a very miscellaneous character were from time to time brought within the scope of enactments passed for a very different purpose. The offence is of a nature highly criminal, though not capital, and more immediately affects the crown and Government. The statute 16 Rich. II. c. 5 (1392) is usually designated the Statute of Præmunire; it is, however, but one only of numerous stringent measures (many of which are still unrepealed) resulting from the enactment of the Statute of Provisors (35 Edw. I. c. 1), passed in a previous reign, which according to Coke (*Instit.*) was the foundation of all the subsequent statutes of præmunire. Cowel (*Law Dict.*) describes a provisor as one who sued to the court of Rome for a provision which was called *gratia expectiva.*

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[1] Præmunire is a corruption of the Latin *præmonere*, to preadmonish or forwarn, and is taken from the words of the writ itself, which runs "Præmunire facias" A. B., etc., *i.e.*, cause A. B. to be forwarned that he appear to answer the contempt wherewith he stands charged.

The penalties of præmunire involved the loss of all civil rights, forfeiture of lands, goods, and chattels, and imprisonment during the royal pleasure. In the Habeas Corpus Act (31 Car. II. c. 2, 1679) the committing of any man to prison out of the realm was made præmunire unpardonable even by the king. It thus appears that, whilst the crown by its prerogative might at any time remit the whole or any part of the punishment incurred by a præmunire, an exception was made in transgressions of the Statute of Habeas Corpus. The Royal Marriage Act (12 Geo. III. c. 11) of 1772 is the last statute which subjects any one to the penalties of a præmunire as ordained by 16 Rich. II.

It cannot be doubted that the legislation exemplified in the Statutes of Præmunire and Provisors was felt by the popes to be a great check on their freedom of action. In the hands of Henry VIII. præmunire became eventually a lever for the overthrow of papal supremacy. The last ancient statute concerning præmunire, until the Reformation, was the 2 Hen. IV. c. 3 (1400) by which all persons who accepted any provision from the pope to be exempt from canonical obedience to their proper ordinary were subjected to the penalties prescribed. Bishop Stubbs,[1] in summing up his account of the various statutes of præmunire, succinctly says of them that they were intended to prevent encroachments on and usurpations of jurisdiction on the part of the pope, and he adds that the more important statute was that of 16 Rich. II. c. 5 (1392), which he describes as one of the strongest defensive measures taken during the Middle Ages against Rome, and which was called for in consequence of the conduct of the pope who had forbidden the bishops to execute the sentences of the royal courts in suits connected with ecclesiastical patronage. Tomlins (*Law Dict.*) states that there is only one instance of a prosecution on a præmunire to be found in the state trials, in which case the penalties were inflicted upon some persons for refusing to take the oath of allegiance to Charles II. It may be added that on an indictment for præmunire a peer might not be tried by his peers.

See Coke, *Instit.;* Collier, *Eccl. Hist.*, 1708; Hallam, *Middle Ages*, 1868; Stephen, *Comm.*, 1853, and *Hist. Crim. Law;* and Stubbs, *Constit. Hist.*, 1880.

PRÆNESTE (now **PALESTRINA**), a very ancient city of Latium, lies 22 miles east of Rome on a spur of the Apennines facing the Alban Hills. To the natural strength of the place and its commanding situation Præneste owed in large measure its historical importance. The local tradition (adopted by Virgil) named Cæculus, son of Vulcan, as founder. From the remains of Cyclopean masonry and other indications the foundation of the city has been referred to the 8th century B.C., and objects in metal and ivory discovered in the earliest graves prove that as early as this or the following century Præneste had reached a considerable degree of civilization and stood in commercial relations not only with Etruria but with the East. At this time the city was probably under the hegemony of Alba Longa, then the head of the Latin League. In 499, according to Livy, Præneste withdrew from the Latin League and formed an alliance with Rome, but this statement seems irreconcilable with a passage in Dionysius Halicarnensis (*Ant. Rom.*, v. 61). After Rome had been weakened by the Gallic invasion (390), Præneste joined its foes in a long struggle with Rome. The struggle culminated in the great Latin War (340–338), in which the Romans were victorious, and Præneste was punished for its share in the war by the loss of part of its territory. It was not, however, like the other Latin cities, embodied in the Roman state, but continued in the position of a city in alliance with Rome down to the Social War, when it, like the rest of Italy, received the Roman franchise (90 or 89). As an allied city it furnished contingents to the Roman army and possessed the right of exile (*jus exilii*), *i.e.*, persons banished from Rome were allowed to reside at Præneste. To judge from the works of art and inscriptions of this period (338 to 90 B.C.), it must have been for the place a time of prosperity and even luxury. The nuts of Præneste were famous and its roses were amongst the finest in Italy. The Latin spoken at Præneste was somewhat peculiar.[2] In the civil wars of Sulla the younger Marius was blockaded in the town by the Sullans (82 B.C.); and on its capture Marius slew himself, the male inhabitants were massacred in cold blood, and a military colony was settled on part of its territory. It was probably about this time that the city was extended from the hill to the plain and that the temple of Fortune was enlarged so as to include much of the space occupied by the ancient city. Under the empire Præneste, from its elevated situation and cool salubrious air, became a favorite summer resort of the wealthy Romans, whose villas studded the neighborhood. Horace ranked it with Tibur and Baiæ, the Bath and Brighton of Rome. Augustus resorted thither; here Tiberius recovered from a dangerous illness, and here Hadrian built himself a villa. Antoninus erected a palace to the east of the town. Amongst private persons who owned villas at Præneste were Pliny the younger and Symmachus.

But Præneste was chiefly famed for its great temple of Fortune and for its oracle, in connection with the temple, known as the "Prænestine lots" (*sortes Prænestinæ*). As extended by Sully the sanctuary of Fortune occupied a series of six vast terraces, which, resting on gigantic substructions of masonry and connected with each other by grand staircases, rose one above the other on the hill in the form of the side of a pyramid, crowned on the highest terrace by the round temple of Fortune proper. This immense edifice, probably by far the largest sanctuary in Italy, must have presented a most imposing aspect, visible as it was from a great part of Latium, from Rome, and even from the sea. The goddess Fortuna here went by the name of Primigenia (First-Born, but perhaps in an active sense First-Bearer); she was represented suckling two babes, said to be Jupiter and Juno, and she was especially worshipped by matrons.[3] The oracle of the Prænestine lots was very ancient and continued to be consulted down to Christian times. Constantine and Theodosius forbade the practice and closed the temple. In 1297 the Colonna family who then owned Præneste (Palestrina) revolted from the pope, but in the following year the town was taken and razed to the ground. In 1437 the city, which had been rebuilt, was captured by the papal general Cardinal Vitelleschi and once more utterly destroyed. It was rebuilt and fortified by Stefano Colonna in 1448. In 1630 it passed by purchase into the Barberini family. Præneste was the native town of Ælian and in modern times of the great composer Palestrina.

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[1] *Constit. Hist. of Eng.* (1880), iii. 356 *sq.*

[2] Thus the Prænestines shortened some words: they said *conia* for *ciconia*, *tammodo* for *tantummodo* (Plaut., *Truc.*, iii. 2, 23; Id., *Trinum.*, iii. 1, 8; cp. Comment. on Festus, p. 731, ed. Lindemann), and inscriptions exhibit the forms *Acmemeno* and *Tondrus* for *Agamemno* and *Tyndarus.* They said *nefrones* for *nefrendes* in the sense of *testiculi*, and *tongitio* for *notio* (Festus, *s.v.* "nefrendes" and "tongere"). Cp. Quintilian, *Instit.*, i. 5, 56.

[3] Hence Fernique (*Étude sur Préneste*) ingeniously conjectures that Fortuna was originally a goddess of maternity, and that the view of her functions as a goddess of chance was later, being due to the influence of Greek mythology, in which Chance (Τυχη) was a goddess. Fortuna contains the same root as *fero*, "to bear." Fernique observes that the worship of Fortuna was often associated with that of Feronia. Statuettes in terra-cotta representing a woman with a child at her breast have been found at Præneste. These are supposed by Fernique to be votive organs, representing not the goddess but the mothers who offered them at the shrine in fulfilment of vows. Fortuna was sometimes represented in the form of two (or possibly more) females, so at Antium (Macrobius, *Sat.*, i. 23, 13; Sueton, *Cal.* 57), and perhaps at Præneste (Statius, *Sylv.*, i. 3, 80); in one of the Roman temples of Fortuna there was a mysterious veiled figure. Analogous to Fortuna in her double capacity as prophetess and patron of mothers was Carmenta, and she too was sometimes represented in double form (Ovid, *Fasti*, i. 617 *sq.*; Aulus Gellius, xvi. 16).

The modern town of Palestrina, a collection of narrow and filthy alleys, stands on the terraces once occupied by the temple of Fortune. On the summit of the hill (2546 feet), nearly a mile from the town, stood the ancient citadel, the site of which is now occupied by a few poor houses (Castel San Pietro) and a ruined mediæval castle of the Colonnas. The magnificent view embraces Soracte, Rome, the Alban Hills, and the Campagna as far as the sea. Considerable portions of the southern wall of the ancient citadel, built in very massive polygonal (Cyclopean) blocks of limestone, are still to be seen; and the two walls, also polygonal, which formerly united the citadel with the lower town, can still be traced. The ruins of the villa of Hadrian stand in the plain near the church of S. Maria della Villa, about three-quarters of a mile from the town. Here was discovered the well-known statue of Antinous, now in the Vatican. Not far off was found in 1773 the calendar which, as Suetonius tells us, was set up by the grammarian M. Verrius Flaccus in the forum of Præneste. Excavations made, especially since 1855, in the ancient necropolis, which lay on a plateau surrounded by valleys at the foot of the hill and of the town, have yielded important results for the history of the art and manufactures of Præneste. Of the objects found in the oldest graves, and supposed to date from about the 7th century B.C., the cups of silver and silver gilt and most of the gold and amber jewellery are Phœnician (possibly Carthaginian), or at least made on Phœnician models; but the bronzes and some of the ivory articles seem to be Etruscan. No objects have been discovered belonging to the period intermediate between the 7th and 3d centuries B.C.; but the graves of the 3d and 2d centuries have yielded many precious relics, bronze caskets (*cistæ*), convex metal mirrors, strigils, etc. Among these is the famous Ficoroni casket, engraved with pictures of the arrival of the Argonauts in Bithynia and the victory of Pollux over Amycus. It was found in 1774. The inscriptions on the caskets are all Latin; those on the mirrors are mostly Etruscan; those on the strigils are Latin, Greek, and Etruscan. The Latin inscriptions seem to belong to the 3d century. On the whole it appears that between the 3d and 2d centuries there existed at Præneste a native Latin art, which was, however, beginning to be affected by Greek art. Most of the objects discovered in the necropolis are preserved in the Roman collections, especially the Kircher Museum (which possesses the Ficoroni casket) and the Barberini Library. Besides these there is preserved in the Barberini Palace at Palestrina a large mosaic, considered one of the most important in existence. It was found on the site of the temple of Fortune and probably dates from the age of Augustus or Tiberius. It represents scenes from the Nile, with animals and figures in Egyptian and Greek costume. (J. G. FR.)

PRÆTOR, (præ-itor, "he who goes before," "a leader"), originally a military title, was in classical times the designation of the highest magistrates in the Latin towns. The Roman consuls were at first called "prætors"; in the early code of the Twelve Tables (450 B. C.) they appear to have had no other title. By the Licinian law of 367 B.C., which abolished the military tribunes with consular power and enacted that the supreme executive should henceforward be in the hands of the two consuls, a new magistrate was at the same time created who was to be a colleague of the consuls, though with lower rank and lesser powers. This new magistrate was entrusted with the exclusive jurisdiction in civil cases; in other respects his powers resembled those of the consuls. His distinctive title was the "city prætor" (*prætor urbanus*), and in after time, when the number of prætors was increased, the city prætor always ranked first. To this new magistrate the title of "prætor" was thenceforward properly restricted.[1] About 242 B. C. the increase of a foreign population in Rome necessitated the creation of a second prætor for the decision of suits between foreigners (*peregrini*) or between citizens and foreigners. This prætor was known at a later time as the "foreign prætor" (*prætur peregrinus*). About 227 B.C. two more prætors were added to administer the recently acquired provinces of Sicily and Sardinia. The conquest of Spain occasioned the appointment of two more in 197 B. C., of whom one governed Hither and the other Further Spain. The number of prætors, thus augmented to six, remained stationary till Sulla's time, 82 B. C. But in the interval their duties vastly multiplied. On the one hand, five new provinces were added to the Roman dominions—Macedonia and Achaia in 146 B. C., Africa in the same year, Asia in 134, Gallia Narbonensis in 118, Cilicia probably in 102. On the other hand, new and permanent jury courts (*quæstiones perpetuæ*) were instituted at Rome, over which the prætors were called on to preside. To meet this increase of business the tenure of office of the prætors and also of the consuls was practically prolonged from one to two years, with the distinction that in their second year of office they bore the titles of "proprætor" and "proconsul" instead of "prætor" and "consul." The prolongation of office, together with the participation of the proconsuls in duties which properly fell to the prætors, formed the basis of Sulla's arrangements. He increased the number of the prætors from six to eight, and ordained that henceforward all at the eight should in their first year administer justice at Rome and in their second should as proprætors undertake the government of provinces. The courts over which the prætors presided, in addition to those of the city prætor and the foreign prætor, dealt with the following offences: oppression of the provincials (*repetundarum*), bribery (*ambitus*) embezzlement (*peculatus*), treason (*majestatis*), murder (*de sicariis et veneficis*), and probably forgery (*falsi*). A tenth province (Gallia Cisalpina) was added to the previous nine, and thus the number of judicial and provincial departments corresponded to the annual number of prætors, proprætors, and proconsuls. The proportion, however, was not long maintained: new provinces were added to the empire—Bithynia in 74 B. C., Cyrene about the same time, Crete in 67, Syria in 64—and one or more new law courts were instituted. To keep pace with the increase of duties Julius Cæsar increased the number of prætors successively to ten, fourteen, and sixteen; after his time the number varied from eight to eighteen.

The prætors were elected, like the consuls, by the people assembled in the *comitia centuriata* and with the same formalities. (See CONSUL.) They regularly held office for a year; only in the transition period between the republic and the empire was their tenure of office sometimes limited to a few months. The insignia of the prætor were those common to the higher Roman magistrates,—the purple-edged robe (*toga prætexta*) and the ivory chair (*sella curulis*); in Rome he was attended by two lictors, in the provinces by six. The prætors elect cast lots to determine the department which each of them should administer. A prætor was essentially a civil judge, and as such he was accustomed at or before his entry on office to publish an edict setting forth the rules of law and procedure by which he intended to be guided in his decisions. As these rules were often accepted by his successors the prætor thus acquired an almost legislatorial power, and his edicts, thus continued, corrected, and amplified from year to year became, under the title of the "perpetual edicts," one of the most important factors in moulding Roman law. Their tendency was to smooth away the occasional harshness and anomalies of the civil law by substituting rules of equity for the letter of the law, and in this respect the Roman prætor has been compared to the English chancellor. His functions were considerably modified by the introduction of the standing jury courts (*quæstiones perpetuæ*). Hitherto the prætor had conducted the preliminary inquiry as to whether an action would lie, and had appointed for the actual trial of the case a deputy, whom he instructed in the law applicable to the case and whose decisions he enforced. The proceedings before the prætor were technically known as *jus* in distinction from *judicium*, which was the actual trial before the deputy judge. But in the standing jury courts (of which the first—that for *repetundæ*—was instituted in 149 B.C.), or rather in the most important of them, the prætors themselves presided and tried the cases. These new courts, though formally civil, were substantially criminal courts; and thus a criminal jurisdiction was added to the original civil jurisdiction of the prætors. Under the empire various special functions were assigned to certain prætors, such as the two treasury prætors (*prætores ærarii*), appointed by Augustus in 23 B.C.; the spear prætor (*prætor hastarius*), who presided over the court of the Hundred Men, which dealt especially with cases of inheritance; the two trust prætors (*prætores fideicommissarii*), appointed by Claudius to look after cases of trust estates, but reduced by Titus to one; the ward prætor (*prætor tutelaris*), appointed by Marcus Antoninus to deal with the affairs of minors; and the liberation prætor (*prætor de liberalibus causis*), who tried cases turning on the liberation of slaves. There is no evidence that the prætors continued to preside over the standing courts after the beginning of the 3d century A.D., and the foreign prætorship disappears about this time.[1] Even the jurisdiction of the city prætor seems not to have survived the reforms of Diocletian, though the office itself continued to exist. But of the prætorships with special jurisdiction (especially the ward prætorship and the liberation prætorship) some lasted into the 4th century and were copied in the constitution of Constantinople.

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[1] Some writers, following Livy, vi. 42, assert that at first the prætorship was open to patricians only, but Mommsen (*Röm. Staatsrecht*, ii. p. 195) shows that this is probably a mistake. The election of a plebeian to the office for the first time in 337 B. C. was certainly opposed by the consul who presided at the election, but there appears to have been no legal obstacle to it.

Besides their judicial functions, the prætors, as colleagues of the consuls, possessed, though in a less degree, all the consular powers, which they regularly exercised in the absence of the consuls; but in the presence of a consul they exercised them only at the special command either of the consul or, more usually, of the senate. Thus the prætor possessed military power (*imperium*); even the city prætor, though attached by his office to Rome, could not only levy troops but also in certain circumstances take the command in person. As provincial governors the prætors had frequent occasion to exercise their military powers, and they were often accorded a triumph. The city prætor presided over popular assemblies for the election of certain inferior magistrates, but all the prætors officiating in Rome had the right to summon assemblies for the purpose of legislation. In the absence of the consuls the city prætor, and in default of him the other prætors, were empowered to call meetings of the senate. Public religious duties, such as the fulfilment of state vows, the celebration of sacrifices and games, and the fixing of the dates of movable feasts, probably only fell to the prætors in the absence of the consuls. But since in the early times the consuls as a rule spent only the first months of their year of office in Rome it is probable that a considerable share of religious business devolved on the city prætor; this was certainly the case with the Festival of the Cross-roads (*compitalia*), and he directed the games in honor of Apollo from their institution in 212 B.C. Augustus in 22 B.C. placed the direction of all the popular festivals in the hands of the prætors, and it is not without significance that the prætors continued thus to minister to the pleasures of the Roman mob for centuries after they had ceased almost entirely to transact the business of the state. For the prætor as provincial governor, see PROVINCE. (J. G. FR.)

PRÆTORIANS (*prætoriani*) was the name borne by the body-guards of the Roman emperors. The name was derived from the prætorian cohort, a picked body of troops who in the time of the republic formed the guard of a general in command of an army, the old Latin name for a general being *prætor* and his quarters in the camp being known as the *prætorium*. As the emperor was commander-in-chief the headquarters (*prætorium*) were established at Rome, and one of the earliest measures of Augustus was the new organization of the guard. The command of the prætorians rested legally with the emperor, but after 2 B.C. it was practically exercised by one or more colonels chosen by the emperor with the title of "prætorian præfects" (*præfecti prætorio*, see PRÆFECT). The prætorians were divided into cohorts of 1000 men each, horse and foot, and hence they are often referred to as the prætorian cohorts. Augustus raised nine corps, of which he quartered three in different parts of Rome and the rest in neighboring cities. One cohort kept guard in the palace. Under Tiberius the crafty and energetic prætorian præfect Sejanus collected the prætorians into a permanent fortified camp outside the Viminalian Gate of Rome. Thus united they acquired and exercised the power of making and unmaking emperors. The number of the cohorts was raised temporarily by Vitelius to sixteen; from 112 A.D. to the end of the 3d century, and probably to the time of Constantine, the number was ten. At first they were recruited exclusively from Italy, but afterwards from the Romanized provinces also of Spain, Noricum, and Macedonia. Their pay was nominally double, but really more than double, that of the legionaries;[2] their period of service was shorter, being sixteen years instead of at least twenty; and from the time of Claudius it was the custom of the emperors on their succession to the throne to purchase the favor of their powerful guards by a liberal donative. But the sense of their own power, to which these special privileges bore witness, fostered the pride, while the luxurious life of the capital relaxed the discipline, of the prætorians. Their insolence culminated when they murdered the virtuous Pertinax, put the empire up to auction, and knocked it down to the highest bidder (193). In the same year they were disgraced and disbanded by Severus, only, however, to be replaced by a still more numerous corps,[3] which was now recruited indifferently from all parts of the empire. Diocletian reduced their numbers, and they were finally suppressed by Constantine in 312.

PRÆTORIUS,[4] MICHAEL (1571–1621), German musical historian, theorist, and composer, was born at Kreuzberg in Thuringia on 15th February, 1571. He acted as kapellmeister at Lüneburg early in life, was engaged first as organist and later as kapellmeister and secretary to the duke of Brunswick, and was eventually rewarded for his long services with the priory of Ringelheim, near Goslar. He died at Wolfenbüttel on 15th February, 1621. Of his very numerous compositions copies are now so scarce that it is doubtful whether a complete set is anywhere to be found. The most important are—*Polyhymnia* (15 vols.), *Musæ Sioniæ* (16 vols.), and *Musa Aonia* (9 vols.), all written partly to Latin and partly to German words. But more precious than all these is the *Syntagma musicum* (3 vols. and a cahier of plates, 4to, Wittenberg and Wolfenbüttel, 1615–20). Only two copies of this very rare work are believed to exist in England, one in the library of the Rev. Sir F. A. Gore-Ouseley and the other in that of Mr. Alfred Littleton. In the original prospectus of the work four volumes were promised, but it is certain that no more than three were ever published. The fourth volume mentioned in Forkel's catalogue is clearly nothing but the cahier of plates attached to vol. ii.

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[1] Marquardt conjectures with much probability that when Caracalla extended the Roman franchise to the whole empire he at the same time abolished the foreign prætorship.

[2] The legionaries received 10 asses [9.37 cents] daily, or 3600 asses [$33.75] (=225 denarii) annually; the prætorians received twenty asses [18.75 cents] daily, or 7200 asses [$67.50] annually. But, whereas in paying the legionaries the as was reckoned at its current value of 16 to the denarius, in paying the prætorians it was reckoned at its old and higher value of 10 to the denarius, and hence the 7200 asses [$67.50] of a prætorian were equal to 11,520 asses [$108] at the current rate, or 720 denarii [$108]. This is Mommsen's highly ingenious and probable explanation of the apparent discrepancy between the statements of Dio Cassius (liii. 11, 55) and Tacitus (*Ann.*, i. 17). See Marquardt's *Römische Staatsverwaltung*, ii. p. 480. Pliny (*N. H.*, xxxiii. 45) states that after the value of the as was lowered it continued to be reckoned at its old value in the payment of soldiers. But by combining the statements of Suetonius (*Cæs.*, 26, and *Domit.*, 7) we see that Julius Cæsar, while he nominally and really raised the pay of the soldiers, paid it in asses of the current value, and hence after his time it was only the prætorians who retained the privilege of having their pay reckoned in asses of the old value (see Marquardt, *op. cit.*, p. 95).

[3] According to Herodian (iii. 13, 4) Severus increased the troops in Rome fourfold.

[4] German *Schultz* or *Schultze* (*Schultheiss*), meaning the head-man of a township, Latinized into Prætor or Prætorius. Many other members of the family of Prætorius were eminent as musicians.

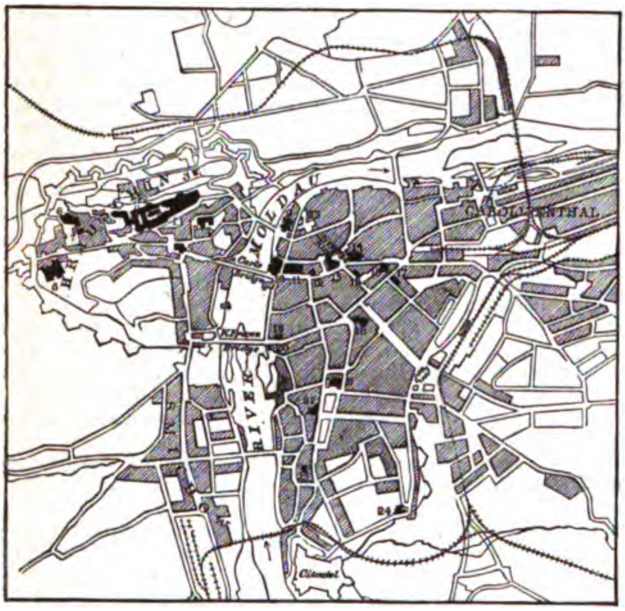
The chief value of this very remarkable work lies in the information it gives concerning the condition of instrumental music in the early years of the 17th century. The plates include excellent representations of all the musical instruments in use at the time they were published, together with many forms even then treated only as antique curiosities. Many of these instruments are known to us only through these representations and the descriptions with which they are accompanied, the instruments themselves having long fallen into disuse, and no real examples having been preserved to us. Among the most important instruments described and figured are the whole family of flutes, oboes, and bassoons; the different kinds of trombone, many of which exactly resemble those now in use; trumpets and horns of all conceivable varieties; viols, violins, and basses; the entire family of stringed and keyed instruments, including the psaltery, the spinet, the harpsichord, and a curious combination of the harpsichord and viol called the "Nurembergisch Geigenwerck," known only through this description; and finally the organ, to the historical and technical description of which an entire section is devoted. The work thus throws a light upon the earlier forms of instrumental music which to the historian is invaluable. In fact, without the information bequeathed to us by Prætorius it would be impossible to reconstruct in theory the orchestra of the earlier half of the 17th century, during which the opera and the oratorio both sprang into existence, or even to understand the descriptions left us by other less careful writers.

PRAGMATIC SANCTION, the technical name given to some decrees which have been issued as fundamental laws. The term is of Byzantine origin, the edicts of the Eastern emperors having been called "pragmatics." There is a famous document known as the Pragmatic Sanction of St. Louis, which contains six articles directed against the assumptions of the papacy; but there are reasons for doubting its genuineness. In 1438 Charles VII. of France issued at Bourges a pragmatic sanction which embodied the most important decisions of the council of Basel. This decree formed the basis of the liberties of the Gallican Church. Louis XI. entered into negotiations with the papacy for its revocation; but it continued in force until the time of Francis I., who substituted for it a concordat with Pope Leo X. The decisions of the council of Basel were also embodied in a pragmatic sanction by a diet which met at Mainz in 1439; but by the concordat of Vienna, concluded in 1448 by the emperor Frederick III. with Pope Nicholas V., most of the advantages which the diet had hoped to secure for the church in Germany were abandoned. The most famous of all pragmatic sanctions was that of the emperor Charles VI. In 1713 it was issued as a family statute, but, as the emperor proposed that it should become a fundamental law of the state, it was afterwards submitted to the diets of the lands ruled by the house of Austria by hereditary right. Having been accepted by the estates of Lower Austria and Bohemia in 1720, by the Hungarian diet in 1722, and by the remaining diets between 1720 and 1724, it was proclaimed as a fundamental law on the 6th of December, 1724. By this edict it was decreed that the Austrian lands should always be united; that they should be ruled by Charles VI.'s male descendants; that, if he had no male descendants, his territories should pass to his female descendants; and that, if his female descendants died without issue, the right of succession should belong to the daughters of his brother Joseph and to their male and female offspring in accordance with the law of primogeniture. In the interest of his daughter Maria Theresa the emperor spared no pains to secure from the empire and from the other powers guarantees for the execution of this law; and, when his nieces, who as the daughters of his elder brother might prove to be dangerous rivals of Maria Theresa, were married, one to the electoral prince of Saxony, the other to the electoral prince of Bavaria, he caused them to declare on oath that they abandoned their claims. Nevertheless after his death the pragmatic sanction led to the War of the Austrian Succession. In 1759 a pragmatic sanction was issued by Charles III. of Spain granting the throne of the two Sicilies to his third son and his descendants.

PRAGUE (German, *Prag*; Bohemian, *Praha*), the capital of Bohemia, the seat of an archbishop, and the third largest town of the Austrian-Hungarian monarchy, lies on both banks of the Moldau in 50° 5′ N. lat. and 14° 25′ E. long., 150 miles to the northwest of Vienna and 75 miles to the south-southeast of Dresden. Its position, near the centre of the country and at the only point where the valley of the Moldau expands sufficiently to make room for a great city, marks it out as the natural capital of Bohemia, and the picturesque effect of its masses of buildings and innumerable spires and towers, filling the valley and climbing the hills on either side, is enhanced by their stirring historical background. The heights on the left bank descend somewhat rapidly to the river, and are crowned by the venerable Hradschin, or palace of the Bohemian kings, which forms the dominant feature in every view of the town. On the other bank there is a considerable level space between the river and the base of the hills. An additional charm is lent to the scene by the pleasant green islands in the Moldau, which is here 500 to 1500 feet in width. The general features of the situation recall those of Budapest, and the smaller scale is fully compensated for by the greater variety and interest of the buildings.

The town proper consists of four main divisions, the Altstadt and the Neustadt on the right bank of the Moldau, and the Kleinseite and the Hradschin on the left. Immediately beyond the old line of circumvallation are the suburbs of Carolinenthal, Wyscherad, Smichow, and Weinberg, while these in turn are adjoined by various outer suburban districts. Down to 1866 Prague was surrounded with walls and bastions, which, however, had long lost their military importance, and have since been, to a great extent, removed. The two sides of the river are connected by seven bridges, of which the most important are the Kaiser Franz suspension bridge, the new Palacky bridge, and the fine old Carls bridge. This last, erected between 1350 and 1500, is closed at each end by a mediæval gate-tower, of which that to the east is particularly interesting. The numerous buttresses are adorned with statues of saints, among them that of St. John Nepomuk, who earned his title to be regarded as the patron saint of bridges from the fact that he here allowed himself to be thrown into the Moldau at the order of King Wenceslaus rather than divulge the queen's confidences in the confessional (1393). The statue is regarded with great veneration and is visited by thousands of devotees on the saint's anniversary (16th May).

The *Altstadt* or old town, is the most densely populated part of Prague and the principal seat of traffic. Most of the streets are narrow and irregular, but the centre of the district is occupied by a spacious square called the Grosser Ring, and the side next the Moldau is bordered by wide quays embellished with handsome monuments to Charles IV. and Francis I. On one side of the Ring stands the town-house, to a great extent rebuilt, but still comprising part of the mediæval structure that witnessed so many of the stormy scenes of Bohemian history. Opposite is the Teyn church, or old church of the Calixtine Hussites, built in 1407, and containing the tomb of Tycho Brahe, the Danish astronomer. Another interesting structure is the Late Gothic Pulverthurm, a relic of the old wall that once separated the Altstadt from the Neustadt. The Altstadt is also the seat of the university and several other educational establishments. The university, founded by Charles IV. in 1348, was the first in the German empire, and was attended by 10,000 to 15,000 students, until invidious distinctions made between Bohemians and Germans led the latter to secede in a body and found academies for themselves in other parts of Germany. The institution, however, still ranks high among European seats of learning and numbers above 2600 students. Lectures are delivered both in Bohemian and in German, and students may graduate in either language. The faculties of medicine and law occupy the Carolinum near the town-hall, while those of theology and philosophy are established in the Clementinum, a huge old Jesuit college, which also comprises the university library (180,000 vols.), several chapels, a school, and the archiepiscopal seminary. The most conspicuous modern buildings are the civil courts, the savings bank, and the Rudolfinum, a large Renaissance edifice on the quay, containing an academy of art, a conservatorium for music, and an industrial museum. The church of the Knights of the Cross (Kreuzherrenkirche) is an imposing building modelled on St. Peter's at Rome, and the palace of Count Clam Gallas is a tasteful Renaissance structure of 1701. Enclosed within the Altstadt is the Josephstadt, or Jewish quarter, a labyrinth of crowded and dingy streets, to which the Jews were strictly confined down to 1848. The Jewish colony of Prague is one of the most ancient in Europe; the Jewish cemetery, with its thousands of closely-packed tombstones interspersed with shrubs and creeping plants, is one of the most curious sights in Prague.



Plan of Prague.

1. Imperial Palace.
2. St. Vitus's Cathedral.
3. Belvedere Villa.
4. Palace Waldstein.
5. St. Nicholas Church.
6. Capuchin Monastery
7. St. Loretto Church.
8. Strahow Monastery.
9. Rudolfinum.
10. Church of the Knights of the Cross.
11. Clementinum.
12. Count Clam Gallas's Palace.
13. Town-house.
14. Teyn Church.
15. Carolinum.
16. Civil Courts.
17. Nat. Bohem. Muse'm.
18. Maria Schnee Ch'rch.
19. Savings Bank.
20. Bohemian Theatre.
21. Neustadt T'wn-house
22. Technical College.
23. Emmaus Church.
24. Carlshof Church.
25. Jewish Cemetery.

The *Neustadt*, or new town, surrounds the old town in the form of a semicircle, reaching the river both to the north and to the south of it. The site of the old wall and moat that formerly separated the two quarters is now occupied by a line of the handsomest and busiest streets in Prague, and the rest of the Neustadt also consists of broad and well-built streets and squares. Conspicuous among the buildings are the numerous hospitals and asylums on the south side, forming a phalanx of charitable institutions that do great credit to the philanthropy of the citizens. The town-house, now used as a criminal court, is interesting as the spot where the Bohemian Hussite war was inaugurated by the hurling of several unpopular councillors from the window. Other noteworthy edifices are the Bohemian museum, the Bohemian technical college (1500 students), the magnificent new Bohemian theatre (erected at a cost of £200,000 [$972,000]), and the churches of Carlshof, Emmaus, and Maria Schnee. To the south the Neustadt is adjoined by the Wyscherad, or citadel, the oldest part of Prague. The original fortress was almost entirely destroyed by the Hussites, and the present fortifications are modern.

The *Kleinseite*, or Little Prague, on the left bank of the Moldau, occupies the slopes of the Laurenzberg and the Hradschin and is the headquarters of the aristocratic and official classes. Like the Altstadt, its centre is formed by a " ring," containing the large and handsome Jesuit church of St. Nicholas and a fine monument to Marshal Radetzky. The most generally interesting of the numerous palaces of the Bohemian noblesse is the Palace Waldstein or Wallenstein, an extensive edifice built by the hero of the Thirty Years' War and still occupied by his descendants. Kleinseite also contains the hall of the Bohemian diet and the residence of the statthalter or governor of Bohemia. To the north it ends in the pleasant promenades named after the crown-prince Rudolf, which stretch along the bank of the Moldau.

The *Hradschin*, or castle hill, rises abruptly behind the Kleinseite to a height of about 240 feet. The imperial palace, a vast and irregular group of buildings crowning the height, is remarkable rather for its situation and extent than for architectural importance. It is said to have been founded by Princess Libussa, and was greatly enlarged by Charles IV. and others, but now offers little of a mediæval character with the exception of two or three towers. Few of the 440 rooms it is said to contain are of any special interest; in the council chamber is still pointed out the window from which the imperial councillors Martinitz and Slavata were hurled in 1618. Within the large court of the palace stands the cathedral of St. Vitus, begun in 1344, in evident imitation of the cathedral of Cologne, but consisting of little more than the extensive Late Gothic choir (1385). Efforts are now being made to bring it to completion. The tower was originally 500 feet high, but lost two-fifths of its height by a fire. The interior enshrines several works of considerable interest and value, such as the mausoleum of the Bohemian kings, a fine Renaissance work in alabaster and marble by Alex. Colin of Mechlin (1589); the shrine of St. John Nepomuk, said to contain 1½ tons of solid silver; and the chapel of St. Wenceslaus, the walls of which are encrusted with jasper, chalcedony, and amethyst. In the treasury are the Bohemian regalia. The palace precincts also enclose the church of St. George, dating from the 12th century, and one of the few Romanesque edifices of which Prague can boast. To the west of the imperial palace is a wide square with three large palaces, one belonging to the archbishop of Prague. Farther on is another square, surrounded by the extensive palace of Count Czernin (now a barrack), a large Capuchin monastery, and the church of St. Loretto, an imitation of the wandering Casa Santa.

At the extreme west of this quarter, adjoining the wall, is the imposing monastery of Strahow, possessing a good collection of pictures and a large library. To the north of the imperial palace is a picturesque gorge called the Hirschgraben, beyond which are the palace gardens, containing the Belvedere, a villa erected by Ferdinand I. in 1536, and considered one of the most tasteful reproductions of Italian architecture to the north of the Alps.

Prague is unusually well supplied with public parks and gardens, as, in addition to those already mentioned, pleasure-grounds have been laid out on the islands in the Moldau, on the slopes of the Laurensberg, and on part of the ground occupied by the old fortifications. Among the most popular resorts are the charming grounds of the Baumgarten, a mile to the north of the Kleinseite. Both the industry and the commerce of Bohemia have their focus in Prague, the chief seats of the former being the large manufacturing suburbs of Smichow (21,000 inhabitants), and Carolinenthal (20,000 inhabitants) the one to the south of the Kleinseite and the other to the northeast of the Neustadt. The most prominent items in a very miscellaneous list of industrial products are linen, cotton, calico, and leather goods, gloves, machinery, confectionery, beer, and chemicals. Garnet wares also form a specialty. Trade is facilitated by an extensive system of roads and railways, but the river navigation is unimportant owing to the numerous weirs and the insufficient depth. In 1880 Prague proper contained 162,323 inhabitants, or including the suburban districts about 250,000; and at the beginning of 1885 the total population was officially stated at 272,333. Nearly five-sevenths of these are of Slavonic race, while all are Roman Catholics with the exception of 20,000 Jews and 5000 Protestants. The Germans, however, though diminishing in relative numbers, still claim to represent the bulk of the capital and culture of the city. The garrison consists of from 8000 to 10,000 men.

The foundation of Prague is ascribed to the princess Libussa, who appears at the beginning of the 8th century of our era as ruling the Bohemians from her stronghold of Wyscherad on the right bank of the Moldau. It is at least certain that the town made rapid progress under the fostering care of the early Bohemian sovereigns, and in the 13th century it was able to bid defiance to the Tatar hordes that then overran the country. Its chief period of prosperity was the reign of Charles IV. (1346-1378), who by founding the university, establishing fairs, and investing the town with valuable privileges attracted to it numerous strangers. At this time Prague was perhaps the most important town in Germany, and could even boast of an independent school of art. Afterwards, however, Prague became the centre of the agitation that culminated in the Hussite wars, and thus brought upon itself a long train of misfortunes. The Hussites took possession of the city soon after defeating the emperor Sigismund, and allowed their religious zeal to carry them so far as to destroy many of the most interesting old churches in the city—a fact that accounts for the want of venerable ecclesiastical edifices in Prague. The town was, however, afterwards rebuilt by the imperialists upon an improved scale. Under Rudolf II. (1576–1612) a second season of prosperity was enjoyed; Copernicus, Tycho Brahe, and other men eminent in science, art, or letters flocked to the court of this enlightened monarch and contributed to the importance of his capital. Prague suffered its full share of the evils of the Thirty Years' War, which may be said to have begun here with the precipitation of the councillors from the window of the Hradschin (1618), and to have ended here with the occupation of the Kleinseite by the Swedes in 1648. The town was occupied by the imperialists after the defeat of the Protestants at the White Hill in 1620, and its Protestant sympathies caused it to find scant grace in the eyes of the victors. It was taken by the Swedes in 1631, by Wallenstein in 1632, by the French and Bavarians in 1741, and by Frederick the Great in 1744. In 1757 it narrowly escaped a second capture by Frederick, who held it closely invested after defeating the Austrians at the battle of Prague, but was compelled to raise the siege by the disaster of Kolin. This was the last time Prague underwent a siege, though it was occupied by the Prussians in 1866. During the present century its material advance has been unbroken, but its harmonious social development has been hampered by the disunion between the Czechish and German elements of its population. The revolutionary ideas of 1848 found a warm response in the nationalist party of Bohemia, and a Pan-Slavonic congress was opened at Prague in May of that year. Unfortunately, however, a collision took place between the military and the populace, and Prince Windischgrätz forcibly dissolved the congress and bombarded the town for two days. In 1862 a new impetus was given to the Slavonic agitation by the formation of a Bohemian diet, and since then the fissure between the warring races has grown wider rather than diminished. The Slavs seem to be steadily gaining ground at the expense of the Germans both in numbers and influence. Among the celebrated natives of Prague the most eminent in public interest are John Huss (1369-1415) and Jerome of Prague (*c.* 1365–1416). A fragment of the house of the former is still shown in the Altstadt. (J. F. M.)

PRAHRAN, a city of Victoria, Australia, is situated about 3¼ miles southeast of Melbourne, with which it is connected by the Melbourne and Brighton Railway, and by road over a fine iron girder bridge which crosses the Yarra. It is a well-built city, with handsome shops and numerous villas. Among the public buildings are the town-hall, with a lofty tower, containing the rooms of the free library, and the mechanics' institute. There are a number of charitable institutions. Prahran was created a municipality in 1856, a borough in 1863, and a city in 1879. The area of the city is 2320 acres, with a population in 1881 of 21,169.

PRAIRIE DOG. See MARMOT, vol. xv. p. 567.

PRAKRIT (*prākṛta*, "common," as contrasted with *saṃskṛta*, "perfect") is the term applied to the vernacular languages of India derived from Sanskrit. In the Sanskrit drama all except the highest male characters speak Prakrit. Prakrit grammar was written in the Hindu scientific style—on the lines of Pāṇini—by Vararuci, one of the "nine gems" of Vikramāditya's court,[1] and by Hemacandra; these grammarians distinguish at least four different kinds of Prakrit, the relations and localization of which are by no means clear. The word Prakrit is sometimes used of all the still spoken Aryan vernaculars of India. See SANSKRIT.

PRAM, CHRISTEN HENRIKSEN (1756–1821), Scandinavian poet, was born in Gudbrandsdal, Norway, in 1756, and educated in Copenhagen, where in 1781 he received an appointment in the chamber of commerce, which gave him considerable leisure for literature. In 1785 he published *Stærkodder*, a romantic epic based on some of the old Scandinavian legends, in fifteen cantos, and in the same year he began to edit *Minerva*, a journal of some influence in Danish literature. He also wrote two tragedies (*Damon and Pythias* and *Frode and Fingal*), several comedies, and a number of tales characterized by brightness and humor. In 1819 he removed to the West Indian island of St. Thomas, where he died on 25th November, 1821. His select poetical works were afterwards edited, with a biography, by his friend K. L. Rahbek (6 vols., 1824–29). Compare DENMARK, vol. vii. p. 80.

PRATINCOLE, a word apparently invented by Latham (*Synopsis*, v. p. 222), being the English rendering of *Pratincola*, applied in 1756 by Kramer (*Elenchus*, p. 381) to a bird which had hitherto received no definite name, though it had long before been described and even recognizably figured by Aldrovandus (*Ornithologia*, xvii. 9) under the vague designation of "*hirundo marina.*" It is the *Glareola pratincola* of modern ornithologists, forming the type of a genus *Glareola*, founded by Brisson[2] in 1760, and unquestionably belonging (as is now generally admitted) to the group *Limicolæ*, being either placed in the Family *Charadriïdæ* or regarded as constituting a separate Family *Glareolidæ*. The Pratincoles, of which some eight or nine species have been described, are all small birds, slenderly built and mostly delicately colored, with a short stout bill, a wide gape, long pointed wings, and a tail more or less forked. In some of their habits they are thoroughly Plover-like, running very swiftly and breeding on the ground, but on the wing they have much the appearance of Swallows, and like them feed, at least partly, while flying.[1] The ordinary Pratincole of Europe, *G. pratincola*, breeds abundantly in many parts of Spain, Barbary and Sicily, along the valley of the Danube, and in Southern Russia, while owing to its great powers of flight it frequently wanders far from its home, and more than a score of examples have been recorded as occurring in the British Islands. In the southeast of Europe a second and closely-allied species, *G. nordmanni* or *G. melanoptera* which has black instead of chestnut inner wing-coverts, accompanies or, further to the eastward, replaces it; and in its turn it is replaced in India, China, and Australia by *G. orientalis*. Australia also possesses another species, *G. grallaria*, remarkable for the great length of its wings and much longer legs, while its tail is scarcely forked—peculiarities that have led to its being considered the type of a a distinct genus or subgenus *Stiltia*. Two species, *G. lactea* and *G. cinerea*, from India and Africa respectively, seem by their pale coloration to be desert forms, and they are the smallest of this curious little group. The species whose mode of nidification is known lay either two or three eggs, stone-colored, blotched, spotted, and streaked with black or brownish-gray. The young when hatched are clothed in down and are able to run at once—just as are young Plovers. (A. N.)

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[1] The era of Vikramâditya is reckoned from 56 B. C., but many authorities place him 550 A. D.

[2] Not by Gmelin as inadvertently misstated (ORNITHOLOGY, vol. xviii. p. 23, note 2).

PRATO, a city and bishop's see of Italy, in the province of Florence, on the north edge of the alluvial plain which extends between Florence and Pistoia. By rail it is distant from the former city 11¼ miles and from the latter 9¾. The cathedral of St. Stephen, which stands in a square surrounded by houses of the 16th century, is partly of the 12th and partly of the 14th and 15th centuries. The façade, in alternate bands of white calcareous sandstone and green serpentine, has a fine doorway and a bas-relief by Luca della Robbia; but the most striking external feature is the lovely open-air pulpit at an angle of the building, erected (1428) by Donatello and Michelozzo for displaying to the people without risk the Virgin's girdle, brought from the Holy Land by a knight of Prato in 1130. The chapel of the Girdle has frescos by Agnolo Gaddi and a statue of the Virgin by Giovanni Pisano; and the frescos in the choir are considered the most important work of Fra Filippo LIPPI (*q.v.*). The municipal palace also possesses a collection of Lippi's paintings. Prato is a busy industrial town, the seat of a great straw-plaiting establishment, paper-mills, brass-foundries, etc., and outside of the gates which pierce the old city walls several small suburbs have grown up. The city had 13,410 inhabitants in 1881 (inclusive of the suburbs, 15,510) and the commune 16,641.

Prato is said to be first mentioned by name in 1107, but the cathedral appears as early as 1048 as the parish church of Borgo Cornio or Santo Stefano. In 1313 the town acknowledged the authority of Robert, king of Naples, and in 1350 Niccola Acciajoli, seneschal of Joanna, sold it to the Florentines for 17,500 florins of gold. In 1512 it was sacked by the Spaniards under General Cardona. In 1653 it obtained the rank of city.

PRATT, CHARLES. See CAMDEN, EARL.

PRAXITELES, a Greek sculptor, son and apparently also pupil of the Athenian Cephisodotus. An account of his works is given in vol. ii. p. 315; but since that was written there has been found at Olympia, where it still remains, a marble statue from his hand, Hermes carrying the infant Dionysus. Though a work of comparatively youthful years, as may be inferred from his obvious indebtedness to his father Cephisodotus, particularly in the figure of Dionysus, it is nevertheless a masterpiece in those qualities for which Praxiteles was famed in antiquity, the representation of what is called sympathetic types of human or divine beings, and the rendering of very subtle phases of emotion. The Hermes, while massive in build, is flexible and sensitive in his skin and flesh, indolent in his attitude, his mind sufficiently occupied for the moment in trifling with the infant on his left arm. In recent years it has been sought to prove that certain of the sculptures attributed in antiquity to Praxiteles were really the work of a grandfather of his of the same name. But the tendency of investigation has rather been to dispel these views as illusory.

PRECEDENCE. This word in the sense in which it is here employed means priority of place, or superiority of rank, in the conventional system of arrangement under which the more eminent and dignified orders of the community are classified on occasions of public ceremony and in the intercourse of private life. In the United Kingdom there is no complete and comprehensive code whereby the scheme of social gradation has been defined and settled, once and for all, on a sure and lasting foundation. The principles and rules at present controlling it have been formulated at different periods and have been derived from various sources. The crown is the fountain of honor, and it is its undoubted prerogative to confer on any of its subjects, in any part of its dominions, such titles and distinctions and such rank and place as to it may seem meet and convenient. Its discretion in this respect is altogether unbounded at common law, and is limited in those cases only wherein it has been submitted to restraint by Act of parliament. In the old time all questions of precedence came in the ordinary course of things within the jurisdiction of the Court of Chivalry, in which the lord high constable and earl marshal presided as judges, and of which the kings of arms, heralds, and pursuivants were the assessors and executive officers. When, however, points of unusual moment and magnitude happened to be brought into controversy they were occasionally considered and decided by the sovereign in person, or by a special commission, or by the privy council, or even by the parliament itself. But it was not until towards the middle of the 16th century that precedence was made the subject of any legislation in the proper meaning of the term.[2]

In 1539 an Act "for the placing of the Lords in Parliament" (31 Hen. VIII. c. 10) was passed at the instance of the king, and by it the relative rank of the members of the royal family, of the great officers of state and the household, and of the hierarchy and the peerage was definitely and definitively ascertained.[3]

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[1] This combination of characters for many years led systematizers astray, though some of them were from the first correct in their notions as to the Pratincole's position. Linnæus, even in his latest publications, placed it in the genus *Hirundo;* but the interleaved and annotated copies of his *Systema Naturæ* in the Linnean Society's library show the species marked for separation and insertion in the Order *Grallæ—Pratincola trachelia* being the name by which he meant to designate it in any future edition. He seems to have been induced to this change of view mainly through a specimen of the bird sent to him by John the brother of Gilbert White; but the opinion published in 1769 by Scopoli (*Ann. I. hist. naturalis*, p. 110) had doubtless contributed thereto, though the earlier judgment to the same effect of Brisson, as mentioned above, had been disregarded. Want of space here forbids a notice of the different erroneous assignments of the form, some of them made even by recent authors, who neglected the clear evidence afforded by the internal structure of the Pratincole. It must suffice to state that Sundevall in 1873 (*Tentamen*, p. 86) placed *Glareola* among the *Caprimulgidæ*, a position which osteology shows cannot be maintained for a moment.

[2] Ample materials for the satisfaction of the curiosity of those who are desirous of investigating the history of precedence under its wider and more remote aspects will be found in such writers as Selden or Mackenzie, together with the authorities quoted or referred to by them—Selden, *Titles of Honor*, part ii. p. 740 sq. (London, 1672); Mackenzie, *Observations upon the Laws and Customs of Nations as to Precedency* (Edinburgh, 1680, and also reprinted in Guillim, *Display of Heraldry*, 6th ed., London, 1724).

[3] Sir Bernard Burke, Ulster king of arms, in his *Book of Precedence*, cites 1 Edw. VI. c. 7, an Act "for the Continuance of Actions after the death of any king of this Realm," as a statute bearing on precedence, since, he says, "it enumerates the then names of dignity." But, as the late Sir Charles Young, Garter king of arms,

In 1563 an Act "for declaring the authority of the Lord Keeper of the Great Seal and the Lord Chancellor to be the same" (5 Eliz. c. 18) also declared their precedence to be the same. In 1689 an Act "for enabling Lords Commissioners of the Great Seal to execute the office of Lord Chancellor or Lord Keeper" (1 Will. and Mary c. 21) gave to the commissioners not being peers of the realm place next to the speaker of the House of Commons and to the speaker place next to the peers of the realm. In 1707 the Act of Union with Scotland (6 Anne c. 11) provided that all peers of Scotland should be peers of Great Britain[1] and should have rank immediately after the peers of the like degrees in England at the time of the Union and before all peers of Great Britain of the like degrees created after the Union. In 1800 the Act of Union with Ireland (39 and 40 Geo. III. c. 67) provided that the lords spiritual of Ireland should have rank immediately after the lords spiritual of the same degree in Great Britain, and that the lords temporal of Ireland should have rank immediately after the lords temporal of the same degree in Great Britain at the time of the Union, and further that "peerages of Ireland created after the Union should have precedence with peerages of the United Kingdom created after the Union according to the dates of their creation." At different times too during the current century several statutes have been passed for the reform and extension of the judicial organization which have very materially affected the precedence of the judges, more especially the Judicature Act of 1873 (36 and 37 Vict. c. 66), under which the lords justices of appeal and the justices of the High Court now receive their appointments. But the statute of Henry VIII. "for the placing of the Lords" still remains the only legislative measure in which it has been attempted to deal directly and systematically with any large and important section of the scale of general precedence; and the law, so far as it relates to the ranking of the sovereign's immediate kindred whether lineal or collateral, the principal ministers of the crown and court, and both the spiritual and temporal members of the House of Lords, is to all practical intents and purposes what it was made by that statute nearly 350 years ago. Where no Act of Parliament applies, precedence is determined either by the will and pleasure of the sovereign or by what is accepted as "ancient usage and established custom." Of the sovereign's will and pleasure the appropriate method of announcement is by warrant under the sign-manual, or letters patent under the great seal. But although the crown has at all periods very frequently conceded special privileges of rank and place to particular persons, its interference with the scale of general precedence has been rare and exceptional. In 1540 it was provided by warrant from Henry VIII. that certain officers of the household therein named should precede the secretaries of state when and if they were under the degree of barons.[2] In 1612 James I. directed by letters patent, not without long and elaborate argument in the Star Chamber, that baronets, then newly created, should be ranked after the younger sons of viscounts and barons, and that a number of political and judicial functionaries should be ranked between knights of the Garter and such knights bannerets as should be made by the sovereign in person "under his Standard displayed in an Army Royal in open war."[3] Four years later he further directed, also by letters patent, that the sons of baronets and their wives and the daughters of baronets should be placed before the sons of knights and their wives and the daughters of knights "of what degree or order soever."[4] And again in 1620 the same king commanded by warrant "after solemn argument before his Majesty" that the younger sons of earls should precede knights of the privy council and knights of the Garter not being "barons or of a higher degree."[5] If we add to these ordinances the provisions relating to precedence contained in the statutes of several of the orders of knighthood which since then have been instituted or reconstructed, we shall nearly, if not quite, exhaust the catalogue of the interpositions of the sovereign with regard to the rank and place of classes as distinguished from individuals. Of "ancient usage and established custom" the records of the College of Arms furnish the fullest and most trustworthy evidence. Among them in particular there is a collection of early tables of precedence which were published by authority at intervals from the end of the 14th to the end of the 15th century, and to which peculiar weight has been attached by many successive generations of heralds. On them, indeed, as illustrative of and supplementary to the action of parliament and the crown, all subsequent tables of precedence have been in great measure founded. The oldest is the "Order of All Estates of Nobles and Gentry," prepared apparently for the coronation of Henry IV. in 1399, under the supervision of Ralph Nevill, earl of Westmoreland and earl marshal; and the next is the "Order of All States of Worship and Gentry," prepared, as announced in the heading, for the coronation of Henry VI. in 1429, under the supervision of the lord protector Humphrey, duke of Gloucester, and the earl marshal, John Mowbray, duke of Norfolk. Two more are of the reign of Edward IV., and were severally issued by John Tiptoft, earl of Worcester and lord high constable, in 1467, and by Anthony Widvile, Earl Rivers and lord high constable, in 1479. The latest is commonly and shortly known as the "Series Ordinum" and was drawn up by a special commission presided over by Jasper Tudor, duke of Bedford, it is presumed for observance at the marriage of Henry VII. and Elizabeth of York in 1486. To these may be added the "Order for the Placing of Lords and Ladies," taken at a grand entertainment given by command of Henry VIII. at the king's manor-house of Richmond in 1520 by Charles Somerset, earl of Worcester, lord chamberlain of the household, to the French ambassador, Olivier de la Vernade, seigneur de la Bâtie; the "Precedency of All Estates," arranged in 1594 by the commissioners for executing the office of earl marshal; and the "Roll of the King's Majesty's most Royal Proceeding through London" from the Tower to Whitehall on the eve of the coronation of James I., also arranged by the commissioners for executing the office of earl marshal. On many isolated points, too, of more or less importance special declaratory decisions have been from time to time propounded by the earls marshal, their substitutes and deputies; for example, in 1594, when the younger sons of dukes were placed before viscounts; in 1625, when the rank of knights of the Bath and their wives was fixed; and in 1615 and 1677, when the eldest sons of the younger sons of peers were placed before the eldest sons of knights and of baronets. It is from these miscellaneous sources that the precedence among others of all peeresses, the eldest sons and their wives and the daughters of all peers, and the younger sons and their wives of all

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has pointed out in one of his privately printed tracts, the object of the Act was simply to prevent the abatement of suits under certain circumstances, and the names of dignity therein enumerated are enumerated in their wrong order. If the statute of Edward VI. had any effect on precedence, dukes would precede the archbishops, barons the bishops, and knights the judges, which they have never done, and which parliament could never have intended that they should do.

[1] For the parliamentary rights of Scottish peers, see PEERAGE, vol. xviii. p. 476.

[2] Quoted by Sir Charles Young from *State Papers: published by Authority* (4to. 1830) p. 623, in *Privy Councillors and their Precedence* (1850) p. 15.

[3] *Patent Rolls*, 10th Jac., part x. mem. 8. It is commonly stated that the bannerets here referred to could be made by the prince of Wales as well as by the king. But the privilege was conferred by James I. on Henry, the then prince of Wales, only (Selden, *Titles of Honor*, part ii. p. 750).

[4] *Patent Rolls*, 14th Jac., part. ii. mem. 24; Selden, *Titles of Honor*, part ii. p. 752.

[5] Cited by Sir Charles Young, *Order of precedence, with Authorities and remarks*, p. 27 (London, 1851).

dukes, marquesses, and earls is ascertained and established. And further, for the purpose of proving continuity of practice and disposing of minor questions not otherwise and more conclusively set at rest, the official programmes and accounts preserved by the heralds of different public solemnities and processions, such as coronations, royal marriages, state funerals, national thanksgivings and so on, have always been considered to be of great historical and technical value.[1]

1.—*General Precedence of Men.*

The sovereign; (1) prince of Wales; (2) younger sons of the sovereign; (3) grandsons of the sovereign; (4) brothers of the sovereign; (5) uncles of the sovereign; (6) nephews of the sovereign;[2] (7) archbishop of Canterbury, primate of all England; (8) lord high chancellor of Great Britain or lord keeper of the great seal; (9) archbishop of York, primate of England;[3] (10) lord high treasurer of Great Britain;[4] (11) lord president of the privy council; (12) lord keeper of the privy seal;[5] (13) lord great chamberlain of England; (14) lord high constable of England; (15) earl marshal; (16) lord high admiral; (17) lord steward of the household; (18) lord chamberlain of the household;[6] (19) dukes;[7] (20) marquesses, (21) dukes' eldest sons;[1] (22) earls; (23) marquesses' eldest sons; (24) dukes' younger sons; (25) viscounts; (26) earls' eldest sons; (27) marquesses' younger sons; (28) bishops; (29) barons;[2] (30) speaker of the House of Commons; (31) commissioners of the great seal;[3] (32) treasurer of the household; (33) comptroller of the household; (34) master of the horse; (35) vice-chamberlain of the household; (36) secretaries of state;[4] (37) viscounts' eldest sons; (38) earls' younger sons; (39) barons' eldest sons; (40) knights of the Garter;[5] (41) privy councillors;[6] (42) chancellor of the exchequer; (43) chancellor of the duchy of Lancaster; (44) lord chief justice of England; (45) master of the rolls; (46) lords justices of appeal;[7] (47) judges of the High Court of Justice;[8] (48) knights bannerets made by the sovereign in person; (49) viscounts' younger sons; (50) barons' younger sons; (51) baronets;[9] (52) knights bannerets not made by the sovereign in person; (53) knights of the first class of the Bath, the Star of India, and St. Michael and St. George;[10] (54) knights of the second class of the Bath, the Star of India, and St. Michael and St. George;[11] (55) knights bachelors;[12] (56) eldest sons of the younger sons of peers; (57) baronets' eldest sons; (58) knights' eldest sons; (59) baronets' younger sons; (60) knights' younger sons;[13] (61) companions of the Bath, the Star of India, St. Michael and St. George,[14] and

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[1] Selden, *Titles of Honor*, part ii. p. 753.

[2] The precedence of the members of the royal family depends on their relationship to the reigning sovereign and not on their relationship to any of the predecessors of the reigning sovereign. It is provided by 31 Hen. VIII. c. 10 that no person, "except only the King's children," shall have place "at the side of the Cloth of Estate in the Parliament Chamber," and that "the King's Son, the King's Brother, the King's Nephew, or the King's Brother's or Sister's Sons" shall have place before all prelates, great officers of state, and peers. Lord Chief Justice Coke was of opinion that the king's nephew meant the king's grandson or *nepos* (*Institutes* iv., cap. 77). But, as Mr. Justice Blackstone says, "under the description of the King's children his grandsons are held to be included without having recourse to Sir Edward Coke's interpretation of nephew" (*Commentaries*, i. ch. 4). Besides, if grandson is to be understood by nephew, the king's grandson would be placed after the king's brother. The prince of Wales is not specifically mentioned in the statute "for the placing of the Lords"; but, as he is always, whether the son or the grandson of the sovereign, the heir-apparent to the crown, he is ranked next to the sovereign or the queen-consort. With the exception of the prince of Wales, all the male relations of the sovereign are ranked first in the order of their degrees of consanguinity with him or her, and secondly, in the order of their proximity to the succession to the crown; thus the members of the several groups into which the royal family is divided take precedence according to their own seniority and the seniority of their fathers or mothers, the sons of the sons or brothers of the sovereign being preferred to the sons of the daughters or sisters of the sovereign among the sovereign's grandsons and nephews.

[3] By 31 Hen. VIII. c. 10, the king's vicegerent "for good and due administration of justice in all causes and cases touching the ecclesiastical jurisdiction" is placed immediately before the archbishop of Canterbury. The office of vicegerent or vicar-general was then held by Thomas, Lord Cromwell, afterwards earl of Essex, together with that of lord privy seal, and it was never conferred on any other person. By the Act of Union with Ireland the archbishops of Ireland had place next to the archbishops of England, and if consecrated before and not after the disestablishment of the church in Ireland they retain this position under the Irish Church Act of 1869. At the coronation of William IV. the lord chancellor of Ireland walked next after the lord chancellor of Great Britain and before the lord president of the council and lord privy seal. In Ireland, if he is a peer he has precedence between the archbishops of Armagh and Dublin, and if he is not a peer after the archbishop of Dublin. But, except in the House of Lords, the precedence of the lord chancellor of Great Britain or the lord keeper of the great seal is the same whether he is a peer or a commoner. The lord keeper has the same precedence as the lord chancellor under 5 Eliz. c. 18. But the last appointment to the lord keepership was that of Sir Robert Henley, afterwards Lord Henley, lord chancellor, and earl of Northington, in 1757, and the office is not likely to be revived.

[4] The last lord high treasurer was Charles Talbot, duke of Shrewsbury, in 1714; since then the office has been executed by commission and as a dignity is practically extinct. None of the commissioners—neither the first lord, who is now always the prime minister, nor any of the other or junior lords—of the treasury have any official precedence whatever.

[5] The lord president of the council and the lord privy seal, if they are peers, are placed by 31 Hen. VIII. c. 10 before all dukes except dukes related to the sovereign in one or other of the degrees of consanguinity specified in the Act. And, since the holders of these offices have been and are always peers, their proper precedence if they are commoners has never been determined.

[6] It is provided by 31 Hen. VIII. c. 10 that "the Great Chamberlain, the Constable, the Marshal, the Lord Admiral, the Grand Master or Lord Steward, and the King's Chamberlain shall sit and be placed after the Lord Privy Seal in manner and form following: that is to say, every one of them shall sit and be placed above all other personages being of the same estates or degrees that they shall happen to be of, that is to say the Great Chamberlain first, the Constable next, the Marshal third, the Lord Admiral the fourth, the Grand Master or Lord Steward the fifth, and the King's Chamberlain the sixth." The lord high steward of England is not mentioned in the Act for the placing of the Lords, "because it was intended," Lord Chief Justice Coke says, "that when the use of him should be necessary he should not endure longer than *hac vice*" (*Inst.* iv., 77). But it may be noted that, when his office is called out of abeyance for coronations or trials by the House of Lords, the lord high steward is the greatest of all the great officers of state in England. The office of lord great chamberlain of England is hereditary, and is held jointly during alternate reigns by the heads of the houses of Willoughby de Eresby and Cholmondeley as representing co-heiresses of the Berties, dukes of Ancaster, who derived it from an heiress of the De Veres, earls of Oxford, in whose line it had descended from the reign of Henry I. By a private Act, 1 Geo. I. c. 3, passed previous to the advancement of Robert Bertie, marquess of Lindsey, to the dukedom of Ancaster in 1715, it was provided that the tenure of the great chamberlainship should not give him and his heirs precedence of all other dukes except when in the immediate discharge of the functions of the office; and Sir Bernard Burke still restricts the precedence of the lord great chamberlain to him "when in actual performance of official duty" (*Book of Precedence*, p. 10). But, as Sir Charles Young justly contends, "the limitations of this statute (1 Geo. I. c. 3) failed on the death of the last Duke of Ancaster in 1809 [he should have said "the last duke of Ancaster, who held the great chamberlainship in 1779"], when the precedence of the office of Great Chamberlain fell under the operation of the 31st of Henry VIII." (*Order of Precedence*, p. 20). The office of lord high constable of England is called out of abeyance for and pending coronations only. The office of earl marshal is hereditary in the Howards, dukes of Norfolk, premier dukes and, as earls of Arundel, premier earls of England, under a grant in special tail male from Charles II. in 1672. The office of lord high admiral, like the office of lord high treasurer, is practically extinct as a dignity. Since the reign of Queen Anne there has been only one lord high admiral, namely, William, duke of Clarence, afterwards William IV., for a few months in the Canning administration of 1827. The office is executed by commission, the lords of the admiralty being as destitute of any official precedence as the lords of the treasury, although the first lord of the admiralty is invariably a leading cabinet minister. The lord steward and the lord chamberlain of the household are always peers, and have seldom been under the degree of earls. We may here remark that both the Scottish and Irish Acts of Union make no reference to the precedence of the great officers of State of Scotland and Ireland. Not to mention the prince of Wales, who is by birth steward of Scotland, the earl of Shrewsbury is hereditary great seneschal of Ireland, and the earl of Errol is hereditary lord high constable of Scotland; but what places they are entitled to in the scale of general precedence is altogether doubtful and uncertain. In Ireland the great seneschal ranks after the lord chancellor if he is a commoner and after the archbishop of Dublin if the lord chancellor is a peer, and in both cases before dukes, ("Order of Precedence," *Dublin Gazette*, 3d June, 1848). Again, on George IV.'s visit to Edinburgh in 1821 the lord high constable had place as the first subject in Scotland immediately after the members of the royal family. At every coronation from that of George III. to that of Queen Victoria, the lord high constable of Scotland has been placed next to the earl marshal of England, and, although no rank has been assigned on these occasions to the hereditary great seneschal of Ireland, the lord high constable of Ireland appointed for the ceremony has been at all or most of them placed next to the lord high constable of Scotland. It is worthy of notice, however, that Sir George Mackenzie, writing when lord advocate of Scotland in the reign of Charles II., says that "the Constable and Marischal take not place as Officers of the Crown but according to their creation as Earls," and he moreover expresses the opinion that "it seems very strange that these who ride upon the King's right and left hand when he returns from his Parliaments and who guard the Parliament itself, and the Honors, should have no precedency by their offices" (*Observations*, etc., p. 25, in Guillam's *Display of Heraldry*, p. 461, *sq.*; but see also Wood-Douglas, *Peerage of Scotland*, vol. i. p. 557.).

[7] Both Sir Charles Young and Sir Bernard Burke place "Dukes of the Blood Royal" before dukes, their eldest sons before marquesses, and their younger sons before marquesses' eldest sons. In the "Ancient Tables of Precedence," which we have already cited, dukes of the blood royal are always ranked before other dukes, and in most of them their eldest sons and in some of them their younger sons are placed in a corresponding order of precedence. But in this connection the words of the Act for the placing of the Lords are perfectly plain and unambiguous: "All Dukes not aforementioned," *i. e.*, all except only such as shall happen to be the king's son, the king's brother, the king's uncle, the king's nephew, or the king's brother's or sister's son, "Marquesses, Earls, Viscounts, and Barons, not having any of the offices aforesaid, shall sit and be placed after their ancienty as it hath been accustomed." As Lord Chief Justice Coke and Mr. Justice Blackstone observe, the degrees of consanguinity with the sovereign to which precedence is given by 31 Hen. VIII. c. 10 are the same as those within which it was made high treason by 28 Hen. VIII. c. 18 for any man to contract marriage without the consent of the king. Queen Victoria, by letters patent under the great seal in 1865, ordained that, "besides the children of Sovereigns of these realms, the children of the sons of any of the Sovereigns of Great Britain and Ireland shall have and at all times hold and enjoy the style or attribute of 'Royal Highness' with their titular dignity of Prince or Princess prefixed to their respective Christian names, or with their other titles of honor." But, notwithstanding this, their rank and place are still governed by the Act for the placing of the Lords. Thus the duke of Cambridge, although he is, as the son of a son of George III., properly designated "Royal Highness" under the letters patent of 1865, has no precedence as the first cousin of the sovereign under the statute of 1539. In the same way the duke of Cumberland has no precedence as the first

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cousin once removed of Queen Victoria, and being the grandson only of a son of George III. would not be a "Royal Highness" at all if his father had not been, like his grandfather, king of Hanover. In *Garter's Roll of the Lords Spiritual and Temporal*, the official list of the House of Lords, the duke of Cambridge is entered before the archbishop of Canterbury, instead of in the precedence of his dukedom after the duke of Leinster, while the duke of Cumberland is entered in the precedence of his dukedom after the duke of Northumberland. By the etiquette of society, however, both of them are regarded and treated as royal dukes, and even in parliament they are always alluded to not as "noble" but as "illustrious." Under the combined operation of the Act for the placing of the Lords and the Acts of Union with Scotland (art. 23) and with Ireland (art. 4) peers of the same degrees, as dukes, marquesses, earls, viscounts, and barons, severally, have precedence according to priority in the creation of their respective peerages. But peerages of England created before 1707 precede peerages of Scotland created before 1707, peerages of Great Britain created between 1707 and 1801 precede peerages of Ireland created before 1801, and peerages of Ireland created before 1801 precede peerages of the United Kingdom and of Ireland created after 1801, which take precedence in common. The relative precedence of the members of the House of Lords, including the representative peers of Scotland and Ireland, is officially set forth in *Garter's Roll*, which is prepared by the Garter king of arms at the commencement of each session of parliament, that of the Scottish peers generally in the *Union Roll*, and that of the Irish peers generally in *Ulster's Roll*, a record which is under the charge of and is periodically corrected by the Ulster king of arms. The *Union Roll* is founded on the "Decreet of Ranking" pronounced and promulgated by a royal commission in 1606, which, in the words of an eminent authority in such matters, "was adopted at once as the roll of the peers in Parliament, convention, and all public meetings, and continued to be called uninterruptedly with such alterations upon it as judgments of the Court of Session upon appeal in modification of the precedency of certain peers rendered necessary, with the omission of such dignities as became extinct and with the addition from time to time of newly created peerages—down to the last sitting of the Scottish Parliament on the 1st May, 1707" (*The Earldom of Mar*, etc., by the earl of Crawford (25th) and Balcarres (8th), vol. ii. p. 16). As the crown was precluded by the Act of Union from creating peerages of Scotland after the Union, all Scottish peers in their several degrees have rank and place before all peers of Great Britain, Ireland, and the United Kingdom.

[1] Eldest sons of peers of any given degree are of the same rank as, but are to be placed immediately after, peers of the first degree under that of their fathers; and the younger sons of peers of any given degree are of the same rank, but are to be placed immediately after peers of the second degree and the eldest sons of peers of the first degree under that of their fathers.

[2] Secretaries of state, if they are barons, precede all other barons under 31 Hen. VIII. c. 10. But if they are of any higher degree their rank is not influenced by their official position.

[3] Under 1 Will. and Mary c. 21, being the only commissioners for the execution of any office who have precedence assigned to them.

[4] The officers of the household who, under Henry VIII.'s warrant of 1540, precede the secretaries of state have been for a long time always peers or the sons of peers, with personal rank higher, and usually far higher, than their official rank. The practical result is, seeing also that the great seal is only very rarely indeed in commission, that the secretaries of state, when they are commoners whose personal precedence is below a baron's, have official precedence immediately after the speaker of the House of Commons. The principal secretaries, for so they are all designated, are officially equal to one another in dignity, and are placed among themselves according to seniority of appointment.

[5] During more than two centuries only one commoner has been indebted for his precedence to his election into the order, and that was Sir Robert Walpole, the minister, who at the coronation of George II. in 1727 was placed as a knight of the Garter immediately before privy councillors. The proper precedence of both knights of the Thistle and knights of St. Patrick is undecided.

[6] Privy councillors of Great Britain and of Ireland take precedence in common according to priority of admission. The chancellors of the exchequer and of the duchy of Lancaster, the lord chief justice of England, the master of the rolls, and the lords justices of appeal are always members of the privy council, and have rank and place as privy councillors, if they are not also peers.

[7] The lords justices of appeal have precedence among themselves according to seniority of appointment. Until recently they were preceded by the lord chief justice of the Common Pleas and the lord chief baron of the Exchequer (divisions of the High Court of Justice). But under existing arrangements these offices have fallen into abeyance, although they have not been formally abolished. The vice-chancellors used to follow the lords justices of appeal; but, in spite of the fact that there is still one vice-chancellor remaining, the office of vice-chancellor is practically extinct and will altogether disappear on his decease. In Ireland all these offices are in existence; but they have no precedence allotted to them in England; as the judges holding them are invariably privy councillors, however, they are ranked accordingly. And it is the same with regard to the lord justice-general and the lord justice-clerk in Scotland.

[8] The judges of all the divisions of the High Court of Justice are ranked together according to seniority of appointment. Neither the senators of the College of Justice in Scotland nor the judges of the various divisions of the High Court in Ireland have any precedence in England. The precedence of the Scottish judges among themselves is settled by a royal warrant of 1729, which is printed in full by Nisbet in his *System of Heraldry* (vol. ii. p. 277). The precedence of the Irish judges among themselves is the same as the precedence of the English judges among themselves used to be before the offices of chief justice of the Common Pleas and chief baron of the Exchequer were suspended.

[9] It is a question whether baronets ought or ought not to have precedence, like peers, according as they are of England, Scotland, Great Britain, Ireland, or the United Kingdom. Baronets are not referred to in either the Scottish or the Irish Act of Union; and Sir Bernard Burke contends that, since the Acts of Union are silent with regard to them, they are still entitled to whatever precedence was originally conferred on them. He therefore places the whole body of the baronets together in the order merely of the dates of their several creations, and in this he appears to us to have both law and reason on his side.

[10] These knights consist of grand crosses of the first, grand commanders of the second, and grand crosses of the third order, and have precedence in their respective orders according to seniority of creation. By the statutes of the order of the Bath as revised in 1847 it is ordained that the knight's grand crosses are to be placed "next to and immediately after baronets," thus superseding knights bannerets not created by the sovereign in person.

[11] Knights commanders of all three orders are placed in each order according to seniority of creation.

[12] Knights bachelors are ranked together according to seniority of creation, whether they are made by the sovereign or the lord lieutenant of Ireland.

[13] The sons of all persons, when any specified rank is assigned to them, are placed in the precedence of their fathers. Eldest sons of the younger sons of peers were ranked before the eldest sons of knights by order of the earl marshal, 18th March, 1615, and before the eldest sons of baronets by order of the earl marshal, 6th April, 1677. But no precedence has been given to the younger sons of the younger sons of peers, although precedence is given to the younger as well as the eldest sons of baronets and knights by James I.'s decree of 1616. Moreover, no precedence has been given to either the eldest or the younger sons of the eldest sons of peers. But in practice this omission is generally disregarded, and the children of the eldest sons of dukes, marquesses, and earls, at all events, are accorded the same rank and titles which they would have if their fathers were actual instead of *quasi* peers of the degree next under that of their grandfathers. Sir Charles Young says that "by decision (Chap. Coll. Arms of 1680) if the eldest son of an Earl died in his father's lifetime, leaving a son and heir, such son and heir during the life of the Earl his grandfather is entitled to the same place and precedence as was due to his father; so had the father been summoned to Parliament as the eldest son of a peer the grandson would succeed to the dignity even during the grandfather's lifetime" (*Order of Precedence*, p. 27). And, of course, what applies to the grandson and heir of an earl applies equally to the grandsons and heirs of dukes and marquesses. But the grandsons and heirs of viscounts and barons are differently situated, and have neither honorary additions to their names nor any ascertained place and precedence even by the etiquette of society.

[14] Companions are members of the third class of the first three orders and the only members of the fourth order, except the sovereign and the grand master. Sir Charles Young and Sir Bernard Burke concur in placing the companions of these orders before the eldest sons of the younger sons of peers, on the ground that under their statutes they are entitled to precede "all Esquires of the *Realm*." But the sons of peers themselves—the eldest as well as the younger—are merely esquires, and are ranked before, and not among, other esquires because they have a particular precedence of their own assigned to them. Similarly the eldest sons of the younger sons of peers and the eldest sons of baronets and of knights who are also esquires, and likewise the younger sons of baronets and of knights who are not esquires, have a particular precedence of their own assigned to them. All of them are placed before esquires as a specific grade in the scale of general precedence, and it seems clear enough that it is before esquires considered as a specific grade that the companions of the orders ought to be placed and not before any other persons who, whether they are or are not esquires, have a definite and settled rank which is superior to that specific grade in the scale of general precedence.

the Indian Empire; (62) esquires;[1] (63) gentlemen.[2]

2.—*General Precedence of Women.*

The queen;[3] (1) princess of Wales; (2) daughters of the sovereign; (3) wives of the sovereign's younger sons; (4) granddaughters of the sovereign; (5) wives of the sovereign's grandsons; (6) sisters of the sovereign; (7) wives of the sovereign's brothers; (8) aunts of the sovereign; (9) wives of the sovereign's uncles; (10) nieces of the sovereign; (11) wives of the sovereign's nephews;[4] (12) duchesses;[5] (13) marchionesses; (14) wives of the eldest sons of dukes; (15) dukes' daughters;[6] (16) countesses; (17) wives of the eldest sons of marquesses; (18) marquesses' daughters; (19) wives of the younger sons of dukes; (20) viscountesses; (21) wives of the eldest sons of earls; (22) earls' daughters; (23) wives of the younger sons of marquesses; (24) baronesses; (25) wives of the eldest sons of viscounts; (26) viscounts' daughters; (27) wives of the younger sons of earls; (28) wives of the eldest sons of barons; (29) barons' daughters; (30) maids of honor to the queen;[7] (31) wives of knights of the Garter; (32) wives of knights bannerets made by the sovereign in person; (33) wives of the younger sons of viscounts; (34) wives of the younger sons of barons; (35) baronets' wives; (36) wives of knights bannerets not made by the sovereign in person; (37) wives of knights grand crosses of the Bath, grand commanders of the Star of India, and grand crosses of St. Michael and St. George; (38) wives of knights commanders of the Bath, the Star of India, and St. Michael and St. George; (39) knights bachelors' wives; (40) wives of the eldest sons of the younger sons of peers; (41) daughters of the younger sons of peers; (42) wives of the eldest sons of baronets; (43) baronets' daughters; (44) wives of the eldest sons of knights; (45) knights' daughters; (46) wives of the younger sons of baronets; (47) wives of the younger sons of knights;[8] (48) wives of companions of the Bath, the Star of India, St. Michael and St. George, and the Indian Empire; (49) wives of esquires;[9] (50) gentlewomen.[10]

Attention to the foregoing tables will show that general precedence is of different kinds as well as of several degrees. It is first either personal or official, and secondly either substantive or derivative. Personal precedence belongs to the royal family, the peerage, and certain specified classes of the commonalty. Official precedence belongs to such of the dignitaries of the church and such of the ministers of state and the household as have had rank and place accorded to them by parliament or the crown, to the speaker of the House of Commons, and to the members of the privy council and the judicature. Substantive precedence, which may be either personal or official, belongs to all those whose rank and place are enjoyed by them independently of their connection with anybody else, as by the archbishop of Canterbury, the lord high chancellor or the lord great chamberlain, peers and peeresses, baronets, knights, and some esquires. Derivative precedence, which can only be personal, belongs to all those whose rank and place are determined by their consanguinity with or affinity to somebody else, as the lineal and collateral relations of the sovereign, the sons, daughters, and daughters-in-law of peers and peeresses in their own right, and the wives, sons, daughters, and daughters-in-law of baronets, knights, and some esquires. It is to be observed, however, that the precedence of the sovereign is at once official and personal, and that the precedence of peeresses by marriage is at once derivative and substantive. In the case of the sovereign it is his or her actual tenure of the office of king or queen which regulates the rank and place of the various members of the royal family, and in the case of peeresses by marriage, although their rank and place are derivative in origin, yet they are substantive in continuance, since during coverture and widowhood peeresses by marriage are as much peeresses as peeresses in their own right, and their legal and political status is precisely the same as if they had acquired it by creation or inheritance.

Bearing the above definitions and explanations in mind, the following canons or rules may be found practically useful.

1. Anybody who is entitled to both personal and official precedence is to be placed according to that which implies the higher rank. If, for example, a baron and a baronet are both privy councillors, the precedence of the first is that of a baron and the precedence of the second is that of a privy councillor. And similarly, except as hereafter stated, with respect to the holders of two or more personal or two or more official dignities.

2. Save in the case of the sovereign, official rank can never supply the foundation for derivative rank. Hence the official precedence of a husband or father affords no indication of the personal precedence of his wife or children.

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[1] It appears to be admitted on all hands that the following persons are esquires and ought to be so described in all legal documents and processes: first, the eldest sons of peers in the lifetime of their fathers, and the younger sons of peers both in and after the lifetime of their fathers; secondly, the eldest sons of the younger sons of peers and their eldest sons in perpetual succession, and the eldest sons of baronets and knights; thirdly, esquires created with or without the grant of armorial bearings by the sovereign; fourthly, justices of the peace, barristers at law, and mayors of corporations; and fifthly, those who are styled esquires in patents, commissions, or appointments to offices under the crown in the state, the household, the army or navy, and elsewhere. Sir Bernard Burke accords precedence to serjeants at law and masters in lunacy, not only before esquires as such but also before the companions of the orders of knighthood. It is, however, enough to observe with regard to the first, since no more of them are to be created, that, in spite of the extravagant pretensions which have been frequently urged by them and on their behalf, "they have not in the general scale," as Sir Charles Young says, "any precedence, and when under the degree of a Knight rank only as Esquires," and with regard to the second that the statute 8 and 9 Vict. c. 100, on which the Ulster king of arms bases their claims, simply provides that they "shall take the same rank and precedence as the masters in ordinary of the High Court of Chancery," who are now extinct, "apparently," to recur to Sir Charles Young, "assuming the rank of the masters without defining it." "The masters, however," he adds, "as such have not a settled place in the order of general precedency emanating from any authority by statute or otherwise." (*Order of Precedence*, p. 71). Sir William Blackstone says that before esquires "the Heralds rank all Colonels, Sergeants at Law, and Doctors in the three learned professions" (*Commentaries*, i. c. 12). But the only foundation for this statement seems to be a passage in Guillim, which is obviously without any authority.

[2] The heralds and lawyers are agreed that gentlemen are those who, by inheritance or grant from the crown, are entitled to bear coat armor (see Coke, *Inst.* iv., c. 77; Blackstone, *Comm.*, i. ch. 12; Selden, *Titles of Honor*, pt. ii, ch. 8; Guillim, *Display of Heraldry*, pt. ii. ch. 26.)

[3] The queen-consort is the second personage in the realm, and has precedence of the queen-dowager. But the husband of a reigning queen has no rank or place except such as is specially accorded to him by the sovereign.

[4] There is no Act of parliament or ordinance of the crown regulating the precedence of the female members of the royal family. But the above is the gradation which appears to have become established among them, and follows the analogy supplied by the Act for the placing of the Lords in the case of their husbands and brothers.

[5] Peeresses in their own right and peeresses by marriage are ranked together, the first in their own precedence and the second in the precedence of their husbands.

[6] Among the daughters of peers there is no distinction between the eldest and the younger as there is among the sons of peers. Their precedence is immediately after the wives of their eldest brothers, and several degrees above the wives of their younger brothers. They are placed among themselves in the precedence of their fathers. But the daughter of the premier duke or baron ranks after the wife of the eldest son of the junior duke or baron.

[7] Maids of honor to the queen are the only women who have any official precedence. They have the style or title of honorable, and are placed immediately after barons' daughters by Sir Bernard Burke, the rank which is accorded to them by the etiquette of society. But Sir Charles Young does not assign any precedence to them, and we do not know on what authority the Ulster king of arms does so, although he is by no means singular in the course he has taken.

[8] The wives of baronets and knights, the wives of the eldest sons and the daughters of the younger sons of peers, and the wives of the sons and the daughters of baronets and knights are all placed severally in the precedence of their respective husbands, husbands' fathers, and fathers.

[9] "Esquire" and "gentleman" are not names of "dignity" but names of "worship," and esquires and gentlemen do not, in strictness, convey or transmit any precedence to their wives or children (see Coke, *Inst.* ii., "Of Additions," p. 667).

[10] "And *generosus* and *generosa* are good additions: and if a gentlewoman be named Spinster in any original writ, *i. e.*, appeal or indictment, she may abate and quash the same, for she hath as good right to that addition as Baroness, Viscountess, Marchioness, or Duchess have to theirs." (Coke, *Inst.* ii., "Of Additions," p. 668.)

The wives and children, for example, of the archbishop of Canterbury, the lord high chancellor, or the speaker of the House of Commons do not participate in their official rank but only in their personal rank whatever it may be.

3. Among subjects men alone can convey derivative rank, except in the case of the daughters and sisters of the sovereign, or of peeresses in their own right. But no man can acquire any rank or place by marriage. The sons-in-law or brothers-in-law of the sovereign and the husbands of peeresses in their own right have as such no precedence whatever. And the daughter and heiress of the premier duke of England, unless she happens to be also a peeress in her own right, does not transmit any rank or place to her children.

4. Within the limits of the peerage derivative rank is as a rule always merged in personal, as distinguished from official, substantive rank. If, for example, the younger son of a duke is created a baron or inherits a barony, his precedence ceases to be that of a duke's younger son and becomes that of a baron. But, where the eldest son of a duke, a marquess, or an earl is summoned to the House of Lords in a barony of his father's, or succeeds as or is created a baron, he is still, as before, "commonly called" by some superior title of peerage, as marquess, earl, or viscount, and retains his derivative precedence on all occasions, except in parliament or at ceremonies which he attends in his character as a peer. The younger sons of all peers, however, who are created or who inherit peerages—which they often do under special limitations—are everywhere placed according to their substantive rank, no matter how inferior it may be to their derivative rank. But if the son of a duke or a marquess, whether eldest or younger, or the eldest son of an earl is consecrated a bishop his derivative rank is not merged in his substantive rank, because it is official, and his derivative and personal rank implies the higher precedence. Again, the daughters of dukes, marquesses, and earls who become peeresses by marriage or creation, or who inherit as peeresses, are placed according to their substantive and not according to their derivative rank, although they may thereby be assigned a far lower precedence than that to which their birth entitles them.

5. The widows of peers and baronets have precedence immediately before the wives or widows of the next successors in their husbands' dignities. But the sons and daughters of peers and baronets have precedence immediately before the sons and daughters of the holders of the dignities to whom their fathers succeeded. The reason of this is that the first are senior in the dignities and the second are nearer in the line of succession to them.

6. The widows of peers who marry again either share the precedence of their second husbands or resume the precedence belonging to them independently of their marriage with their first husbands. Thus, if the daughter of a duke or an esquire marries first an earl and secondly a baron, although she remains a peeress, she is placed as a baroness instead of a countess. But if either of them should marry a commoner as her second husband, whatever may be his rank or degree, she ceases to be a peeress. While, however, the duke's daughter, if her second husband were not the eldest son of a duke, would resume her precedence as the daughter of a duke, the esquire's daughter would share the precedence of her second husband, whether he were a peer's son, a baronet, a knight, or an esquire. By the etiquette of society, however, the widows of peers who marry again do not forfeit the titles and precedence acquired by their marriage with their first husbands unless they choose to lay them aside, or unless their own rank or the rank of their second husbands is equal or superior to that of their first husbands.

7. The widows of the eldest and younger sons of dukes and marquesses and of the eldest sons of earls, and also the widows of baronets and knights who marry again, are permitted by the etiquette of society to keep the titles and rank acquired by their first marriage if their second marriage is with a commoner whose precedence is considerably lower. But the widows of the younger sons of earls and of the eldest and younger sons of viscounts and barons, although their precedence is higher than that of the widows of baronets and knights, are not allowed to retain it, under any circumstances, after a second marriage.

8. Marriage does not affect the precedence of peeresses in their own right unless their husbands are peers whose peerages are of a higher degree, or, being of the same degree, are of more ancient creation than their own. If, for example, a baroness in her own right marries a viscount she is placed and described as a viscountess, or if she marries a baron whose barony is older than hers she is placed in his precedence and described by his title. But if she marries a baron whose barony is junior to hers she keeps her own precedence and title.

9. The daughters of peers, of sons of peers, baronets, and knights retain after marriage the precedence they derive from their fathers, unless they marry peers of any rank or commoners of higher rank than their own. Hence, for example, the daughter of a duke who marries the eldest son of a marquess is placed as a duke's daughter, not as the wife of a marquess's eldest son, and the daughter of a baronet who marries the younger son of a knight is placed as a baronet's daughter and not as the wife of a knight's younger son.

10. What are termed "titles of courtesy" are borne by all the sons and daughters of peers and peeresses in their own right, who in this connection stand on exactly the same footing. The eldest sons of dukes, marquesses, and earls are designated by the names of one or other of the inferior peerages of their fathers, usually a marquessate or an earldom in the first, an earldom or a viscounty in the second, and a viscounty or barony in the third case. But, whatever it may be, it is altogether without effect on the rank and place of the bearer, which are those belonging to him as the eldest son of his father. The younger sons of dukes and marquesses are styled "lords" followed by both their Christian names and surnames. The younger sons of earls and both the eldest and the younger sons of viscounts and barons are described as "honorable" before both their Christian names and surnames. The daughters of dukes, marquesses, and earls are styled "ladies" before both their Christain names and surnames. The daughters of viscounts and barons are described as "honorable" before both their Christain names and surnames. If the eldest son of a marquess or an earl marries a woman of rank equal or inferior to his own, she takes his title and precedence; but if she is of superior rank she retains, with her own precedence, the prefix "lady" before her Christian name followed by the name of her husband's title of courtesy. Again, if the younger son of a duke or a marquess marries a woman of rank equal or inferior to his own, she is called "lady," with his Christian and surname following, and is placed in his precedence; but, if she is of superior rank, she retains, with her own precedence, the prefix "lady" before her Christian name and his surname. If the daughter of a duke, a marquess, or an earl marries the younger son of an earl, the eldest or younger son of a viscount or baron, a baronet, a knight, or an esquire, etc., she retains, with her own precedence, the prefix "lady" before her Christian name and her husband's surname. If the daughter of a viscount marries the younger son of an earl or anybody of inferior rank to him, or the daughter of a baron marries the younger son of a viscount or anybody of inferior rank to him, she retains her own precedence with the prefix "honorable" before the addition "Mrs." and his surname or Christian name and surname. But, if her husband is a baronet or a knight, she is called the Honorable Lady Smith or the Honorable Lady Jones, as the case may be. The wives of the younger sons of earls and of the eldest and younger sons of viscounts and barons, if they are of inferior rank to their husbands, take their precedence and are described as the Honorable Mrs. with the surnames or Christain names and surnames of their husbands following. It was because the judges were placed by James I. before the younger sons of viscounts and barons that they were accorded the title of "honorable," and that they are designated as the Honorable Mr. Justice Hawkins or the Honorable Mr. Justice Stephen, instead of as Sir Henry Hawkins or Sir James Stephens, which would connote their inferior personal dignity of knighthood. But in this addition their wives do not participate, since it is merely an official distinction.

It is manifest on even a cursory examination of the tables we have given that, although they embody the only scheme of general precedence, whether for men or for women, which is authoritatively sanctioned or recognized, they are in many respects very imperfectly fitted to meet the circumstances and requirements of the present day. In both of them the limits prescribed to the royal family are pedantically and inconveniently narrow, and stand out in striking contrast to the wide and ample bounds through which the operation of the Royal Marriage Act (12 Geo. III. c. 11) extends the disabilities but not the privileges of the sovereign's kindred. Otherwise the scale of general precedence for women compares favorably enough with the scale of general precedence for men. If, indeed, it includes the queen's maids of honor and the wives of the companions of the knightly orders, there certainly does not seem to be any good reason why it should omit the mistress of the robes and the ladies of the bedchamber, or the ladies of the royal order of Victoria and Albert and the imperial order of the Crown of India. But these are trifling matters in themselves, and concern only an extremely minute fraction of the community. The scale of general precedence for men is now in substantially the same condition as that in which it has been for between two and three centuries, and the political, to say nothing of the social, arrangements to which it was framed to apply have in the interval undergone an almost complete transformation. The consequence is that a good deal of it has come down to us in the shape of a survival, and has ceased to be of any practical use for the purpose it was originally designed to effect. While it comprises several official and personal dignities which are virtually obsolete and extinguished, it entirely omits the great majority of the members of Government in its existing form, and whole sections of society on a less exalted level, to whom it is universally felt that some rank and place at all events are both in public and in private justly due.

As we have already said, it accords no precedence whatever to the prime minister, whether as premier or as first lord of the treasury. In the same way it ignores not only the first lord of the admiralty but also the presidents of the Board of Trade and the Local Government Board, the postmaster-general, the vice-president of the council, and all the law officers of the crown.[1] And, when it does confess the presence of any of the sovereign's principal ministers, it commonly places them in positions which are out of all keeping with their actual eminence and importance. It ranks the lord president of the council and the lord privy seal before dukes, while it places the chancellor of the exchequer after the younger sons of earls and the eldest sons of barons, and the secretaries of state after the master of the horse and the vice-chamberlain of the household. The lord chancellor still has precedence as the first of the great officers of state, which was allotted to him not as what he is, the head of the judicature, but as what he once was, the prime minister of the sovereign; and the lord chief justice, who is next to him in regular judicial rank, as presiding over the Common Law Courts, as he presides over the Courts of Equity, is placed after the chancellors of the exchequer and of the duchy of Lancaster, who still have the precedence which was allotted to them not as ministers, which they are, but as judges, which they are no longer. Neither the lord lieutenant of Ireland, the viceroy of India, nor the governor-general of Canada has any rank or place at St. James's, where, as well as at Westminster, the lord steward or the lord chamberlain of the household is a much greater and more splendid personage. Again, in the scale of general precedence there are no clergymen except bishops, no lawyers except judges, and no officers of either the army or the navy from field-marshals and admirals of the fleet downwards. Nor, of course, are any colonial governors or lieutenant-governors entered on it. It contains no mention of under-secretaries of state, chairmen or commissioners of administrative boards, comptrollers or secretaries of Government departments, lord lieutenants or sheriffs of counties, deputy lieutenants or justices of the peace, members of the House of Commons, or graduates of the universities. It is true that among some of these classes definite systems of subordination are established by either authority or usage, which are carefully observed and enforced in the particular areas and spheres to which they have reference. But we have seldom any means of determining the relative value of a given term in one series as compared with a given term in another series, or of connecting the different steps in the scales of local, professional, or academical precedence with the different steps in the scale of general precedence, to which such scales of special precedence ought to be contributory and supplementary. We know, for example, that major-generals and rear-admirals are of equal rank, that with them are placed commissaries-general and inspectors-general of hospitals and fleets, that in India along with civilians of thirty-one years' standing they immediately follow the vice-chancellors of the Indian universities, and that in relation to the consular service they immediately precede agents-general and consuls-general. But there is nothing to aid us in determining whether in England they should be ranked with, before, or after deans, queen's counsel, or doctors in divinity, who are as destitute as they are themselves of any recognized general precedence, and who, as matters now stand, would certainly have to give place to the younger sons of baronets and knights and the companions of the knightly orders.

The subjoined tables of special precedence, although their authority would not always be admitted in the College of Arms, may perhaps assist towards the solution of some of the problems which occasionally arise in ordinary society.

1. *Ecclesiastical Precedence.*—(1) Archbishop of Canterbury; (2) archbishop of York; (3) archbishop of Armagh; (4) archbishop of Dublin; (5) bishop of London; (6) bishop of Durham; (7) bishop of Winchester; (8) other bishops of England; (9) bishop of Meath; (10) other bishops of Ireland; (11) suffragan bishops of England; (12) bishop of Sodor and Man; (13) bishops of Scotland; (14) colonial bishops; (15) deans of cathedrals; (16) archdeacons; (17) canons; (18) rural deans; (19) rectors; (20) vicars; (21) curates.

2. *Legal Precedence.*—(1) Lord chancellor of Great Britain; (2) lord chancellor of Ireland; (3) lords of appeal in ordinary in the House of Lords; (4) members of the judicial committee of the privy council; (5) lord chief justice of England; (6) lord justice-general and president of the Court of Session of Scotland; (7) lord chief justice of Ireland; (8) master of the rolls in England; (9) lord justice-clerk and president of the second division of the Court of Session of Scotland; (10) master of the rolls in Ireland; (11) lords justices of appeal in England; (12) lords chief justice of the Common Pleas, chief baron of the Exchequer, and justices of appeal in Ireland; (13) vice-chancellor in England; (14) vice-chancellor in Ireland; (15) judges of the High Court of Justice in England; (16) senators of the College of Justice in Scotland; (17) judges of the High Court of Justice in Ireland; (18) attorney-general for England; (19) lord advocate of Scotland; (20) attorney-general for Ireland; (21) solicitor-general for England; (22) solicitor-general for Scotland; (23) solicitor-general for Ireland; (24) queen's counsel; (25) serjeants-at-law; (26) masters in lunacy; (27) recorder of London; (28) treasurers of the Inns of Court; (29) dean of the faculty in Scotland; (30) barristers; (31) advocates; (32) president of the Incorporated Law Society; (33) solicitors; (34) writers to the signet; (35) writers.

3. *Military Precedence.*—(1) Field-marshals; (2) generals; (3) lieutenant-generals; (4) major-generals, inspectors-general of hospitals after three years' service or with an army in the field, and commissaries-general; (5) brigadier-generals, deputy paymasters-general, and inspectors-general of hospitals of under three years' service and not with an army in the field; (6) colonels, deputy judge advocate, and deputy inspectors-general of hospitals after five years' service; (7) lieutenant-colonels, deputy commissaries-general after five years' service, deputy inspectors-general of hospitals, and surgeon-majors; (8) majors, deputy commissaries-general under five years' service, assistant commissaries-general, inspectors of army accounts, staff or regimental surgeons, chaplains attached to brigades, deputy judge advocates if not at the head of their department, storekeepers of the ordnance, and barrack masters of the first and second classes; (9) captains, deputy assistant commissaries-general, assistant deputy paymasters-general, regimental paymasters, principal examiner of military accounts, staff or regimental assistant surgeons after ten years' service, veterinary surgeons after twenty years' service, chaplains attached to regiments, deputy storekeepers of the ordinance, and barrack masters of the third and fourth classes;[2] (10) lieutenants, acting deputy assistant commissaries-general, examiners of military accounts, assistant surgeons, apothecaries of less than fifteen years' service, deputy medical purveyors, and veterinary surgeons after ten years' service; (11) second lieutenants, commissariat clerks, clerks in the paymaster-general's and military accounts departments, medical and ordnance clerks, and veterinary surgeons under ten years' service; (12) superintending school masters.

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[1] "There are no doubt certain public ceremonials of State, such as Coronations, Royal Public Funerals, and Processions of the Sovereign to Parliament, etc., wherein various public functionaries walk and have for the occasion certain places assigned to them, but which they may not at all times find the same, as it by no means follows that they are always entitled to the same place for having been there once: there is to a certain extent a precedent furnished thereby, and in some cases the uniformity of precedence in regard to one class over another has in such cases become established. This applies, for instance, to the places of the Gentlemen of the Privy Chamber, Law Officers of the Crown, and Masters and Six Clerks in Chancery, who have no definite or fixed place in the tables of precedency regulating the general orders of society, though in reference to State ceremonials they have certain places assigned in the order of procession in right of their offices, which, however, give them no general rank. Upon such occasions, nevertheless, the legal rank and precedence which they hold in the Courts of Law is observed, and so far establishes among themselves, and in respect to their several classes, their precedency" (Sir Charles Young, *Order of Precedence*, etc., pp. 59-61).

[2] Town or fort majors, if officers under the rank of captain, rank as the junior captains in the garrison, and apothecaries after fifteen years' service rank immediately before lieutenants.

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4. *Naval Precedence.*—(1) Admirals of the fleet; (2) admirals; (3) vice-admirals; (4) rear-admirals and inspectors-general of hospitals and fleets; (5) commodores; (6) captains of over three years' seniority, deputy inspectors-general of hospitals and fleets, secretaries to admirals of the fleet, paymaster-in-chief, chief inspectors of machinery, and inspectors of machinery of eight years' standing; (7) captains of under three years' seniority; (8) staff captains, secretaries to commanders-in-chief of five years' standing, and inspectors of machinery of under eight years' standing; (9) commanders; (10) staff commanders, fleet surgeons, secretaries to commanders-in-chief of under five years' standing, paymasters of fifteen years', chief engineers of ten, and naval instructors of fifteen years' standing; (11) lieutenants of eight years' seniority; (12) navigating lieutenants of eight years' seniority, staff surgeons, secretaries to junior flag officers, paymasters of eight, naval instructors of eight, and chief engineers of under ten years' standing; (13) lieutenants of under eight years' seniority; (14) navigating lieutenants of under eight years' seniority, surgeons, secretaries to commodores of the second class, paymasters and naval instructors of under eight and assistant paymasters and engineers of over eight years' standing; (15) sub-lieutenants; (16) navigating sub-lieutenants, assistant paymasters and engineers of under eight years' standing, chief carpenters, and assistant engineers; (17) chief gunners and chief boatswains; (18) gunners, boatswains, and carpenters; (19) midshipmen and clerks; (20) naval cadets and assistant clerks.

5. *Relative Military and Naval Precedence.*—(1) Field-marshals with admirals of the fleet; (2) generals with admirals; (3) lieutenant-generals with vice-admirals; (4) major-generals with rear-admirals; (5) brigadier-generals with commodores; (6) colonels with captains of over three years' seniority; (7) lieutenant-colonels with captains of under three years' seniority and staff captains, and before commanders and staff commanders; (8) majors with lieutenants and navigating lieutenants of eight years' seniority; (9) captains with lieutenants and navigating lieutenants of under eight years' seniority; (10) lieutenants with sub-lieutenants and navigating sub-lieutenants; (11) second lieutenants with midshipmen.

6. *Diplomatic and Consular Precedence.*—(1) Ambassadors immediately after the royal family and the sons and brothers of sovereigns, and before archbishops, great officers of state, and dukes; (2) envoys and ministers accredited to the sovereign after dukes and before marquesses; (3) chargés d'affaires who are accredited, not to the sovereign, but to the minister of foreign affairs, have no recognized general precedence; (4) military or naval attachés of higher rank than colonel in the army or captain in the navy, next to the head of the mission; (5) agents-general and consuls-general with but after major-generals and rear-admirals; (6) consuls-general with but after brigadier-generals and commodores; (7) secretaries of embassy; (8) secretaries of legation; (9) military or naval attachés of or under the rank of colonel in the army or captain in the navy, next to the secretary of embassy or legation; (10) consuls with but after colonels in the army and captains in the navy; (11) second secretaries of embassy; (12) second secretaries of legation; (13) vice-consuls with but after majors in the army and lieutenants in the navy of eight years' seniority; (14) third secretaries of embassy; (15) third secretaries of legation; (16) consular agents with but after captains in the army and lieutenants in the navy of under eight years' seniority; (17) attachés.

7. *Colonial Precedence generally.*—(1) The governor or lieutenant governor or officer administering the government; (2) general in command of the troops and admiral in command of the naval forces; (3) the bishop; (4) the chief justice; (5) colonel or lieutenant-colonel in command of the troops and the officer of equivalent rank in command of the naval forces; (6) members of the executive council; (7) president of the legislative council; (8) members of the legislative council; (9) speaker of the house of assembly; (10) puisne judges; (11) members of the house of assembly; (12) colonial secretary not being in the executive council; (13) commissioners or Government agents of provinces or districts; (14) attorney-general; (15) solicitor-general; (16) major or other senior officer in command of the troops and the officer of equivalent rank in command of the naval forces; (17) the archdeacon; (18) treasurer, paymaster-general, or collector of internal revenue; (19) auditor-general or inspector of general accounts; (20) commissioner of crown lands; (21) collector of customs; (22) comptroller of customs; (23) surveyor-general; (24) clerk of the executive council; (25) clerk of the legislative council; (26) clerk of the house of assembly.

8. *Precedence in the Dominion of Canada.*—(1) The governor-general or officer administering the government; (2) general commanding the troops and admiral commanding the naval forces; (3) lieutenant-governor of Ontario; (4) lieutenant-governor of Quebec; (5) lieutenant-governor of Nova Scotia; (6) lieutenant-governor of New Brunswick; (7) archbishops and bishops; (8) members of the cabinet; (9) speaker of the Senate; (10) chief judges of the courts of law and equity; (11) members of the privy council; (12) generals and admirals not in chief command; (13) colonel in command of the troops and naval officer of equivalent rank in command of the naval forces; (14) members of the Senate; (15) speaker of the House of Commons; (16) puisne judges; (17) members of the House of Commons; (18) members of provincial executive councils within their province; (19) speaker of legislative councils within his province; (20) members of legislative councils within their province; (21) speaker of legislative assemblies within his province; (22) members of legislative assemblies within their province.

9. *Precedence in the Indian Empire.*—(1) Governor-general and viceroy of India; (2) governors of Madras and Bombay; (3) president of the council of the governor-general; (4) lieutenant-governors of Bengal, the Northwest Provinces, and the Punjab when in their own territories; (5) commander-in-chief in India; (6) lieutenant-governors of Bengal, the Northwest Provinces, and the Punjab; (7) chief justice of Bengal; (8) bishop of Calcutta, metropolitan of India; (9) ordinary members of the council of the governor-general; (10) commanders-in-chief in Madras and Bombay; (11) commander-in-chief of the naval forces unless senior in relative rank to the above; (12) chief justices of Madras, Bombay, and the Northwest Provinces; (13) bishops of Madras and Bombay; (14) ordinary members of council in Madras and Bombay; (15) chief commissioners and resident at Hyderabad, and agents to the governor-general in Rajputana, Central India, and Baroda; (16) puisne judges of the High Courts of Calcutta, Madras, Bombay, and the Northwest Provinces; (17) military officers above major-generals; (18) additional members of the councils of the governor-general; (19) secretaries to the Government of India; (20) commissioner in Sind; (21) judges of the Chief Court in the Punjab; (22) additional members of the councils of the governors of Madras and Bombay; (23) chief secretaries to the Governments of Madras and Bombay; (24) members of the legislative council of the lieutenant-governor of Bengal; (25) vice-chancellors of Indian universities. *First class:* (26) civilians of thirty-one years' standing and major-generals; (27) advocate-general, Calcutta; (28) advocates-general, Madras and Bombay; (29) members of the boards of revenue, Bengal, Madras, and the Northwest Provinces, and commissioners of revenue and customs, Bombay; (30) financial commissioner, Punjab; (31) judicial commissioners and recorder of Rangoon; (32) comptroller-general of accounts in India; (33) commissioners of divisions within their own divisions, and residents, political agents, and superintendents, on pay of Rs. 2000 [$972] per mensem or more (not being collectors or deputy commissioners of British districts), within their own charges; (34) civil and military secretaries to Governments of Madras and Bombay, and civil secretaries to Governments of Bengal, Northwest Provinces, and Punjab; (35) surveyor-general of India, and directors-general of the post-office and of telegraphs; (36) chief engineers, first class; (37) archdeacons of Calcutta, Madras, and Bombay; (38) brigadier-generals. *Second class:* (39) civilians of twenty-three years' standing and colonels; (40) commissioners of divisions, and commissioners of police, Calcutta; (41) private secretary to the viceroy; (42) residents, political agents, and superintendents on pay of Rs. 2000 [$972] per mensem or more (not being collectors or deputy commissioners of British districts; (43) superintendent of the trigonometrical survey; (44) commissioner of inland customs; (45) sanitary commissioner of the Government of India; (46) superintendent of the Geological Survey; (47) inspector-general of forests in India; (48) standing council to the Government of India; (49) military accountant-general; (50) directors of public instruction under local governments; (51) accountant-general for local governments; (52) inspectors-general of police under local governments; (53) director of revenue settlement and superintendent of revenue survey, Madras, survey and settlement commissioners, Bombay, and commissioner of settlements, Punjab; (54) remembrancers of legal affairs and Government advocates in the Northwest Provinces, the Punjab, and British Burmah; (55) consulting engineers to the Government of India for guaranteed railways, Calcutta and Lahore, and chief engineers (second and third classes) under local governments; (56) district and sessions judges, collectors and magistrates of districts, deputy superintendent of Port Blair, and the chief officer of each presidency municipality, within their respective charges; (57) officers of the first class graded list of civil offices not reserved for members of the Covenanted Civil Service. *Third class:* (58) civilians of eighteen years' standing and lieutenant-colonels; (59) political agents and superintendents on pay of Rs. 1000 [$486] and less than Rs. 2000 [$972] per mensem (not being collectors or deputy commissioners in British districts) within their own charges; (60) military secretary to the Government, Punjab, and civil secretaries to local administrations; (61) private secretaries to governors; (62) directors of public instruction under local administration; (63) administrators-general, Calcutta, Madras, and Bombay; (64) inspectors-general of jails and of registration, sanitary commissioners, inspectors, and conservators of forests under local governments, and postmasters-general; (65) accountants-general for local administrations; (66) consulting engineer to the Government of India for guaranteed railways, Lucknow, and chief and superintending engineers when secretaries to local administrations or to agents to the governor-general; (67) inspectors-general of police under local administrations; (68) senior chaplains; (69) superintendent of marine, Bombay; (70) master attendants; (71) sheriffs within their own charges; (72) officers in the second class graded list of civil offices not reserved for members of the Covenanted Civil Service. *Fourth class:* (73) civilians of twelve years standing and majors; (74) political agents and superintendents of less than Rs. 1000 [$486] per mensem within their own charges; (75) Government solicitors; (76) inspectors-general of jails and of registration, sanitary commissioners, and conservators of forests under local administrations; (77) officers in the third class graded list of civil offices not reserved for members of the Covenanted Civil Service.[1]

10. *Academical Precedence.*—(1) Chancellors; (2) high stewards; (3) vice-chancellors; (4) rectors; (5) principals; (6) heads of colleges and halls; (7) doctors of divinity; (8) doctors of law; (9) doctors of medicine; (10) doctors of music; (11) bachelors of divinity; (12) proctors; (13) professors; (14) masters of law; (15) masters of arts; (16) bachelors of law; (17) bachelors of medicine; (18) bachelors of music; (19) bachelors of arts. Offices in the universities are more or less different in each of them, and those which are peculiar to any one vary so much from those which are peculiar to the others that it is not convenient to enumerate and distinguish them. Among graduates of all of them the senior take precedence of the junior according to their several faculties and degrees and the relative antiquity of their universities in the order of Oxford, Cambridge, St. Andrews, Glasgow, Aberdeen, Edinburgh, Dublin, London, Durham, Queen's, Sydney, Melbourne, Catholic, Royal, and Victoria. (F. DR.)

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[1] "All ladies to take place according to the rank herein assigned to their respective husbands, with the exception of wives of Peers and of ladies having precedence in England independently of their husbands and who are not in rank below the daughters of Barons, such ladies to take place according to their several ranks with reference to such precedence in England immediately after the wives of members of council at the presidencies in India" (*Royal Warrant*, 18th October, 1876).

PREDESTINATION is a theological term, sometimes used with greater latitude to denote the decree or purpose of God by which He has from eternity immutably determined whatever comes to pass; sometimes more strictly to denote the decree by which men are destined to everlasting happiness or misery; and sometimes with excessive strictness to denote only predestination to life or election.[1]

The question to which the theory of predestination supplies an answer, although it has a special interest to Christian thought, yet arises in all minds which are occupied with the problems of human existence. That question is, To what cause can we refer the diversities in human character, fortunes, and destiny? The Greek tragedians made it their business to exhibit the helplessness of man in his strife against fate. Sometimes indeed they explicitly distinguish fate from a mere pitiless and non-moral sovereignty and identify it with the Nemesis which pursues hereditary or individual guilt; and sometimes—as in the case of Œdipus—they follow the history of the sufferer for the sake of showing how the predestined and inevitable transgression and punishment educate the character. But the idea which fascinates and pursues them is that man cannot escape his destiny, that his life is woven with a "shuttle of adamant," and that when God means to destroy a man He makes evil seem good to him (Soph., *Antig.*, 622-24). The Greek philosophy tended in the same direction; and the Stoic doctrine of necessity or providence, though based on a broad and thoroughly philosophical view of nature and of man's place in it, was entangled in the very difficulties which attach to Calvinism.

Among the Jews the Sadducees carried their defence of free will so far as to deny predestination; while the Pharisees and Essenes ran to the other extreme and left no place for human freedom (Josephus, *Antiq.*, xviii. 1, 3, 4; xiii. 5, 9).

In Islam the subject of predestination has produced endless controversy. The orthodox doctrine is thus stated by Al-Berkevi. "It is necessary to confess that good and evil take place by the predestination and predetermination of God, that all that has been and all that will be was decreed in eternity and written on the *preserved table;* that the faith of the believer, the piety of the pious, and their good actions are foreseen, willed, predestinated, decreed by the writing on the preserved table produced and approved by God: that the unbelief of the unbeliever, the impiety of the impious, and bad actions come to pass with the foreknowledge, will, predestination, and decree of God, but not with His satisfaction and approval. Should any ask why God willeth and produceth evil, we can only reply that He may have wise ends in view which we cannot comprehend." Some Mohammedan teachers (disciples of Al-Ash'ari) endeavor to maintain the consistency of this doctrine with man's freedom and responsibility; but practically the Sunnite or orthodox Mohammedans believe that by the force of God's eternal decree man is constrained to act thus or thus. From this there has resulted, on the one hand, the Epicurean pessimism of 'Omar Khayyám—

"'Tis all a chequer-board of nights and days
Where destiny with men for pieces plays:
Hither and thither moves, and mates, and slays,
And one by one back in the closet lays"—

or the weak recklessness of the poet Faizi: "Before thou and I were thought of, our freewill was taken from us; be without cares, for the Maker of both worlds settled our affairs long before we were made." On the other hand, there has resulted the freethinking (Mo'tazilite) reaction, to which the Shiahs incline and which rehabilitates freewill at the expense of the divine sovereignty.

Within the Christian church there have in like manner always existed two opposed beliefs regarding predestination, which have received their ultimate development and expression in the Calvinistic and Arminian systems respectively. The Calvinistic doctrine of predestination is that "from all eternity God chose or elected some men—certain definite persons of the human race—to everlasting life; that He decreed or determined certainly and infallibly, and not conditionally and mutably, to bring those persons to salvation by a Redeemer; that in making this selection of some men, and in decreeing to save *them*, He was not influenced or determined by anything existing in them or foreseen in them—such as faith or good works—by which they were distinguished from other men, or by anything out of Himself, or by any reason known to us or comprehensible by us; and that this eternal purpose or decree He certainly and infallibly executes, in regard to each and every one included under it; while all the rest of men not thus elected He decreed to pass by,—to leave in their natural state of sin and misery, and finally to punish eternally for their sin." The Arminian doctrine of predestination (see **ARMINIUS**) is that God has from eternity decreed to give eternal life to as many as repent and believe, and foreseeing who shall repent and believe He has determined to give life to these. The "peremptory" election of individuals to life eternal proceeds only on the foreknowledge of their faith and obedience, so that, as the Remonstrants explicitly affirmed, the decree proper in predestination is that decree by which it is determined on what grounds or conditions God assigns sinners to salvation.[2] The difference between these two views of predestination is wide, and, when logically carried out, radical. The Calvinist maintains that God absolutely decrees the salvation of a certain fixed number of definite persons, and in pursuance of this decree infallibly secures their salvation; the Arminian maintains that God's decree, so far as it concerns the salvation of individuals, is conditional upon their use of the means of grace. That which constitutes Arminianism is the denial that God absolutely elects individuals to eternal life; and that which lies at the root of Calvinism, and out of which all that is characteristic of the system springs, is the affirmation that God does absolutely elect certain individuals to life eternal, and in pursuance of this decree works in them all that constitutes life eternal. According to Calvinism, salvation is the work of God. Seeing men to be all alike helplessly involved in sin and misery, God determined to save some, not on account of any good in them but for some inscrutable but necessarily wise and just reasons, and because of this determination He gives to those whom He wills to save, and enables them to receive and retain, all that is involved in salvation,—renewal of will, union to Christ, holiness of life, the indwelling Spirit.

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[1] This restricted use of the term is favored by Lutherans ("Accipitur prædestinatio vel *improprie*, quomodo destinationem et ad vitam et ad mortem complectitur, . . . vel *proprie*, quomodo phrasi scripturæ tantum ordinationem ad vitam notat," Quenstedt). In a different interest, the Westminster Confession seems to incline to restrict the use of the word "predestinate" to the decree which secures to some men life eternal, while for the obverse of that decree, by which the rest of men are consigned to everlasting death, it prefers the term "foreordained": its words are, "By the decree of God, for the manifestation of His glory, some men and angels are *predestinated* unto everlasting life and others *foreordained* to everlasting death. These angels and men, thus predestinated and foreordained," etc. Dr. Cunningham (*Historical Theol.*, ii. 422) tells us that this distinction is not grounded either on etymology or on the usage of theologians, "but Calvinists, in general, have held that there is an important difference between the way and manner in which the decree of election bears or operates upon the condition and fate of those who are saved, and that in which the decree of reprobation, as it is often called, bears or operates upon the condition of those who perish; and the *existence* of this difference, though without any exact specification of its nature, the compilers of the Confession seem to have intended to indicate, by restricting the word 'predestinate' to the elect, the saved; and using the word 'foreordained' in regard to the rest." Probably a significance slightly more definite should, however, be attached to the introduction of this distinction; for as early as the age of Augustine objection was taken to the expression "*prædestinati ad interitum*" on the specific ground that it seemed to impose upon men a necessity of perishing. And Bishop Davenant, while he does not shrink from using the term "predestinate to death," gives this significant explanation: "if by predestinating *ad interitum* we understand the causing and effectual working of any man's destruction, God cannot be said *prædestinare ad interitum:* but if we only understand the foreordaining of those to damnation whom God foresaw deserving and working the same, we neither think nor speak otherwise than the orthodox Fathers did" (*Animadversions*, etc., p. 41).

[2] "Sententia Remonstr.," in Hale's *Letters from Dort*, pp. 174-175; also *Apol. Conf. Remonstr.*, p. 102.

The doctrine of predestination was first formulated in the church by Augustine. The Pelagian idea that man is competent to determine his own character, conduct, and destiny was repugnant to him, and he strove to show that the initial and determining element in the salvation of the individual is not the human but the divine will. He based his position upon the doctrine of original sin and the consequent depravity of the will. This doctrine represents the whole human race as involved in moral ruin, guilty and sinful, incapable of self-regeneration or of willing what is good. By God alone, therefore, can regeneration and deliverance be accomplished. The salvation designed by God must not be allowed to depend for its efficacy on the depraved and incapable will of man; it must be an absolute act of power on God's part. Provision must be made not only for the offer but for the acceptance of grace. In a word, grace must be effectual or irresistible. Hence Augustine distinguished between "assistance without which a thing cannot be done" and "assistance by which a thing is done" (the Jansenist *adjutorium sine quo non* and *adjutorium quo*, assisting and efficacious or irresistible grace). By every device of language he throws the whole work of salvation upon God ("facit credentes," "data sunt et ipsa merita quibus datur," "non solum mentes bonas adjuvat, verum etiam bonas eas facit"). This is the distinctive characteristic of the dispensation of redemption, that it depends not on man's will but on God's. "A dispensation which left the salvation of man dependent on his will was highly suitable as a first one, suitable alike to the justice of the Creator and the powers of the untried creature, and such as we should naturally expect at the beginning of things, but such having been the nature of the first, the second must, for that very reason, be a dispensation of a different kind, effecting its design not by a conditional but by an absolute saving act." This absolute saving act being an act of God, and it being maintained by all theologians that whatever God Himself does in time He has from eternity decreed to do, we have the doctrine of predestination. As Aquinas tersely puts the kernel of the Augustinian doctrine: "It is manifest that whatever is of grace is the effect of predestination." With Augustine grace is nothing else than predestination realized. Grace is irresistible because it is God's instrument in fulfilling His decree. This carries with it a refutation of the three modified forms of predestinarian doctrine which continually seek to make good for themselves a position within the church. It maintains (1) that men are elected not to means of grace only but to grace itself. Salvation is infallibly secured to the elect (*De Dono Persev.*, passim). It maintains (2) that not nations or the church but individuals are the objects of predestination—a certain fixed number, "so certain that no one can be added to it or taken from it" (*De Corr. et Gratia*, 13). And (3) this predestination must be founded, not on foreseen good in man, but on the inscrutable but necessarily just will of God (*De Præd. Sanct.*, 17).[1]

As Augustine thus constructed the doctrine of predestination as an integral part of the evangelical system, he necessarily spoke much more of election than of reprobation, but he did not shrink from acknowledging, with all intelligent predestinarians, that the election of some involved the passing by (præteritio) of the rest: "for the *rest*, where are they but in that mass of perdition where the Divine justice most justly leaves them?" (*De Dono Persev.*, 14). "If God from eternity absolutely elected some unto the infallible attainment of grace and glory, we cannot but grant that those who are not comprised within this absolute decree are as absolutely passed by as the others are chosen" (Bishop Davenant's *Animadversions*, p. 4). All men being naturally under condemnation, it seemed to Augustine no injustice that in some that condemnation should take effect, and, if it is suggested that it would at all events have been better had all been saved, he is content to reply, "Who art thou, O man, that repliest against God?" He has no hesitation, therefore, in using the expressions "prædestinati ad interitum," or "ad æternam mortem," or "damnationi prædestinati;" and in using these expressions he indicates that there are some to whom God has decreed not to give saving grace, and that He foresaw that these persons would sin and be damned. He does not bring the decree of reprobation into direct, and of course not into causal connection with the sins of the reprobate, holding that, while the decree of God is the efficient cause of all good in the elect, the cause of sin in the reprobate is the evil will of man. He denies that God's foreknowledge of man's sin makes that sin necessary, but he nowhere exhaustively discusses the distinction between foreknowledge and decree. When pushed to defend God's justice in creating those whose damnation He foreknew, he responds to the challenge sometimes by showing that, so far as the Creator's responsibility is concerned, the creature which sins with free will is of a higher kind than that which cannot sin because it has no free will; sometimes on the ground that it contributes to God's glory that His retributive justice should be manifested; and sometimes on the ground that in the destruction of sinners the elect will see what God's goodness has saved them from.

About the middle of the 9th century Gottschalk attempted to revive Augustinianism (see GOTTSCHALK). His teaching regarding predestination was precisely that of his master, and as such it was maintained by Remigius of Lyons in opposition to the blundering and intolerant Hincmar of Rheims. Hincmar admitted predestination to life and also the consequent abandonment of the rest of men to their sinful state, and yet he mercilessly persecuted Gottschalk for maintaining a predestination to punishment, and sought to establish a distinction between leaving men in a state which involves punishment and ordaining them to punishment. Remigius exposed the futility of such a distinction and showed that "the abandonment of a certain portion of mankind to the state of sin in which they are born is predestinarian reprobation, whether we express it as abandonment to sin or as ordaining to punishment." The discussion, however, extensive and heated as it was, did not go deeply into the substance of the controversy. The incident which gave a distinctive character to this period of the development of the doctrine was the appeal for aid which Hincmar made to John Scotus Erigena, for in the tract on predestination which Erigena wrote in response to this appeal he introduced the terms and methods of philosophy and sought a solution for the problem in the nature of God. He argued that, God being eternal, foreknowledge and predestination, which are temporal relations, could only improperly be predicated of Him. He argued also that sin and its consequences in death and misery are nonentities, the mere corruption, defect, or privation of their opposite realities, and that therefore they can neither be caused by God nor be known by Him. Reprobation is therefore impossible. Still further, he argued that evil is only a stage in the development of good, and that the ultimate issue of the development is universal return to God. This orthodoxy was considered more dangerous than the heresy it was called in to resist. Prudentius, Ratramnus, Lupus, and Florus denounced the introduction of this style of discussion, for which indeed the mind of the church was not at that time prepared. Not only did interested individuals resist the teaching of Erigena, but two councils condemned his treatise as containing "hæreses plurimas, ineptas quæstiunculas, et aniles pæne fabellas, pluribus syllogismis conclusas, Scotorumque pultes puritati fidei nauseam inferentes." Accordingly no additional light on the problem was received by the church at this time.

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[1] See Mozley, *Augustinian Doctrine of Predestination.*

This controversy, however, was merely the prelude to a discussion which was maintained throughout the scholastic period, and in which the Thomists adopted the more rigid Augustinian view, while the Scotists leaned to Semi-pelagianism. Anselm and Peter Lombard were moderately and guardedly Augustinian. Thomas Bradwardine (archbishop of Canterbury, d. 1349) complained that almost the whole world had fallen into Pelagianism, and strenuously opposed this tendency. But it is in Aquinas (*Summa*, 1, Q. xxiii.) that we find the clearest and most compact treatment of the subject. His doctrine is substantially that of Augustine. In express terms he teaches that predestination is an essential part of the divine providence, and that, as some, and these a fixed number, are ordained to life eternal, so by the same divine providence others are allowed to fail of this end ("et hoc dicitur reprobare"). He teaches further that this predestination does not depend upon any foreseen difference of character ("præscientia meritorum non est causa vel ratio prædestinationis"). Aquinas derives his doctrine of predestination directly from his doctrine of God (not from his anthropology, as Augustine had done). His idea of God was the Aristotelian "first mover, itself unmoved." That God is in all things by His power, presence, and *essence* he explicitly maintains against three forms of error regarding the connection of God and the world. The divine will is the cause of all things past, present, and to come.

But the contribution made by Aquinas consists in his theory of the divine concurrence, by which he seeks to provide a philosophical basis for Augustinianism. The divine providence governs all things by means of two great classes of secondary causes, the necessary or natural and the contingent or voluntary. The mediate or proximate causes of all that takes place in the natural world are necessary; the proximate causes of human action are the voluntary motions of the will. But both are set in motion by God, the First Cause: as the actings of natural causes remain natural, though they are moved by God, so do the actings of voluntary causes remain voluntary though moved by God.[1] But obviously this theory leaves only an appearance of free will. "Free will is here *reconciled* and made *consistent* with the divine power, brought into the same scheme and theory. But it is of itself a sufficient test that a system is necessitarian, that it maintains the divine power in *harmony* with free will. The will as an original spring of action is irreconcilable with the divine power"—at least with the scholastic idea of the divine power—"a second first cause in nature being inconsistent with there being only one First Cause." Besides, every theory of predestination which bases itself on the idea that God is the sole originating and true cause must give an account of the origin of evil. Aquinas recognizes this and endeavors to meet the requirement by showing (1) that to a complete universe all kinds of creatures are requisite, not only the highest but the lowest; (2) that there cannot be a perfect universe without the existence of free will, but that this involves the risk of evil; and (3) that evil is a negation. Of these arguments there are hints in the writings of Augustine and Erigena, and none of them is satisfactory, although they certainly point in the right direction.

At the Reformation the discussion was drawn back from the endeavor initiated by the schoolmen to find for the doctrine of predestination a scientific basis in the nature of God and His connection with the world. The more circumscribed method of Augustine was reverted to, and it was deemed sufficient to show that predestination was indispensable to the ideas of grace which found a response in the devout Christian consciousness, and that it was in harmony with Scripture. Not only Calvin, but much more unguardedly Luther, and even Melanchthon in the earliest (1521) edition of his *Loci Communes*, taught the most rigid Augustinian doctrine. In the later editions (1535, 1543) Melanchthon greatly modified his opinions and inclined more to the synergistic view, though even in this he was not thoroughgoing. But the attempt to terminate the synergistic controversy saddled the Lutherans with a symbol—the *formula concordiæ*—which, awkwardly enough, rejected both the Semipelagian theory of co-operation and the Augustinian doctrine of predestination. The consequence has been that later Lutheran theologians, in their efforts to purge their church of this inconsistency, have devised the theory that man, unable as he is to will any good thing, can yet use the means of grace, and that these means of grace, carrying in themselves a divine power, produce a saving effect on all who do not voluntarily oppose their influence. Baptism, *e.g.*, confers grace which, if not resisted, is saving. And God, foreseeing who will and who will not resist the grace offered, predestinates to life all who are foreseen as believers.

The theory of Calvin (*Inst.*, i. 15–18; iii. 21–24) need not be detailed, because it is Augustinian not only in its substance but in the methods and grounds by which it is sustained.[2] Hagenbach (*Hist. of Doctrines*, iii. 103) and others have indeed asserted that Calvin held the supralapsarian theory, and in so far differed from Augustine. But in order to prove Calvin or any one else a supralapsarian it is not enough to show that he believed that the fall was decreed, for this is admitted by Augustine and all sublapsarians; it must be shown that the fall was decreed *as a means towards carrying out a previous decree to save some and leave others to perish*,—a view which Calvin turns from as an *otiosa curiositas*. The supralapsarian view was, however, adopted by Beza and other Calvinists, as it had been held by some of the Augustinian schoolmen: and indirectly this led to the reopening of the controversy in the beginning of the 17th century. For it is said to have been the extreme supralapsarianism of Perkins which repelled Arminius from Calvanism and led him to promulgate the opinions which are known as Arminianism, and which led to the summoning of the synod of Dort (see ARMINIUS and DORT). The canons of Dort, while not definitively exclusive of supralapsarianism, are favorable to the sublapsarian view; and the Westminster divines followed the lead of Dort in constructing their *Confession* so as to admit of signature by either party.

Meanwhile the Church of Rome had been torn by similar diversities of opinion. The council of Trent was careful not to offend the Dominicans by explicitly repudiating Augustinian doctrine. But, as time went on, the Jesuit MOLINA (*q.v.*) stirred the sleeping controversy by a well-meant and decidedly able attempt to reconcile free will and God's foreknowledge. A still more serious disturbance was created by the strenuous efforts of Jansen to revive the decaying Augustinianism of the church. But neither then nor in more recent times has anything essential been added to the argument on either side; and until our knowledge of the freedom of the will becomes more scientific—that is, more accurate, thorough, and reliable—it is impossible that the argument can advance. During the last two centuries the discussion in England has turned not so directly on the truth or falsity of Calvinism as upon the question whether the Church of England Articles are or are not Calvinistic. This question has been reopened at various times—at the dismissal of Baro from the Margaret professorship at Cambridge at the close of the 16th century; on occasion of Dr. Samuel Clarke's plea for Arian subscription; in connection with the Wesleyan claim that the Articles favored Arminianism; and again, in this century, in the Bampton lectures of Archbishop Laurence. The arguments which may be gathered from the actual terms of the seventeenth Article itself are very fairly stated by Bishop Burnet, who, though himself an Arminian, frankly allows that Calvinists can sign the Article with less scruple than Arminians, "since the Article does seem more plainly to favor them." The historical facts regarding the theological school to which the framers of the Articles belonged are very fully given in Goode's *Effects of Infant Baptism.*[1] In Germany, notwithstanding Herder's dismissal of the subject of predestination with the curse, "May the hand wither that shall ever bring it back," theologians still range themselves in opposite camps—Kliefoth, Frank, and Sartorius advocating the Augustinian doctrine, while Thomasius, Hofmann, and Luthardt attempt a middle course.

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[1] "Sicut naturalibus causis, movendo eas, non aufert quin actus earum sint naturales, ita movendo causas voluntarias, non aufert quin actiones earum sint voluntariæ, sed potius hoc in eis facit."

[2] Compare Burnet, *On the XXXIX. Articles*, and Mozley's *Augustin. Doct.*, where this agreement is affirmed.

Lipsius justly observes that the solution of the problem of predestination is the solution of the religious problem in general. The Augustinian theory is not an isolated doctrine which may be accepted or rejected without any material alteration of fundamental beliefs. It is rather a deliverance upon the relation which subsists between God and the world,—that is, upon the radical problem of philosophy. No doubt it is rather in a theological than in a philosophical interest that the subject has usually been debated. It has been felt that the Augustinian theory accords better with the devout humility of the religious spirit, and lays a sure ground for hopeful confidence; while the opposed theory is considered to be more likely to excite human effort and secure a more satisfactory level in conduct, if not a higher spiritual condition. Both parties have been influenced by a perhaps somewhat officious zeal for the divine reputation, the one party being concerned to maintain God's sovereignty, the other His goodness. Our ignorance of the divine nature, and our inability to apprehend the subtlety of His connection with the world, have not been sufficiently allowed for by either party. Is God the absolute sovereign without whose will no individual act is done? Is He in all things by His essence and will? Then the Calvinistic scheme seems alone legitimate. As Calvin himself argues, if God has not absolutely decreed all things, then "ubi erit illa Dei omnipotentia, qua secundum arcanum consilium, quod aliunde non pendet, omnia moderatur?" (*Inst.*, iii. 23, 7). And yet, if God's sovereignty is thus universal, can the freedom of the human will be preserved in more than name? Is not the world of human thought and action reduced to a mere play of puppets, a pantheistic sham? If God's will has determined all that is to be, what real power of origination is left to man? He who determines upon a certain event sets in operation such causes as will produce it, and is himself its proper efficient cause. If God is thus the real cause of all that is, the universe would seem to be merely God evolving Himself, and there has been no true creation, no bringing into being of wills separate from His own.

The grave difficulty, therefore, with which the strict doctrine of predestination has always to contend is its apparent inconsistency with human accountability. It is accused generally of colliding with human freedom, and particularly of representing God as the author of sin. This consequence of their teaching Calvinists repudiate. They maintain that by God's foreordination of whatsoever comes to pass "violence is not offered to the will of the creature"; and they have adopted various methods of relieving their doctrine from the odium of this charge. The character of an act has been separated from its substance or actuality, and, while its character is ascribed to man's free will, its actuality is referred to God's sustaining energy. Or it has been supposed that God may have created men with the power of originating action, so that, though dependent upon God for life, yet when kept in life men can act freely. But this scarcely meets the difficulty, for Calvinism maintains that each individual act is determined by God. Others again prefer to relegate these seeming contradictions to the region of the unknowable, and to say with Locke: "I cannot have a clearer perception of anything than that I am free, yet I cannot make freedom in man consistent with omnipotence and omniscience in God, though I am as fully persuaded of both as of any truth I most firmly assent to; and therefore I have long since given off the consideration of that question, resolving all into the short conclusion that if it be possible for God to make a free agent, then man is free, though I see not the way of it." (M. D.)

PRE-EMPTION. See SALE.

PRELATE. See ABBOT and BISHOP.

PRELLER, FRIEDRICH (1804–1878), German landscape-painter, was born at Eisenach on 25th April, 1804. After studying drawing at Weimar, he went in 1821, on Goethe's advice, to Dresden, where he made such progress that in 1824 he was invited to accompany the grand-duke of Weimar to Belgium, where he became a pupil in the academy at Antwerp. From 1827 to 1831 he studied in Italy, and in the last-named year he received an appointment in the Weimar school of art. In 1834–36 he executed in tempera six pictures on subjects taken from the *Odyssey* in the "Roman House" at Leipsic, in 1836–37 the landscapes with scenes from *Oberon* in the Wieland room in the grand-ducal palace at Weimar, and in 1836–48 six frescos in Thuringian subjects commissioned by the grand-duchess. In 1840 he visited Norway and produced a number of easel works, some of which are preserved at Weimar. In 1859 he revisited Italy, and on his return in 1861 he completed for the grand-ducal museum the landscapes illustrative of the *Odyssey*, which are held to constitute his chief claim to fame, entitling him to rank with Poussin and Claude Lorraine in the hierarchy of painters. Preller, who was also a successful etcher, died at Weimar on 23d April, 1878.

PRELLER, LUDWIG (1809–1861), author of well-known works on Greek and Roman mythology, was born at Hamburg on 15th September, 1809. He studied philology at Leipsic under Gottfried Hermann, at Berlin under Böckh, and at Göttingen under O. Müller, graduating at the last named university in 1832. After "habilitating" as privat-docent in Kiel, he was called in 1838 to an ordinary professorship at Dorpat, which, however, he speedily resigned along with several other German professors in consequence of misunderstandings with the Russian governing body. He afterwards spent some time in Italy, but settled in Jena in 1844, where he became professor in 1846. In the same year he removed to Weimar as head librarian and hofrath. In 1852 he travelled in Greece and Asia Minor. His death occurred at Weimar on 21st June, 1861.

Preller's chief works are—*Demeter u. Persephone* (1837), *Griechische Mythologie* (1854–55; 3d ed., 1872–75), and *Römische Mythologie* (1858; 3d ed., 1878). He also co-operated with H. Ritter in the preparation of a useful *Historia philosophiæ græcæ et romanæ ex fontium locis contexta* (1838; 4th ed., 1869), and contributed extensively to Ersch and Gruber's *Allgem. Encykl.*

PRENZLAU, or PRENZLOW, a town of Prussia, in the province of Brandenburg, lies on the lower Ucker See, 60 miles north by east of Berlin and 30 miles west by south of Stettin. It is a busy little place with various branches of industry, among the chief of which are wool cleaning and spinning, iron-founding, and sugar-refining. A good deal of tobacco is grown in the neighborhood, and there is a cigar manufactory in the town. A brisk trade is carried on also in cattle and grain. The Gothic church of the Virgin, dating from 1340, is one of the finest churches in the district, and the remains of the old town gates and walls are also interesting. In 1880 Prenzlau contained 16,933 inhabitants, nearly all Protestants and many of French descent. The garrison consists of about 800 men.

Prenzlau is first mentioned in a document of the close of the 12th century, and received its municipal charter in 1235. As the capital of the old Ucker mark it was a frequent object of dispute between Pomerania and Brandenburg until finally incorporated with the latter about 1480. It was at

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[1] A review of the controversy and its literature will be found in Cunningham's *Reformers and Theology of the Reform.*, Essay iv.; and, on the other side, Hardwick's *Hist. of the Articles* may be consulted.

Prenzlau that Prince Hohenlohe, with his corps of 12,000 men, surrendered to Murat on the retreat after the battle of Jena.

PRERAU (Slav. *Prerov*), one of the oldest towns in Moravia, lies on the Beczwa, 13 miles to the south-east of Olmütz. It is an important railway junction and carries on a considerable trade. The chief industries are sugar-boiling (from beetroot), rope-making, and the manufacture of agricultural and other machinery. The only buildings of interest are the old castle, once occupied by Matthias Corvinus, and the Gothic town-house. The population in 1880 was 10,985.

PREROGATIVE, in law, is an exclusive privilege of the crown. The word, originally an adjective, is derived from the *centuria prærogativa*, or century which voted first on a proposed law (*rogatio*) in the Roman *comitia centuriata*. In English law, Blackstone says, "by the word prerogative we are to understand the character and power which the sovereign hath over and above all other persons, in right of his regal dignity; and which, though part of the common law of the country, is out of its ordinary course. This is expressed in its very name, for it signifies, in its etymology, something that is required or demanded *before*, or in preference to, all others; and, accordingly, Finch lays it down as a maxim that the prerogative is that law in the case of the king which is law in no case of the subject" (Stephen's *Comm.*, vol. ii. bk. iv. pt. i. ch. vi.). The prerogative is sometimes called *jura regalia* or *regalia*, the *regalia* being either *majora*, the regal dignity and power, or *minora*, the revenue of the crown. The word "prerogative" is used to denote the whole privilege of the crown or any part of it; in the latter sense it may be used in the plural number.

The theory of English law as to the prerogative of the king seems to be not quite consistent. On the one hand, he is a perfect and irresponsible being, holding his office by divine right; "Victoria, *by the grace of God* of Great Britain and Ireland Queen,"[1] is still the heading of every writ. On the other hand, his powers are defined and limited by law. This is laid down as early as the 13th century: "Rex non debet esse sub homine sed sub Deo et sub lege, quia lex facit regem" (Bracton, 5b),—a striking contrast to the rule of Roman law, "quod principi placuit legis habet vigorem." A consequence of this position is that the prerogative may be confined or extended by the supreme legislative authority, and that the courts have jurisdiction to decide whether or not any alleged right falls within the prerogative. The prerogative of the crown, still of great extent, has been gradually limited by a long series of enactments, the most worthy of notice being *Magna Carta*, *Confirmatio Cartarum*, *Prerogativa Regis*, the Petition of Right, the Habeas Corpus Act, the Bill of Rights, and the Act of Settlement. (See ENGLAND.) Where a prerogative was abolished by statute, in some instances compensation was granted in return for the surrender, in others no compensation was given. An example of the former is the statute 12 Car. II. c. 24, by which excise duties were granted to the crown in return for the abolition of military tenures and their incidents; of the latter, the statute 16 Car. I. c. 20, abolishing the prerogative of imposing compulsory knighthood or a fine in its place. The prerogative has also been limited by judicial decision and by tacit abandonment. Thus monopolies were declared illegal (in the respectful language of the judges the queen was held to have been deceived in her grant) in the reign of Elizabeth by *The Case of Monopolies* (11 Coke's *Reports*, 84), and the right to exclude a member from parliament was abandoned by the same queen in 1571. The most important of the obsolete prerogatives, other than those named, which have been at one time claimed and exercised are the following. (1) The right to impose a tax upon the subject without the consent of parliament was the subject of contest for centuries. Sums were raised at various times under the names of talliage, scutage, hydage, subsidies, aids, benevolences, tonnage and poundage, tolls, ship-money, tenths, fifteenths, etc. (2) The right to dispense with the obligation of statutes, by the insertion in a grant of the clause *non obstante statuto*, was frequently asserted by the crown down to the Revolution. An end was finally put to this and the last right by the Bill of Rights. (3) The right of purveyance and pre-emption—that is, of buying up provisions at a valuation without the consent of the owner—and the right of impressing carriages and horses were finally abolished by 12 Car. II. c. 24. (4) The authority to erect tribunals not proceeding according to the ordinary course of justice was declared illegal by 16 Car. I. c. 10 (the Act dissolving the Star Chamber, the court of the marches of Wales, and the court of the president and council of the north). (5) The revenue from first-fruits and tenths, annexed to the crown by Henry VIII., was vested by Queen Anne in trustees for the augmentation of poor benefices, 2 and 3 Anne c. 11. This is what is usually called "Queen Anne's bounty." (6) The right of corody—that is, of sending one of the royal chaplains to be maintained by a bishop until the bishop promotes him to a benefice—has become obsolete by disuse. (7) The right by forfeiture to the property of a convict upon his conviction for treason or felony was abolished by the Felony Act, 1870. (8) The immunity of the crown from payment of costs has been taken away in almost all cases. The crown is liable to costs in revenue cases by 18 and 19 Vict. c. 90, in petitions of right by 23 and 24 Vict. c. 34. (9) The right to alienate crown lands by grant at pleasure was taken away by 1 Anne c. 8, passed in consequence of the improvident alienations of land by William III. In very few cases has the prerogative been extended by statute; 34 and 35 Vict. c. 86 is an example of such extension. By that Act the jurisdiction of lords-lieutenant of counties over the auxiliary forces was revested in the crown.

The prerogative may be exercised in person or by delegation. The prerogative of conferring honors is generally (though not necessarily) exercised by the king in person, as in the case of investment with knighthood and military or civil decorations. The delegation of the prerogative often takes place by commission, issued with or without a joint address from both Houses of parliament. An example of a commission issued on a joint address is the commission to inquire into the existence of corrupt practices after an election (15 and 16 Vict. c. 57). In most cases a commission is issued by the prerogative alone without any address from parliament; thus the assent of the crown to a Bill may be given by commission, and rights of command may be granted by commission to officers in the army and navy. The delegation of the prerogative in judicial matters is illustrated by commissions of the peace and commissions of assize. The prerogative may still further be delegated by a delegate; thus commissions of lunacy are and commissions of bankruptcy were issued by the lord chancellor as the representative of the crown. Parts of the prerogative—generally in the nature of profit, and so in derogation of the revenue of the crown—may be conferred upon subjects by grant in letters patent, which will be presumed after enjoyment by the subject for a certain time. What in the king is a prerogative becomes a franchise in the subject, *e.g.*, chases, warrens, wrecks, treasure-trove, courts-leet.

The existing prerogatives may be divided, with Blackstone, into such as are direct and such as are by way of exception; or perhaps better, with Chief Baron Comyns, into those affecting external relations and those affecting internal relations. Under the first class would fall the power of making war and concluding peace. As incidents to this power the king has the right of sending and receiving ambassadors, of concluding treaties, and of granting passports, safe-conducts, letters of marque, and reprisals. These rights may be limited by international agreement; thus the Declaration of Paris, 1856, abolished privateering as far as the assenting nations (of whom Great Britain was one) were concerned.

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[1] There is no difference in the prerogative as exercised by a king or a queen regnant, so that the word "king" in its constitutional sense includes queen. That the queen regnant has the same rights as a king was declared by 1 Mary, sess. 3, c. 1.

The prerogatives affecting internal relations may be conveniently, if not scientifically, classified as personal, political, judicial, ecclesiastical, and fiscal.

Personal.—In order that there may always be an existing head of the state the king is regarded as a corporation. He cannot die; there can be only a demise of the crown,—that is, a transfer of the royal authority to a different person. On the same principle the king cannot be under age, though in cases where the king has been of tender years a protector or regent has usually been appointed for administrative purposes. The king is personally irresponsible for crime or tort, it being an ancient common law maxim that the king can do no wrong, and that any injury suffered by a subject at the hands of the king is to be attributed to the mistake of his advisers. A curious consequence of this irresponsibility is that the king is apparently the only person in the realm who cannot under any circumstances arrest a suspected felon, for no action for false imprisonment would lie against him, and in the event of the arrest of an innocent person there would be a wrong without a remedy. He cannot be guilty of laches or negligence. The maxim of the common law is "Nullum tempus occurrit regi." This is still the law in criminal matters. With a very few exceptions, such as prosecutions for treason and offences against the customs, no lapse of time will in England (though it is otherwise in Scotland) bar the right of the crown to prosecute. In civil matters the crown is barred of its right in suits relating to land by the lapse of sixty years (9 Geo. III. c. 16). The king is exempt from taxation on the ground that, as the revenue of the realm is his prerogative, it is useless for him to tax himself. But lands purchased by the privy purse are liable to taxation (39 and 40 Geo. III. c. 88, s. 6). He is also exempt from tolls (which can only exist as a franchise granted by him), and from the poor-rate, as he is not mentioned in the Poor Law Acts. His person cannot be arrested, or his goods distrained or taken in execution. The privilege of exemption from taxation applies to his palaces and to the public buildings of the state. No kind of judicial process can be executed in a palace as long as it continues to be a royal residence. The privilege does not attach to palaces which the king has ceased to use as a dwelling, such as Hampton Court, with the one exception of Holyrood House, with the precincts, which still affords a sanctuary from civil process. It does not, however, protect criminals or crown debtors. The king has also several personal privileges of minor importance, such as the title of "majesty," the right to a royal salute, to the use of the royal standard and of special liveries, etc.

Political.—The king is the supreme executive and co-ordinate legislative authority. As such authority he has the attribute of sovereignty[1] or pre-eminence, and the right to the allegiance of his subjects. All land is mediately or immediately held of him (see LAND). Land derelict suddenly by the sea, land newly discovered by subjects, and islands arising in the sea are his. As paramount authority in parliament he can dissolve or prorogue it at pleasure, but cannot prolong it beyond seven years. In theory parliament only exists at his will, for it is summoned by his writ, and the vote for a member of parliament is only a franchise, not a right existing independently of his grant. He can refuse his assent to a bill passed by the Houses of parliament. This right has, however, not been exercised since 1707, when Queen Anne refused the royal assent to a Scottish Militia Bill. The king has power to issue proclamations and (with the assent of the privy council) orders in council, in some cases as part of the ancient prerogative, in others under the provisions of an Act of parliament. Proclamations are only binding so far as they are founded upon and enforce the laws of the realm. They cannot alter the common law or create a new offence. By 31 Hen. VIII. c. 8 it was enacted that the king's proclamations should, under certain conditions, have the force of Acts of parliament, but this Act was repealed by 1 Edw. VI. c. 12. The king is not in general bound by an Act of parliament unless named therein. He can, by virtue of his supreme executive authority, recall a subject from abroad, or forbid his leaving the realm by the writ of *ne exeat regno*. This writ at the present day is not used for state purposes, but merely to prevent a party to an action from going abroad. To order aliens to leave the realm is apparently a matter not falling within the prerogative, as, where such a course is necessary, an Act of parliament is passed; 11 and 12 Vict. c. 20 is an instance of such an Act passed for a temporary purpose. The right of the crown to grant letters of denization to aliens is preserved by 33 and 34 Vict. c. 14, s. 13. The king is the fountain of honor; as such he has the valuable power of granting peerages at will, so far as he is not restrained by any Act of parliament, and so far as he keeps within certain constitutional limits, *e. g.*, he cannot insert a shifting clause in a patent of peerage. He all confers all other titles of honor, whether hereditary or not, and grants precedence and armorial bearings. The great officers of state are appointed by the king. The only restriction upon the creation of offices is that he cannot create new offices with new fees attached to them, or annex new fees to old offices, for this would be to impose a tax upon the subject without an Act of parliament. The king, as head of the state, is in supreme command of the army and navy for the defence of the realm. This right, contested by the Long Parliament, was finally declared by 13 Car. II. c. 6 to be in the king alone. All supplies for the maintenance of the army and navy are voted annually, so that it is practically impossible for the king to use his position to the detriment of the state. The army is an annual institution, the Army Act of each session (which corresponds to the Mutiny Act passed annually up to 1878) reciting the provision of the Bill of Rights, "that the raising or keeping a standing army within the kingdom in time of peace, unless it be with consent of parliament, is against law." The right of command carries with it as an incident the right to build forts and defences, to impress seamen in case of necessity, and to prohibit the importation of munitions of war (39 and 40 Vict. c. 36, s. 43), also the right to the soil of the foreshore and of estuaries of rivers and the jurisdiction over territorial waters. (See NAVIGATION LAWS.) Other rights which fall under the political branch of the prerogative may be called the commercial rights, including the coining of money, the regulating of weights and measures, the establishing of markets and fairs, and the erecting of beacons, lighthouses, and sea-marks. The king also has the power of constituting corporations. A royal grant to inhabitants makes them a corporation for the purposes of the grant. The king is presumed to be the visitor of all civil corporations. As *parens patriæ* he is *ex officio* guardian of infants, idiots, and lunatics. It is scarcely necessary to point out that all these prerogatives (except the conferring of honors and such prerogatives as are purely personal) are exercised through responsible ministers, practically in these days members of the party to which the majority of the House of Commons belongs. Thus the jurisdiction over infants, etc., is exercised in England by the lord chancellor, and over beacons, etc., by the Trinity House, under the general superintendence of the Board of Trade.

Judicial.—The king is the fountain of justice, and the supreme conservator of the peace of the realm. "By the fountain of justice," as has been well said by Blackstone, "the law does not mean the *author* or *original*, but only the *distributor*. Justice is not derived from the sovereign, as from his *free gift*; but he is the steward of the public, to dispense it to whom it is *due*. He is not the spring, but the reservoir, from whence right and equity are conducted, by a thousand channels, to every individual" (Stephen's *Comm.*, vol. ii. bk. iv. pt. i. ch. vi.). The king was bound to the observance of justice by the well-known words of *Magna Carta*, "Nulli vendemus, nulli negabimus aut differemus, rectum aut justiciam." As supreme judge the king has the appointment of all judicial officers (other than those in certain local courts), who act as his deputies. He may constitute legal courts for the administration of the general law of the land, but he cannot erect tribunals not proceeding according to the known and established law of the realm, such as the Star Chamber (see above) or the commissions of martial law forbidden by the Petition of Right. Nor can he add to the jurisdiction of courts; thus he cannot give a spiritual court temporal powers. In early times the kings sat in person in the *curia regis*. The growth of a permanent judicature seems to be due to the increase of judicial business, making it impossible for the king to hear all the suits in the *curia regis* in person. Appeals from the colonies, the Channel Islands, and the Isle of Man still lie to the crown in council, a jurisdiction now practically exercised by the judicial committee of the privy council. The king is still (or was until very recently) in theory present in court. Actions in the Queen's Bench were until modern times said to be *coram rege ipso*, and the king could not be non-suited, for a non-suit implied the non-appearance of the plaintiff in court. The king enforces judgment by means of the sheriff, who represents the executive authority.

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[1] The word "sovereign" is frequently applied to the king in legal works. It should be borne in mind at the same time that the king is not a sovereign in the strict sense in which the term is used by Austin.

As supreme conservator of the peace, the king, through the lord lieutenant in counties and through the lord chancellor in cities and boroughs appoints, justices of the peace. In the same capacity he is the prosecutor of crimes. All indictments still conclude with the words "against the peace of our lady the Queen, her crown and dignity." As it is the king's peace that is broken by the commission of a crime, the king has, as the offended party, the power of remission. The king cannot be sued by ordinary action. He may sue by ordinary action, but he has the advantage of being able to use prerogative process (see below). He has the right of intervention in all litigation where his rights are concerned, or in the interests of public justice, as where collusion is alleged between the decree nisi and the decree absolute in divorce. Crown debts have priority in administration and bankruptcy.

Ecclesiastical.—The king is recognized as head of the church by 26 Hen. VIII. c. 1 and 1 Eliz. c. 1. By this prerogative he convenes and dissolves convocation and nominates to vacant bishoprics and other ecclesiastical preferments. He is also guardian of the temporalities during the vacancy of a see, but this is now merely a nominal prerogative. The dean and chapter of a cathedral cannot proceed to the election of a bishop without the king's permission to elect (*congé d' élire*). When any benefice is vacant by the promotion of the incumbent to a bishopric other than a colonial bishopric the king has the patronage *pro hac vice*. He is the supreme court of appeal in ecclesiastical cases. This appellate jurisdiction is now vested in the judicial committee of the privy council, with the assistance of archbishops and bishops as assessors (39 and 40 Vict. c. 59, s. 14). The king cannot create new ecclesiastical jurisdiction in England or in colonies other than crown colonies. (See BISHOP.) Where a new bishopric is created it is under the powers of an Act of parliament. It seems to be as head of the church that the king grants licenses to hold in mortmain, though the right now extends to lay as well as ecclesiastical corporations. The right is acknowledged by 7 and 8 Will. III. c. 37.

Fiscal.—The theory of the constitution is that the king, being entrusted with the defence of the realm and the administration of justice, must have sufficient means given him for the purpose. The bulk of the revenue of the Norman and Plantagenet kings was derived from crown lands and feudal dues. At the present day the rents of crown lands form a very small part of the revenue, and the feudal dues do not exist except in the pecuniarily unimportant cases of escheat, royal fish, wrecks, treasure-trove, waifs and strays, etc. Of the revenue a comparatively small part (the civil list) is paid to the king in person, the rest (the consolidated fund) is applied to public purposes.

Prerogative Process.—This is the name given to certain methods of procedure which the crown alone has the right of using; such are inquest of office (an inquiry by jury concerning the right of the crown to land or goods), extent (a mode of execution), *scire facias* (for the resumption of a grant), and information (by which proceedings are commenced in the name of the attorney-general for a public wrong or for injury to crown property).

Prerogative Writs.—Certain writs are called "prerogative writs," as distinguished from writs of right, because it is within the prerogative to issue or reissue them. In order to induce the court to issue them a *prima facie* case must be made out by the applicant. Writs of right, on the other hand, are *ex debito justitiæ*, and cannot be refused. Examples of prerogative writs are *certiorari*, *habeas corpus*, *mandamus*, *procedendo*, *prohibition*, *quo warranto*.

Prerogative Courts.—This was the name given to the provincial courts of Canterbury and York, as far as regarded their jurisdiction over the estates of deceased persons. They had jurisdiction to grant probate or administration where the diocesan courts could not entertain the case owing to the deceased having died possessed of goods above the value of £5 (*bona notabilia*) in each of two or more dioceses. The jurisdiction of the prerogative courts was transferred to the Court of Probate in 1857 by 20 and 21 Vict. c. 77, and is now vested in the Probate, Divorce, and Admiralty Division of the High Court of Justice by the Judicature Act, 1873 (36 and 37 Vict. c. 66, s. 34).

In the State of New Jersey, United States, the court having jurisdiction over probate matters is called the Prerogative Court (*Kent's Comm.*, vol. ii. p. 427).

Besides the authorities cited and the writers on constitutional history, the reader is referred to Allen, *Inquiry into the Rise and Growth of the Royal Prerogative in England*; Chitty, *The Prerogative of the Crown*; Staumforde, *Exposition of the King's Prerogative*; Comyns, *Digest*, art. "Prærogative"; Broom, *Constitutional Law*. (J.Wt.)

PRESBYTER. Towards the end of the 2d century the organization of the Christian congregations throughout the Roman empire, at least of all the greater ones, was identical. At the head of each was the bishop, whose function it was to conduct public worship, control the church funds, and keep watch over the manners of his flock. The free prophets and teachers having almost everywhere died out, the duty of religious instruction and edification also fell on him. In conducting the worship and in ministering to the wants of the poor he was assisted by the deacon and his subordinates. The presbyters formed a college, whose business was that of advising the bishop. Of this college he was the president, and as such he was himself a presbyter, and conversely the presbytery, inclusive of the bishop, formed the governing body of the community.[1] Outside of the presbytery the individual presbyter as such had no definite official duties. If he baptized, celebrated the eucharist, preached, or the like, this was only as commissioned and deputed by the bishop.[2] Such deputation was frequently necessary, and therefore the presbyter behoved as far as possible to be qualified to teach. As member of the college, which before everything had to do with jurisdiction and discipline, it was required of him that he should be of blameless life, that he should administer just judgment without respect of persons, and that in private life also he should as occasion offered exhort and admonish the faithful and set before them the law of God. The presbyters, who as a rule were expected to be men of advanced years, were, like the bishop and the deacons, chosen by the congregation. Their number was unrestricted, but there were small communities in which they did not exceed three or even two. In rank they were above the deacons, but below the bishop, yet in such a way that the bishop could call them his "co-presbyters."[3] As the bishop was not unfrequently chosen from among the deacons, even although in many congregations it may have been the case that the office was invariably bestowed on presbyters, and as the deacons stood in closer personal relation with the bishop than the presbyters, cases of invasion of the rights of the latter by the former began to occur from an early period. There can be no doubt that at the end of the 2d century all presbyters were elected office-bearers, but the way in which Irenæus speaks makes it quite clear that at an earlier date "presbyter" was also a title of honor borne by worthy and prominent persons in the congregations, who, in virtue of their advanced years, were witnesses for the purity of tradition. Irenæus, frequently speaking (as he does) of bishops simply as "presbyters," also proves that there must have been a time in which the bishop as member of the "synedrium" of the church cannot have held a higher position than the other members of this college.

Tracing the history upwards from Irenæus, we find in the *Epistles* of Ignatius, which may be assigned perhaps to about 140, the presbyters holding essentially the same position as they have at the end of the century. With Ignatius also the presbyters come into account only as a college; according to him they constitute a senate, as it were; he compares them to the college of the apostles, but gives great prominence to their subordination under the bishop, whom he likens to our Lord Himself. Except in the Ignatian *Epistles*, however, one finds the presbyters holding a different position within the Christian communities of the period from 90 to 140. This is not at all surprising, for there was not at that time any rigid and uniform organization of the congregations at all; as yet no *one* bishop stood at the head of each congregation, and as yet the church constitution was not determined by the idea of *office* alone, that of *charismata* (spiritual gifts) still having wide scope alongside of the other. Church organization was still influenced by a variety of ways of looking at the question—ways which sometimes crossed each other, and from the combination of which it cannot be doubted that a variety of constitutions resulted. We are not in a position to give a complete view of these, the historical material being insufficient, but points of leading importance can be established. Before all it is of consequence to recognize that in the congregations a threefold organization had place. (1) The duty of edifying and of preaching the gospel was not yet attached to an office but to a charisma. "Service in the word" was the business of apostles, prophets, and teachers who had been awakened by the Spirit and by the Spirit endowed. These were the *ἡγούμενοι* in the congregations; they alone in the first instance form the class of persons entitled to honor in Christendom; they never belonged to any one congregation exclusively, but were held to be "organs of the Spirit," given by God to the whole church. (2) In so far as each local church embraced a system of higher and lower functions—each was indeed a little world to itself—it possessed a governing body (*οἰκονόμοι*). For the care of the poor, for worship, for correspondence,—in a word, for its "economy," in the widest sense of that word, the congregation needed controlling officials. These were the bishop and the deacons,—the former for higher, the latter for inferior services; they owed their official position to the congregation, and in the nature of their offices there was, strictly speaking, nothing which could have laid the foundation of any special rank or exaltation. Many of the functions discharged by them nevertheless had the result of making the post of a bishop a very influential one (charge of the worship, control of the funds), and in so far as their service rested upon a charisma (*χάρισμα τῆς ἀντιλήμψεως*) a certain inner relation between them and the teachers endowed with the gift of the Spirit was established. (3) In so far as the individual congregation was an actual organism in which the varieties of age, of sex, of experience, of manner of life, and of ethical culture continued to exist and which had to be admonished, disciplined, and heeded, it from the nature of the case divided itself into leaders and led, a distinction which would assert itself in every sphere of the congregation's activities. The leaders were, as might be expected, the "elders" (*οἱ πρεσβύτεροι*), or, so to speak, the patrons; the led were the "younger" members (*οἱ νεώτεροι*). Out of this distinction arose equally naturally—for it was impossible for all the "elders" to take part in the conduct of affairs—the separation of an elected ruling college (*οἱ πρεσβύτεροι οἱ προϊστάμενοι*) from the *πλῆθος* (*plebs*, *λαός*). Thus an "order" (*ordo*) arose, placed over the congregation by the congregation itself.[1] To the presbyters belonged a *τιμὴ καθήκουσα*,—that is to say, the honor which naturally came from their position in life. In some congregations it may have been long before the elders were *chosen*, in others this may have come very soon; in some the sphere of the competency of the presbyters and patrons may have been quite indefinite and in others more precise. In some congregations, lastly, as in those of Asia Minor, the presbyters may have enjoyed particular honor for the special reason that they had known apostles or disciples of apostles personally;[2] in the majority of congregations this was not the case.[2] With the congregational administration, properly so called, in any case, they had nothing to do.

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[1] Tertull., *Apol.*, 39: "Præsident probati quique seniores, honorem istum non pretio sed testimonio adepti."

[2] Tertull., *De Bapt.*, 17: "Baptismi dandi habet jus summus sacerdos, qui est episcopus; dehinc presbyteri . . . non tamen sine episcopi auctoritate." In the oldest constitution of the Catholic Church which has come down to us relating to presbyters a regular service of some presbyters in public worship is indeed presupposed (Κανόνες ἐκκλησιαστ. τ. ἁγ. ἀποστόλων, c. 18), but this fact is unique of its kind.

[3] Compare the regulations laid down in the Arabic text of the *Canones Hippolyti* (c. 4): "At the ordination of a presbyter everything is to be done as in the case of a bishop, save that he does not seat himself upon the throne. The same prayer also shall be said as for a bishop, the name of bishop only being left out. The presbyter shall in all things be equal with the bishop save in the matters of presiding and ordaining, for the power to ordain is not given him.

We may call the first-named organization the *spiritual*, the second the *administrative*, the third the *patriarchal*. It is obvious that from the first it was impossible they should coexist side by side without coming into contact. Here two facts are of the highest importance. (1) If in any congregation prophets and teachers were wanting, then the administrative officials charged themselves with their function.[3] (2) The bishops had as such a seat and a voice in the presbyters' college; every bishop was at the same time a presbyter, whether old or young, but every presbyter was not necessarily also a bishop. In many communities, indeed—as, for example, at Philippi,[4] at Ephesus,[5] and in Crete[6]—all the presbyters may possibly also have been bishops, although this is by no means certain; but in other cases—as, for example, in that of Rome, as we learn from the *Pastor of Hermas*—all presbyters were not also bishops. Thus it is not the case that originally the bishops were simply identical with the presbyters, and that the one bishop was a gradual development out of the presbyters' college; on the contrary, the attributes of presbyters and bishops were originally distinct. But, since the bishops had a seat and a voice in the college and exercised special functions of importance besides, they ultimately acquired a higher place.

The office of presbyter was not during the oldest period (90–140) a *spiritual* one. The apostle, the prophet, the teacher, in a certain sense also even the old bishop and deacon, had a spiritual character, for they possessed a charisma. It was not so with the presbyters; they had no charisma, and the respect in which they were held arose out of the *natural* position which they took within the congregations. Hence the newly-discovered *Διδαχὴ τῶν ἀποστόλων* has nothing to say at all about presbyters, but only about apostles, prophets, teachers, bishops, and deacons. The design of that writing was to give those institutions of the apostles which are peculiar to the Christian community. The system of leaders and led is, however, a matter of order; it does not depend upon the special Christian charismata, and therefore does not impart to the Christian community its peculiar character. But, on the other hand, that the community is God's building is shown by such marks as these, that the apostles spread the gospel by their inspired preaching, that prophets and teachers edify the churches, that everywhere bishops and deacons are found at work in the churches, endowed with the gift of government and of loving service. Other communities also—towns, temples, synagogues, and the like—have presbyters, but they have no persons endowed with the gift of the Spirit. A sure proof of the correctness of the view just given is found in the circumstance that before the time of Domitian we do not possess in Christian literature a single sure testimony to the existence of presbyters. In the genuine epistles of St. Paul and in the Epistle to the Hebrews they are not mentioned. In 1 Cor. xii. 28 Paul says that God has given to the church apostles, prophets, teachers, miracles, gifts of healing, help, government; but of presbyters he has not a word to say. Even from passages where he is speaking of the jurisdiction of the congregation—as, for example, in 1 Cor. v., vi.—the presbyters are absent, while in Phil. i. 1 it is the bishops and deacons that he mentions. In the Epistle of James, in the First Epistle of Peter, in the Acts of the Apostles, and in the pastoral epistles the presbyters certainly occur, but no one is able to show that any of these writings are earlier than the age of Domitian. Even Clement of Rome (*Ad. Cor.*, 42, 4) does not say that the apostles had appointed presbyters in the congregation; he speaks only of bishops and deacons. For this very reason is the statement in Acts xiv. 23 to be looked upon with suspicion. It would be much too precipitate to assert that before the time of Domitian there were no presbyters in the Christian churches; on the contrary, it may be assumed that the distinction between "elder" and "younger" would not fail from the very first to assert itself in these communities, organized as they were so largely on the model of the family. But in this there is no reason for assigning any special importance to the distinction. Out of it there grew very gradually a special rank and gradually the presbyters had assigned to them definite functions; or, in other words, the functions which they had exercised from the first, of exhorting, rebuking, superintending, became recognized ecclesiastical duties and privileges. There is accordingly no need for answering the question whether the Christian "elder" is akin to the Jewish or to any kind of heathen "elder." This, however, can well be affirmed, that the pattern of the civic senates was not without its influence upon the later development of the presbyterate. As for the communities of Jewish Christians, we know nothing certain about their constitution, and are therefore unable to say anything definite about their presbyters.

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[1] Tertull., *De exhort. cast.*, 7: "Differentiam inter ordinem et plebem constituit ecclesiæ auctoritas et honor per ordinis consessum sanctificatus."

[2] Compare what is said by Papias, Irenæus, and also by Clement of Alexandria.

[3] See Διδαχὴ τῶν ἀποστόλων, 15. According to 1 Tim. v. 17 those presbyters are to be counted worthy of special honor οἱ κοπιῶντες ἐν λόγῳ καὶ διδασκαλίᾳ. But this makes it plain that the presbyters were under no obligation to teach.

[4] Polyc., *Ad Philipp.*, 5, 6, 11.

[5] 1 Tim. and Acts xx. 17, 28.

[6] Ep. to Titus.

See Hatch, *Organization of the Early Christian Churches* (2d ed., 1882), and Harnack's excursus in the German translation of this work (1883); also Harnack, *Die Lehre der zwölf Apostel* (1884). (A. HA.)

PRESBYTERIANISM.

Reformation theories.

THE Presbyterian form of church government began at the Reformation and attained development only in the churches commonly called "Reformed." The Saxon Reformers were not indeed fundamentally averse to Presbyterian principles. Melanchthon, for instance, expressly declared that no minister, without a college of elders and the consent of worthy members of the congregation, might excommunicate; and, in a letter to Nuremberg (1540), Bugenhagen, Jonas, Luther, and Melanchthon say, "Restituatur et excommunicatio . . . adhibitis in hoc judicium senioribus in qualibet ecclesia." On the other hand, the "Reformed" churches did not all accept the system, *e.g.*, Zwingli and the Zurich congregation.

In 1526 John Brenz drew up at Halle (Swabia) a scheme including elders, ministers chosen from the elders, and councils, by which the elders were chosen by the Government, who also had the final decision in all questions of importance. Franz Lambert, at the same time, provided for the church at Hesse provincial synods, representative of the churches, and a general or land synod, under the control of the Government. Within the limits of a congregation the scheme was purely congregational. At Ziegenhain in 1539 a decided advance was made towards autonomy, as only half the elders, who had extended powers, were there chosen by the Government. Zwingli theoretically gave the power to the congregation, practically to the civil power, as being the representative of the church. In Basel in 1529 the clergy alone had the power of church discipline. In 1530, however, Œcolampadius, fearing a spiritual tyranny, wished to join a body of elders with the clergy, to be chosen by the council partly from its own body and partly from the congregation, four from each, who with the clergy would form the "censorum consensus." But the council, fearing the *imperium in imperio*, preferred four colleges, one for each parish, each college being formed by two members of the council, one of the congregation, and the minister; and the council also retained the final decision regarding excommunication. At Strasburg (1531) the council created an assembly of the ministers of the seven churches, with three life elders from each, nominated by the council. In 1534 this system was modified: ordinary matters were settled each fortnight by the minister and three of the twenty-one elders. Difficult questions were carried to the twenty-one, and discipline, short of excommunication, to them with the seven ministers. Capito's system at Frankford differed from this in that only three out of nine elders were elected by the council, and that the office was for three years only.

Calvin's system.

These all remained mere theories, limited, fragmentary, and abortive. Calvin set himself to create a majestic and comprehensive system and to give to it the double authority of argumentative statement and practical realization. He saw that the impulses and the aspirations of the Reformation were, for want of discipline, robbed of a large part of their dynamic force. He threw these forces and aspirations into the mould of his own genius, developed order out of tumult, and created a definite yet elastic code, which should match the discipline of Rome and at the same time frustrate the anarchical tendencies of extreme Protestantism. The contrast with Luther is complete: Luther created, Calvin fashioned; "the watchword of the one was war, of the other order." Calvin, surrounded by Catholic powers felt more strongly than Luther that a definite protest as to church government was necessary. His leading principles are that—(1) a separate ministry is an ordinance of God (*Inst.*, iv. 3, 1-3); (2) ministers duly called and ordained may alone preach and administer sacraments (iv, 3, 10); (3) a legitimate ministry is one where suitable persons are appointed with the consent and approbation of the people, but that other pastors should preside over the election to guard against inconstancy, intrigue, or confusion (iv. 3, 15), the final act of ordination, the laying on of hands, being confined to the pastors; (4) to co-operate with the pastors there should be "governors," whom he "apprehends" to be persons of advanced years, selected from the people to join with the pastors in admonishing and in exercising discipline (iv. 3, 8); (5) discipline, the ordering of men's lives, is all-important and is the special business of the governors aforesaid. Calvin arrived at these principles as follows. From Eph. iv. 11 *sq.*, Rom. xii. 7, and 1 Cor. xii. 28 he deduced five orders, of which three—apostles, prophets, and evangelists—were extraordinary and had lapsed, but two—pastors and doctors—were for all time. Doctors are concerned only with interpretation and exposition, pastors with preaching, sacraments, discipline. From the pastors some are singled out (1 Tim. v. 17), called, and ordained to "labor in the word," to occupy themselves, in *fixed* charges, with preaching and administering sacraments; while the rest are invested with jurisdiction in the correction of manners and with the care of the poor. For, although Christ gave to the whole congregation the power of excommunication, as in the Jewish Sanhedrim, and although, therefore, the elders are to use their power only with the consent of the congregation, yet the crowd are not to rule, lest arbitrariness and confusion enter. Deacons (or elders who have the care of the poor) are of two kinds, those who administer alms and those who attend to the sick. For additional sanction to his views Calvin often refers to the primitive church and the writings of the fathers. But with respect to this his position is best indicated by his own words in the preface to the *Institutes:* "We so read their writings as to always keep in view the saying of Paul (1 Cor. iii. 21-23) that all things are ours, to serve us that is, and not to rule over us, while we ourselves belong to the Lord, whom, without exception, we must all obey." (1) His system, while preserving the democratical theory in so far as it recognized the congregation as the holder of church power, was in practice strictly aristocratic, inasmuch as the congregation is never allowed any direct use of that power, which is invested in the whole body of elders; and the system constantly tended to development in the aristocratic direction. (2) The great object is discipline of life: "We come now to the third branch of the power of the church, and that which is the principal one in a well-regulated state, which, we have said, consists in jurisdiction. The whole jurisdiction of the state relates to the discipline of manners" (iv. 11, 1). In his correspondence too Calvin is ever on this subject, while the eldership itself is seldom mentioned; at Strasburg his mind was constantly occupied with it; it was the first business that he set his hand to in Geneva; it was for insisting upon this that he was banished; and he made it his first condition for return (iv. 12). (3) Although the Presbyterian form of church government has to thank Calvin for its vertebrate existence, he nowhere makes the true church depend upon this or any other form of government. The inner life is what he insists upon, not the outward form; all that is needed for a true church, he asserts, is the word of God duly preached and the pure administration of the sacraments. He held the *jus divinum* of the ministerial office as admitting of no question—"that mode of governing the church by its ministers which the Lord appointed to be of perpetual continuance" (iv. 3, 1-3)—but the manner in which the ministerial office is divided is to some extent in his mind a matter of argument and "apprehension." The same elasticity and desire for adaptation may often be noticed in his words, as, for example, when on the very question of election of ministers, whether it should be by the congregation or not, he says, "We must be guided in this respect by times and circumstances" (Henry, i. 371).[1] Nor does he put forward any theory as to the details—the number, method of choice, or period of office. All these he leaves to each individual church. (4) He does not include synods as necessary. Should controversy arise respecting doctrine (iv. 9, 13), there is no better or more certain remedy, he says, than to assemble a council of true "bishops," in which the controverted doctrine may be discussed. Regarding the question historically he gives to the ancient councils a modified approbation, but he denies the power of councils to frame new doctrine.

Calvin on church and state.

With regard to the relations between the church and the state, Calvin was utterly opposed to the Zwinglian theory, whereby all ecclesiastical power was handed over to the state. The political administration, he says, is as necessary to human weakness as are food and light and air; but it has not the right to legislate for religion or divine worship, though it must take care that the gospel religion is not insulted or injured. "The church of God stands in need of a certain spiritual polity, which, however, is entirely distinct from civil polity, and is so far from obstructing or weakening it, that on the contrary it highly conduces to its assistance and advancement" (iv. 11, 2). "The church does not assume to itself what belongs to the magistrate, nor can the magistrate execute that which is executed by the church." Thus the magistrate imprisons a man for drunkenness; the church excommunicates him, and regards him spiritually as an outlaw. Should he repent, the magistrate takes no cognizance of his repentance, but the church can do so by allowing him to return to communion. The magistrate makes laws, and God makes laws; the breach of the one is a "crime," that of the latter is a "sin," though perhaps no crime; it is with the sin that the church deals. The magistrate may neglect to punish magisterially; the church, with spiritual penalty, supplies the neglect.

But, though the church disclaims interference with the domain of the state, she expects the state to support her. Indeed, while Calvin utterly abjures the thought of an *imperium in imperio*, while he spends much labor in showing how the papacy, by continual encroachments, secured the civil power, and in condemning this confusion of two distinct spheres of action, the function of giving support to the church is in the Calvinistic system really the *raison d'être* of the state. In a very remarkable passage (iv. 20, 3) Calvin's position is clearly shown. A well-ordered state, that for which the best of the popes strove, is a theocracy. There can be no question as to what doctrine is right, for the law of God, the only possible doctrine, is plainly stated in the Bible. That law is the highest thing that the state can regard; it is indeed the very life of the state, and the position of the state towards the church follows at once. The words "toward the church" alone introduce the difficulty. They should be "toward God." If the state fail to support the church, it fails to support, not a human, but a divine organization. In the infliction of punishments, for example, the magistrate should regard himself merely as executing the judgments of God. So that the objection of the *imperium in imperio*, the assertion that the church claims spiritual liberty independent of the judgment of the state, while at the same time insisting on the support of that state whose authority she thus disregards, falls to the ground. The civil magistracy is as much a divine institution as is the ministry of Christ; the state and the church are as much one as are the veins and the blood which permeates and vivifies them.

The fallacy in all this is obvious. The argument necessarily presupposes a theocracy, and such a thing did not exist in Europe. A state church, claiming at once independence of the state and support from the state, must bring about contest and complication where the state is not prepared to recognize the claim. The *imperium in imperio* difficulty (expressed most briefly by James I.'s "no bishop, no king") arises acutely at once, however much the church may refuse to admit it. This was the case in Scotland. And where, as was the case in France, it is not a state church but a union of persons holding a religion, and therefore views on important matters, which differ from those of the Government, oppression must arise in an age ignorant of religious liberty, and the oppressed will become a *political* party opposed to the Government, however much they may disclaim the position.

It can now be seen how far Calvin was able to carry out his theory. But for his life the theory, like those which preceded it, would probably have had no universal historical interest.

Calvin's relations with Geneva.

The course of events in Geneva had developed a theocratical feeling; and the essence of a theocracy seemed gained when the citizens were summoned by tens in 1536 to swear the confession contained in Calvin's first *Catechism* (really an analysis of the *Institutes*). They swore *as citizens*, and those who refused lost their citizenship. As soon, however, as Calvin attempted to make this a reality trouble followed. His ruling idea was discipline, and this was exercised against both the moral and the spiritual libertines,—against those who objected to the discipline of manners and those who disliked submission to the confession. As the reins were drawn tighter these two bodies gained influence in the council, and inveighed against the new popedom. At length, in 1538, when Calvin, Farel, and Conrad refused to give the communion in a city which, as represented by the council, would not submit to church discipline, the storm broke out. The three preachers were banished, and Calvin retired to Strasburg. This refusal of the sacrament is important as a matter of ecclesiastical history, because it is the essence of that whole system which Calvin subsequently introduced, and which rests on the principles that the church has the right to exclude those who, according to her judgment, appear unworthy, and that she is in no way subject to the state in matters of religion. For the present the state had refused to admit the claims of the church. Calvin laid down as the conditions of his return the recognition of the church's independence, the division of the town into parishes, and the appointment by the council of elders in each parish for excommunication. The feeling, however, was for three years too strong; the banishment was confirmed on the specific ground that the insistence on excommunication was an attempt at despotic power. Calvin's absence left the town a prey to anarchy; one party threatened to return to Romanism, another to give up their independence to Bern. It was felt to be a *political* necessity to recall Calvin, and in 1541 he returned on his own terms. Meanwhile he had been maturing and carrying out his system (*Inst.*, iv. 8) in the French and Walloon churches in Strasburg.

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[1] On the question of the *jus divinum* of the eldership, see Lorimer, *On the Eldership*, especially the tract therein by James Guthrie, who first suggested the idea in the middle of the 17th century, and two papers in the *Records of the First General Presbyterian Council*, 1877 (pp. 52, 98), by Dr. Cairns and Professor Lee, in the latter of which it is stated with wonderful confidence that "Calvin himself holds that we may rest the doctrine of a divine warrant for the ruling eldership on the ground mentioned in *Inst.*, iv. 3, 8."

Church organization at Geneva.

By the *Ordonnances Ecclésiastiques de l'Église de Genève*, which represent the terms on which Calvin consented to be pastor in Geneva and which were published on 20th November, 1541, in the name of Almighty God by the syndics, the small and great councils, and the people, there are, as in the *Institutes*, the four orders,—pastors, doctors, elders, deacons. (1) The pastors preach, administer the sacraments, and, in conjunction with the elders, exercise discipline. In their totality they form the "vénérable compagnie." It was the duty of each minister, with the elders of his parish, to be diligent in house-to-house visitation, to catechize, and, generally, to supervise family life. After being approved as to knowledge and manner of life, and ordained by the pastors already in office, and settled in a fixed charge *by the magistrate* with the consent of the congregation, the newly-made pastor vowed to be true in office, faithful to the church system, obedient to the laws and the civil government (with reservation of freedom in doctrine and the rights of office; compare Becket's "saving our order"), and, in especial, to exercise discipline without fear or favor. (2) The doctors teach the faithful in sound learning and guard the purity of doctrine. They too are subject to "discipline." (3) The work of the elders ("Anciens, Commis ou Députez par la Seigneurie ou Consistoire") Calvin regarded as the sinew and essential substance of the system. They were the bond of union between church and state, and therefore the most important element of the theocratic government. Their business was to supervise daily life, to warn the disorderly, and to give notice to the consistory of cases requiring church chastisement. They were nominated by the small council and confirmed by the "two hundred." Two were chosen from the small council, four from the "sixty," eight from the "two hundred"; some were to live in each quarter, that the whole might be well supervised. After a year's probation an elder might be dismissed or confirmed by the small council. If confirmed, he held office for life. To form the "consistoire" or church court, all the elders, with the pastors, met every Sunday under the presidency of one of the four syndics. This court was erected purely as a means to secure discipline. It could award punishments up to exclusion from the sacrament. It had, too, great authority (with appeal to the civil Government) in marriage questions. An officer of the Government was placed at its disposal to summon persons before it; should they refuse to appear, the Government itself compelled attendance. Moreover, the consistoire was bound to give notice of every excommunication to the Government, which attached to it certain civil penalties; "et que tout cela ne face en telle sorte que les ministres n'ayent aucune jurisdiction civile et que par ce consistoire ne soit rien derogué à l'authorité de la seigneurie, ni à la justice ordinaire, ainsi que la puissance divine demeure en son entier."

The inevitable quarrel arose in 1546–53, when the council overruled the decision of the consistory in a question of excommunication. The deniers of the autonomy of the church referred to the clause which laid down that excommunications were to be notified to the small council, but Calvin argued that the aim of this was merely that in extreme cases the Government should *support* the action of the church, not criticise it, and he won the victory. His position gradually became stronger. In 1557 banishment was awarded to any one who contemned the sacrament or the sentence of the consistoire. In 1560 it was ordered that the names of the elders should be published *honoris causa;* and in the same year the appearance of state control, by the presence of a syndic with his staff of office at the consistoire, was done away with. He was present, but not officially as a syndic, and without his staff.

It should be noticed (1) that the provision that in certain cases the censure of the consistoire should be followed by civil penalties is in keeping with the theocratic view. So too is the provision that members of political bodies alone were eligible to the eldership. The rights of the church as distinct from the state authority were preserved by the condition that the meeting of the consistoire was summoned by the ministers. (2) In the *Institutes* ecclesiastical power is ascribed to the congregation, to be exercised by foreknowledge of and in agreement with the acts of the ecclesiastical jurisdiction. But in the *Ordonnances* the congregation as a unit is passed over in silence as regards discipline and the choice of elders. (3) It must be remembered that Calvin never professed to regard this as a perfect plan, but as good as under the circumstances he could hope for. It was a compromise, and showed the practical character of the man. If he could secure the essence of his longed-for church discipline he was willing to waive the question of privilege.

To sum up the characteristics of early Presbyterianism—(1) it is an organization for discipline. Whatever else they may be, the elders of the Reformed churches are, primarily, censors of morals. (2) The institution claims the triple ground of Scripture, history, expediency. (3) The Lutheran doctrine of universal priesthood is wanting. (4) No voice is raised for the choice of elders by the congregation. As to *eligibility* there is as little anxiety, Baenz says, "from among the citizens"; Œcolampadius and Capito, partly from the Government, partly from the congregation; Calvin theoretically leaves it unsettled, but in practice gives it only to the political bodies. As to *period of office*, Capito wishes for regular change; the rest leave it in theory undetermined. Geneva retained permanence as the rule and change as the exception. (5) Synods have no place except with Lambert.

Lasky.

In 1549 Lasky, who had established a flourishing church at Emden, was driven to London. There in 1550 he became superintendent of the foreign congregation, which was independent of the state church, but which was intended by the king to serve as a model to be followed when England should be ripe for reform. This church was in two congregations, French and German. The French kept the

Genevan system, the German a modification of it. In this latter, the ministers, elders, and deacons were chosen by the written votes of the congregation, with revision and final decision by the officers already existing, though any objection on the part of the congregation must be duly considered. The strictest discipline was carried out. Not merely the congregation but the ministers also were subject to the elders. Every three months ministers and elders came together for mutual censure. Deacons were subordinate to the elders. The eldership was for life, the diaconate for a year. The essential difference between this and Calvin's system is that here the congregation has a very real though a limited share in the choice of the officers; the groundwork of Lasky's principle is subdued Congregationalism. Lasky held also that the ministers should have a *fixed* president selected from themselves. This office he regarded as a permanent one. Under the Marian persecution the London system found in a modified form a new home in Frankfort and on the lower Rhine. At Frankfort, in the French congregation, in choosing elders, the church council selected twice as many names as were wanted, and out of them the congregation made its choice.[1]

Scotland.

Scotland.—The initial conditions of Scottish Presbyterianism are seen in the historical facts—(1) that the Reformation was the form taken by the triumph of a violent and grasping aristocracy over the encroachments of the sovereign and an alien church; and (2) that John Knox was its spiritual leader. Under his advice the Protestant nobles in December, 1557, formed themselves into a covenanted body called "The Lords of the Congregation"; in 1559 Perth declared itself Protestant, and Knox's sermon there on 11th May was the manifesto of revolt. In 1560, being hard pressed, the lords concluded with England the Pacification of Berwick, and a few months later the treaty of Edinburgh, whereby the whole government was placed in their hands.

Organization of the Presbyterian church.

To the parliament which now assembled a petition was addressed praying (1) that a "true kirk of God" and the sound doctrines of the Reformation might be established, (2) that the true discipline of the ancient church might be restored, and (3) that the ecclesiastical revenues might be applied to the support of the ministry, schools, and the poor. Meanwhile the Reformers garrisoned, as it were, the country. Under Knox's agency Edinburgh, St. Andrews, Aberdeen, Jedburgh, Perth, Dunfermline, and Leith had fixed ministers appointed, whilst wider districts were placed under the superintendents or travelling ministers. To meet the first prayer of the petition Knox and five other ministers drew up a scheme of doctrine and discipline. The *Confession of Faith*, produced within four days and ratified by the three estates on 17th July, 1560,[2] was naturally aggressive and uncompromising. It expresses abhorrence especially of the blasphemy of them "that affirme that men who live according to equity and justice sall be saved what religioun soever they have professed," and of all the doctrines of the Anabaptists. The civil magistrate is appointed for the "suppressing of idolatrie and superstitioun whatsoever." Above all no mercy was to be shown to Catholicism: the celebration of mass was to be punished by death. To accomplish the second prayer of the petition the Reformed ministers and the leading Protestant nobles met at Edinburgh on 20th December, 1560. This was a purely church meeting; parliament had in it no part whatsoever. Even in its birth the Scottish church announced its independence. It will, however, be observed that there were in the forty-six members comprising it but six ministers. At this assembly was drawn up the *First Buik of Discipline*, which, though not accepted by the privy council, was on 27th January, 1561, signed by the great majority of the members, and by the chiefs of the great Protestant families, on the noteworthy condition that the deposed prelates were allowed to enjoy their benefices during life. This book, which was a grand effort to reconstruct society, and for which, its authors asserted, "they took not their example from any kirk in the world,—no, not from Geneva," was nevertheless on the Genevan principle. It deals solely with the congregation; the idea only of synods may be traced. As regards the relations of church and state, the eldership, and the economy of the church generally, especially the supervision of life and manners, its views are those of Calvin. Doctors or teachers are not mentioned until the edition of 1621, published by Calderwood in Holland. The order of deacons was of the utmost service in poor relief. It was abolished, of course, at the Restoration, and the want of it was shown by the fact that in 1688 one-fifth of the population were beggars. Upon the restoration of Presbyterianism the evil was again grappled with, and in 1709 so great a change had taken place that the justices of the peace were instructed to leave the whole question of poor relief to the kirk sessions.[3] Besides the regular orders there were two others, called for by the exigencies of the situation, *superintendents* and *readers*. The latter of these was temporary, lasting only until 1581; it was required by the lack of highly-qualified men for the ministry. Readers were appointed to read the common prayers and the Scriptures; in process of time they might become ministers. The superintendents travelled through their districts—of which there were to be ten—establishing churches, settling ministers, and generally putting the church in order. Moreover, commissions were given, lasting for a year only, for special needs. It has been asserted that this office of superintendent was also intended to be temporary; but is not stated so, as in the case of the readers; on the contrary, the whole language points to permanence. It is obvious that it is only by the most strained use of language that this institution can be used as an historical argument for Episcopacy in any modern sense. Not only was the superintendent in all respects subject to the same rule as his brethren, but in the last exhortation upon election he is strictly charged, "Usurpe not dominion nor tyrannical authority over thy brethren." In June, 1562, however, subjection of ministers to superintendents, as far at any rate as receiving admonition, was enacted; and in December, 1562, the superintendent received the power, *with the consent of the majority* of the ministers in his district, to translate ministers. In 1565 his functions increased vitally; he might then call a disobedient minister before himself, accompanied only by the nearest discreet ministers, who might suspend the delinquent from ministry and stipend until the next general assembly. In 1575 it was ordered that superintendents should be elected yearly, to avoid ambition.

Care was taken to preserve the rights of the congregation: "It apperteaneth to the Pepill, and to everie several congregation, to elect their minister . . . Altogether this is to be avoided that any man be violently intrused or thrust in upon any congregation." But, once elected, he is irremovable, except for heinous crimes or by the majority of the whole kirk. Of course he is strictly "examinated" as regards both "lyiff and maneris" and "doctryne and knawledge," and especially as to his grasp of the chief points of controversy with Papists, Anabaptists, etc. No special method of nomination of elders is laid down, but from those nominated the whole congregation is to choose, special care being taken "that every man may gyf his vote freelie." The liberty of the churches is preserved by making the elections of elders and deacons annual. The affairs of each congregation were managed by the kirk session (French "consistoire"), which met at least once a week. In every considerable town another weekly meeting was held, called the "exercise of prophesying," which in course of time became the presbytery or classical assembly (colloque). It was formally erected in 1579, and generally introduced in 1581. Then, again, the superintendent, with the ministers and delegated elders of his district, formed what developed into the provincial assembly. To this any one aggrieved by the kirk session might appeal, and, if necessary, the appeal went to the general assembly. This right of appeal was given in 1563. The general assembly, composed of delegated ministers and elders, into the constitution of which a change similar to that in France in 1565 was introduced in 1568, met as occasion served.

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[1] On the pre-Calvin reformers and Lasky, see Lechler, *Geschichte der Presbyterial und Synodal-Verfassung seit der Reformation*; Richter, *Gesch. der evang. Kirchenverfassung in Deutschland*, and *Evang. Kirchenordnungen, etc.*; Herzog, *Real-Encyklopädie*; Allix, *Hist. of the Waldenses*; and other works. For Calvin, see *Institutes* and *Correspondence*; Lechler, as above; Henry, *Life and Times*; Mosheim, *Eccles. History*; Hagenbach, *Works*; Cunningham, *Hist. Theology*; Ranke, *Französische Geschichte*; Richter, *ut supra*.

[2] [The estates convened on 17th Aug. and the *Confession* was approved 17th and passed on 27th Aug. See J. H. Burton's *History of Scotland*, vol. iv. pp. 88–89.—AM. ED.]

[3] Hetherington, ii. 243.

Educational system.

A splendid educational system was sketched. Parish schools, where grammar and Latin should be taught; colleges in every important town, with professors of logic, rhetoric, and the tongues; universities at Glasgow, St. Andrews, and Aberdeen,—such was what Knox desired. (The parish schools were not established till 1696.) The principle was affirmed that education was the affair of the *state*. "No fader, of what estait and condition that ever he be, use his children at his own fantasie, especially in their youthheade, but all must be compelled to bring up their children in learnyng and virtue." Compulsion and free education for the poor were Knox's idea. In 1567 parliament compelled patrons who had "provestries, prebendaries, altarages, or chaplaincies at their gift to present bursars to them to studie in anie college or universitie of this realm."

Struggles with the nobles and the crown.

To carry out these schemes and one for composition of tithes Knox proposed to apply the revenues of the disestablished church. But he was completety baffled by the nobles, who hastened to divide the spoil. The absolute irreconcilability of the views of these feudal barons, who were Reformers because their supremacy was threatened by crown and church, and because they coveted the abbey lands, with those of Knox and his fellow-laborers was at once brought into strong relief. His petitions were disregarded; the privy council would not ratify the *Book;* the lords determined that "the kirkmen shall intromett with the 2 parts of their benefices, and the third part be lifted up to the ministers' and queene's use," or, as Knox bitterly said, two parts were "freelie given to the Devill" and the third part was "divided between God and the Devill." Even the sixth part allowed to the ministers was irregularly paid, the leading subject of complaint for many years. Knox's next struggle was to maintain the right to hold assemblies, the independence of which was the essence of the kirk's existence. Against Mary's able secretary, Maitland of Lethington, he threw himself with his whole vigor into this vital contest, and so far won the day that all Mary could gain was the compromise (important in principle) that a representative of the crown should have a place in the meetings.

The next struggle was on the question of patronage. The church requested that the vacant benefices, about 200 in number, might be filled by duly qualified persons. Mary answered that she would not give up her right of patronage. The church replied that no claim was made on this right, only it was desired that the places should be filled, and that the church should have the right of collating, after approval by examination, those presented by the crown or patron. The church, in fact, was compelled to admit the principle of lay patronage. This was accepted in 1567, and no change was made until twenty years later, when all church lands not already bestowed inalienably on the nobles were annexed to the crown. James VI. gave these lands lavishly away with their patronages, which thus became lay patronages. Charles I. and Land used their best efforts, but in vain, to regain them. The church protested until March, 1649, when lay patronage was altogether abolished. It was naturally restored at the Restoration, and remained until the Revolution. On 19th July, 1690, the system was again abolished, and the nomination to a vacancy was placed in the hands of the Protestant heritors and elders with a veto to the whole congregation. In 1712, under the influences of the Jacobite revival, the English parliament reimposed lay patronage. This Act, as violating the Act of Security, has never been admitted as valid by the purer Presbyterians.

During the troublous years 1566–67 the kirk, stable in a time of confusion, consolidated her strength, and within her own bounds established the strictest discipline. In 1567 parliament made the monarchy Protestant, ratified the rights of the church to collation, and established the important principle, resisted from time to time, that the "thrids" of benefices should be henceforth collected by persons nominated *by herself*, and that she should pay the surplus into the exchequer after satisfying the ministers' stipends. Her progress may be gathered from the fact that, while in 1560 the general assembly contained only 6 ministers and 34 laymen, in 1567 she contained 252 ministers and 467 readers. Her power is seen in the censure passed upon the countess of Argyll, the earl being the most powerful of the nobility, for assisting at the baptism of Mary's son with Catholic rites.

To the nobility, which retained the old turbulence of feudalism that had long ceased to be tolerated in any other country in Europe, this power of the church was hateful, and after the death of Murray their enmity became outspoken. Morton, acting under English influence, led the attack. In 1571, the Roman Catholic archbishop of St. Andrews having died, Morton obtained a grant of the archbishopric and of the two-thirds of his revenues disposable, and, by appointing a minister on condition that he himself should retain the greater part of the income, gained a strong footing within the church. In January, 1572, the earl of Mar got together the superintendents and some ministers at Leith, on pretence of consultation. This convention, under the influence of the nobility, assumed the functions of a general assembly, and restored the titles of "archbishop" and "bishop" and the bounds of the dioceses, on the conditions that they should be chosen by a chapter of learned ministers, that they should have no more power than the superintendents, and that they should be subject to the general assembly in spiritual matters. These were the "tulchan" bishops. The general assembly of August, 1572, was not strong enough to resist. The effect of this arrangement, however, was to rob Episcopacy, as a system, of all title to respect. It soon became the earnest belief of all who were truthful and independent in the nation that the Presbyterian system was the one divinely appointed mode of church government, from which it was sinful to deviate in the slightest degree.

Andrew Melville.

In 1574 Andrew Melville appeared on the scene, and, by steady persistence and firm defiance of Morton's violence, gave fresh life to the church. The *Second Book of Discipline*, sanctioned by the general assembly in April, 1578, and ordered in 1581 to be registered in the acts of the church, represents her determination to repel the aggressions of the nobility. It was decreed that no more bishops should be appointed, that the existing ones should be called by their own names, not by their titles and that they should submit to the general assembly for disposal.

The *First Book of Discipline* occupied itself chiefly with the congregation, the *Second Book* with the dependence of the congregation upon higher courts. It did away with superintendents and established complete parity among ministers, transferring discipline and authority from individuals to bodies of men. These were four. (1) The kirk session, which in 1587 was ordered to be subject to the presbytery. (2) The presbytery or eldership, which had the oversight of a number of neighboring congregations, and consisted of all the ministers of the district, and as many elders as congregations, so that clergy and laity were equally represented. It had authority to control the kirk session, try candidates, ordain or depose ministers. It constituted, in fact, the prominent feature of the system. (3) The provincial synod, composed of all the members of the presbyteries in its district, had jurisdiction of appeal over these presbyteries. (4) The general assembly, consisting of ministers and elders, chosen, be it observed, not from the provincial synod, but from the presbytery. Thus the presbytery took the same commanding position in Scotland as, it will be seen, the provincial synod did in France. The importance of these church courts politically, in the organization which they effected of the middle classes against the aristocracy, cannot be overrated.

The ruling elder was now to hold office for life,—an important limitation of the power of the congregation. The general tendency henceforward, natural in a complex society, was towards centralization; the rights of the congregation were gradually diminished, those of the presbytery increased. This tendency was strengthened as time went on by the passionate hatred of the Presbyterians for the congregational system. Thus in 1639 Baillie declares that if the congregation is to have a veto upon the appointment of the minister it is "sheer Brownism" (vol. iv. p. 353); and on 30th July, 1643, although "William Rigg *and the people*" were against an appointment, the intruder was decerned by the general assembly to be admitted, since the patron, presbytery, and provincial synod were in favor of it. As the position of elder increased relatively to that of simple members of the congregation, so the position of minister increased relatively to that of elder. The supremacy of ministers and the subordination of the elders reached their height after the great rising of 1638.

The contest which was waged during 1582–84 between the kirk and the crown was chiefly concerned with the denial by Melville of the primary jurisdiction of the privy council over ministers summoned for offences committed in their ministerial capacity. He demanded in his own case to be tried, in the first instance, by the ecclesiastical courts. A more important case of the same claim, because connected with less important persons, occurred in 1591, and the demand of the church was allowed so far that the offender was tried in both courts concurrently. In May, 1584, the parliament met secretly and, having been thoroughly corrupted by the court, passed the "Black Acts." Act 2 declared Melville's claim to be treason; Act 4 forbade presbyteries, synods, and assemblies, as being not allowed by parliament; Act 20 re-established Episcopacy and made it treason to speak against any of the three estates (*e.g.*, bishops). The king was made supreme in all cases and over all persons, while none were to presume "to meddle with the affairs of his highness and estate." The course of events from 1584 to 1592, the fear of Catholic Spain, the league with England, and especially the ability of Robert Bruce led to a settlement, by which in May, 1592, Presbyterianism was restored and ratified by parliament. It was of course a compromise, as is shown in the provision that, if a presbytery refuse to admit a qualified minister, the patron may retain the income.

Struggle with the crown.

The quarrel, however, was not to be settled. For rejecting the bill of attainder against the popish lords the synod of Fife excommunicated James and convened a meeting from the whole kingdom to complain of his conduct. A little later Andrew Melville, when sent on a deputation, called James "God's silly vassal" and told him that there were two kings and two kingdoms in Scotland, King James the head of the commonwealth and Christ Jesus the head of the church, whose subject he was. James, however, was strong enough to remain inflexible and to secure a victory on the question of the church courts, which in the case of David Black, one of the ministers of St. Andrews, who had in a sermon reflected upon the queen and Church of England, had arisen in its most acute form.

Two alternative steps were now suggested for preventing future strife, the establishment of Episcopacy or the admission into parliament of representatives of the church without any title or jurisdiction derived from the crown. In a general assembly opened at Perth on 29th February, 1597, and packed with ministers from the remote northern presbyteries, where the democratic spirit of the High Presbyterians of the South was unknown, James obtained leave to suggest in a future assembly alterations in the existing government of the church, a dissapproval of the discussion of state questions and of the denunciation of individuals from the pulpit, and the forbidding of extraordinary conventions. Ministers were also to confine their discourses strictly to their own congregations, and summary excommunication was abolished. He had previously with a high hand put down the opposition of the Edinburgh ministers, Bruce and others seeking safety in flight.

In April, at Dundee, an assembly similar to that of Perth consented that commissioners should be appointed to advise the king on church affairs, which step in a great degree freed him from the general assembly. These commissioners were easily induced to petition that the church might be represented in parliament. Parliament thereupon passed an Act allowing those to sit there who might be appointed *by the king*, as bishop, abbot, or other prelate, the duties of their offices to be determined in conference with the assembly. At the second assembly of Dundee, however, which met on 7th March, 1598, and at which Andrew Melville was refused admittance by James on frivolous though legal grounds, it was resolved that fifty-one representatives of the church, chosen partly by the king and partly by the church, should vote in parliament. At a convention held at Falkland on 25th July, at which three representatives of each synod and six doctors of the universities were present, it was decided that the representatives should be nominated by the king out of a list of six as vacancies occurred. They were to be responsible to the general assembly, and were to propose nothing unless instructed to do so by the church. Of these two plans, the parliament's and the church's, James greatly preferred the former; to induce the church to agree to it he held a conference previous to the general assembly at Montrose in 1600, but in vain. At Montrose the assembly put limitations to the plan of the Falkland convention by insisting that their representatives should sit but for one year, and that at the end of that year they should resign and account for their conduct to the assembly, which might depose them. They were to be called commissioners only. Six were to be nominated for each province, from whom the king was to choose one. The commissioner was to have no power above that of other ministers, was to perform full pastoral work, and was to lose his vote in parliament if deposed from the ministry.

Victory of James VI.

James at length took a decisive step. On 14th October, 1600, he summoned a convention of commissioners from the various synods, and by some means secured its consent to the appointment of three bishops in addition to those formerly nominated and still living. They took their seats and voted in parliament next November; but the church, disowning the authority of the convention, refused to acknowledge the appointment as valid, and assigned them no place in her own organization. The quarrel became intensified when James was master of the power of corruption with English money. The proposals for union between the kingdoms at once brought out the views of the church. "The realmes," said Melville, "could not be united without the union of the kirk; neither could the kirkes be united in discipline, the one being Episcopal and the other Presbyterian, unless one should surrender to the other." When James twice prorogued the meeting of the general assembly nine presbyteries met at Aberdeen in defiance. The Government at once struck hard: eight ministers were banished to remote charges and six to France. Next followed the alienation of church lands and revenues and their erection into temporal lordships, the re-establishment of seventeen prelacies, and the restoration of the bishops. The immense step was taken of recognizing the king as "absolute prince, judge, and governor over all estates, persons, and causes, both spiritual and temporal." In 1606 another packed assembly declared for constant moderators of presbyteries and for the supremacy of the bishops in their own presbytery and provincial synod. In 1609 the bishops gained the right of fixing ministers' stipends. In 1610 courts of high commission with most arbitrary powers were erected at Glasgow and St. Andrews; and in June the general assembly placed the whole ecclesiastical power in the king's hands. In 1618, under threats of violence, the general assembly of Perth passed the Five Acts, which enforced kneeling at communion, observance of holy days, Episcopal confirmation, private baptism and private communion. These were ratified by parliament on Black Saturday, 4th August, 1621. Thus matters remained until the death of James.

Almost the first act of Charles I. was to proclaim the strict observance of the articles of Perth. In November, 1625, he revoked all the Acts of his father prejudicial to the crown, as a first step toward the resumption of the church lands. This, of course, met with the vehement opposition of the nobility, and the scheme in the end had to be given up. In 1630 Maxwell, in Laud's confidence, was sent to Scotland to try to force upon the people the English liturgy. It is significant of the change in feeling that a paper of grievances sent in by ministers was supported by several of the nobility. Their hatred was always directed to the nearest enemy, against the crown before the Reformation and during its early stages, against the Reformed Church of late years, now against the crown again. In 1633 Charles came to Edinburgh and forced through the convention the "Act anent his Majesty's Prerogative and Apparel of Churchmen," a combination of two Acts passed in 1606 and 1609 respectively. All protests were disregarded and the whole nation was thrown into a state of anger and disappointment. The attack on Balmerino still further alienated the lords. In 1635 diocesan courts were erected with the most vexatious powers, and the *Book of Canons*, subversive of Presbyterianism and insulting in language, was distributed; and in 1636 the people were ordered to adopt Laud's book of public worship; while in July, 1637, the prelates obtained an order of outlawry against ministers who should be backward in receiving the liturgy. As Baillie said, they were like to go "to Rome for religion, to Constantinople for policy." On 23d July, however, the outburst of St. Giles's took place. The history of the great rising cannot be traced here. The National Covenant, which was its outcome, drawn up by Alexander Henderson and Johnston of Warriston, consisted of the *Second Book of Discipline*, a recapitulation of the Acts of Parliament condemning Popery and ratifying the acts of the general assembly, and the application of the whole to present times.

Final success of the church.

After some months of trickery and evasion, frustrated with firmness and ability by the Covenanters, the general assembly met on Wednesday, 21st November, 1638. When they determined to sit in judgment on the prelates, Hamilton, the king's commissioner, dissolved the assembly. It, however, continued its sitting, refused to acknowledge the assemblies which had introduced prelacy, condemned the Acts of Perth and all the late innovations, and abjured all Episcopacy different from that of a pastor over a particular flock. Baillie alone made a stand for not rejecting Episcopacy as represented by the superintendents of Knox's time. Eight prelates were excommunicated, four deposed only, two reduced to the simple pastorate. All church assemblies were restored, and the principle that the consent of the congregation was necessary to a minister's appointment was re-enacted. Schools and schoolmasters were at once to be provided. In August, 1639, an Act was passed, called the Barrier Act, that no change should be made in the laws of the church until the proposal had been submitted to all provincial synods and presbyteries.

The church was now secure. She had gained the day, because on this occasion the zeal of her ministers and the interests of the nobles had been both enlisted in her service. The victory had been won in her name and the influence of her ministers was vastly increased. For the spirtual tyranny which they introduced the reader should refer to Mr. Buckle's famous chapter; or, if he thinks those statements to be partial or exaggerated, to original records, such as those of the presbyteries of St. Andrews and Cupar.

Rule of ministers of the church.

The arrogance of the ministers' pretensions and the readiness with which these pretensions were granted, the appalling conceptions of the Deity which were inculcated and the absence of all contrary expression of opinion, the intrusions on the domain of the magistrate, the vexatious interference in every detail of family and commercial life and the patience with which it was borne, are to an English reader alike amazing. "We acknowledge," said they, "that according to the latitude of the word of God (which is our theame) we are allowed to treate in an ecclesiastical way of greatest and smallest, from the King's throne that should be established in righteousness, to the merchant's ballance that should be used in faithfulness." The liberality of the interpretation given to this can only be judged of after minute reading.

Up to this point the Kirk had worked out her own salvation; the problem had been purely Scottish: henceforward her history is in close connection with that of England and assumes a different complexion. Her first difficulties, however, arose in her own midst. Under the prelatic rule conventicles had arisen, which after the restoration of Presbyterianism caused great searchings of heart. Whatever he had to say about popery, prelacy, or arbitrary power, the true Presbyterian reserved his fiercest hatred and his most ferocious language for anything which savored of Congregationalism. At the instance of Henry Guthrie, who under Charles II. became a bishop, the general assembly of 1640 limited family worship to the members of each family, and forbade any one to preach who was not duly ordained and approved. This was but the beginning of dissension.

Passing over the events of the next six years, as coming more conveniently under the head of England, we notice that the moment external danger was removed the natural and abiding antipathy between a licentious and entirely selfish aristocracy and a masterful, censorious, and democratic church broke out. Two parties showed themselves—that of the ministers, who insisted that no arrangement should be come to with Charles unless he would take the Covenant (compare the French "consistoriaux"), the other, headed by Hamilton, Lanark, Lauderdale, and others, who "engaged" to raise an army for him on condition, ostensibly, that he would confirm Presbyterian church government for three years. The real conditions, as long believed but only just discovered,[1] contain not a word about the church, but are entirely concerned with the privileges of the Scottish nobility. A vehement disruption of the church at once took place and did not cease until the defeat of Hamilton. Then the ministers were once more masters. Parliament repealed the Act of Engagement and passed the Act of Classes, whereby all those to whom the church deemed it inexpedient to give political power were registered in four classes according to their faults. It was by this parliament that lay patronage was abolished, and that the rights of the congregation as to election of ministers were settled for the time. After the battle of Dunbar, when troops were being hastily raised, the Act of Classes stood much in the way. In spite of the remonstrances of Patrick Gillespie and the western Covenanters, the commission of the assembly (which sat *en permanence* during the recess of the assembly itself) resolved to allow all persons to serve who were not professed enemies to the Covenant or excommunicated. The parliament went further and rescinded the Act of Classes altogether. Against this union of the church with the "malignants" Gillespie's faction protested, and henceforward the rivalry and bitterness between Resolutioners and Protesters, the latter being favored by Cromwell, deprived the church of much of its power of resistance. Both parties, absorbed in their quarrel, looked on while Monk, after the battle of Worcester (1651), took the matter into his own hands by refusing to allow any general assembly whatever to meet, though he permitted the continuance of the other assemblies.

Restoration of Episcopacy.

Within two years of the Restoration the Presbyterian Church ceased to exist. Weariness, internal dissension, the indifference or positive hatred of the nobles, and the extremity of treachery in James Sharp[2] brought about the downfall. The steps by which Episcopacy was restored were these. The leaders of the strict Covenanting party were imprisoned, while a quibbling proclamation was issued by Charles which served to keep the Resolutioners in play. Proclamations were issued against all unlawful meetings, and papers such as Rutherford's *Lex Rex* and Guthrie's *Causes of God's Wrath* were called in. In January, 1661, a bribed and packed parliament passed an oath of allegiance in which the king was acknowledged as supreme over all persons and in all causes. With scarcely an exception, Cassilis being the only one of note, the nobility took the oath. Next the acceptance of the Solemn League and Covenant was declared null and void, and its renewal was prohibited. And, by way of clearing the field entirely, a Rescissory Act was passed annulling all the parliaments since 1633 and thereby suspending the Presbyterian system. The parliament then declared that the church government was to be such as was most agreeable to the word of God, to monarchical government, and to public peace; remonstrances were disregarded and synods suppressed or corrupted. Argyll and James Guthrie were judicially murdered. Finally, on 14th August, 1661, Episcopacy was restored by proclamation; Sharp, Fairfoul, Hamilton, and Leighton were consecrated in London; and on 2d January, 1662, all Presbyterian assemblies of every sort, unless authorized by the prelates, were forbidden. On 8th May the proclamation was enforced by Act of parliament. All religious covenants and leagues, protestations and petitions, were made treasonable, nor might any one be professor, minister, schoolmaster, or private tutor without a bishop's license. On 5th September, 1662, the abjuration of the National Covenant and all other religious covenants was made a condition for public trust. Finally, the Act of Indemnity, which had been delayed as long as possible, contained a schedule of persons of the Presbyterian interest who were punished with heavy fines. Dangerous ministers were banished from Edinburgh and all were ordered to attend the bishops' courts when summoned, while by the Glasgow Act ministers who had taken charges since 1649 were ousted from home, parish, and presbytery unless before 1st November they obtained presentation from the patron and collation from the bishop. This led to the ejectment of 400 ministers. Ejectment led, of course, as in England, to conventicling, and on 17th June and 13th August, 1663, severe Acts were passed against these meetings. Presbyterian ministers from Ireland were forbidden to reside in Scotland, and absentees from public worship were vigorously proceeded against. The system of persecution was now complete, and the triumph was signalized by the execution of Johnston of Warriston, who had been kidnapped in France and who was now put to death with flippant cruelty. In 1664, at the suggestion of the archbishops Sharp and Burnet, a court of high commission was erected with unlimited powers.

Revolt soon followed; it was crushed at Pentland and ruthlessly punished. But the nobles speedily became jealous of the growing power of the prelates. Lauderdale in especial saw his influence threatened. He reported to Charles that Prelacy was becoming as great a danger to the crown as Presbyterianism had been, "so unwilling are churchmen, by whatever name they are distinguished, to part with power." Sharp was easily threatened and cajoled, and Burnet, after a struggle of three years, was forced to resign. It was not, however, until after the fall of Clarendon in 1667 that indulgence was seriously tried there as in England. In July, 1669, ten ministers, of whom Hutcheson was the chief, who were willing to admit the ecclesiastical supremacy of the king and to accept the bishops' collation, were allowed to return to their livings, and were henceforth known as the "bishops' curates." This subservience caused a renewal of the breach in the church; from henceforward the feud between the "Indulged" and the "non-Indulged" took the place of that between Resolutioners and Protesters. Forty-two ministers accepted the indulgence. A second indulgence followed in 1672. From Lauderdale's marriage with Lady Dysart until 1687 there ensued a policy of extermination, borne with marvellous fortitude. To Covenanters had succeeded Protesters, to Protesters Conventiclers, to Conventiclers now succeeded Hamiltonians, to Hamiltonians Cameronians or Society People. Want of space prevents us from giving even the names of a series of Acts which would disgrace any nation however barbarous, in any age however intolerant, and under which, it is asserted with great probability, 18,000 persons died. In February, 1687, James II. proclaimed indulgences to moderate Presbyterians as far only as regarded private worship. By the same proclamation the profession of Roman Catholicism was made absolutely free. In March a more extended indulgence and in June the suspension of all penal laws, except as regarded field-preaching, were granted. The party which had throughout refused compromise refused it still. In their *Informatory Vindication* they scouted the claim of the sovereign to "indulge" or to "tolerate" an inalienable right, and went on with their field-preaching as though nothing had happened. The death of Renwick, their leader, closes the awful story of the rule of the later Stuarts in Scotland.

Presbyterianism once more supreme.

On 5th November, 1688, William landed at Torbay; the bishop's curates were ejected without violence, no retribution was taken, but Presbyterianism quietly reasserted itself as the form of church government natural to the Scottish mind. Presbyterianism, however, was not now what it had been in the days of Andrew Melville or in 1638. The last twenty-six years had thoroughly cowed a great part of the nation, and a new generation had come to manhood who could not even remember the time when Scotland was not Episcopal.

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[1] See *Lauderdale Papers*, vol. i. p. 3 (Camden Society).

[2] For proof of his active participation in the re-establishment of Episcopacy, see *Lauderdale Papers*, vol. ii., App. III.

The nobles had no interest to serve in re-establishing the old form; the very ministers were those who had conformed or had accepted indulgence. Out of the 400 ejected in 1663 only sixty now survived. Moreover, Scotland had not escaped the wave of latitudinarianism that had come over all forms of Protestant religion. Most of all, the character of William III. and his confidential adviser Carstares affected the nature of the settlement. William was above all a statesman, and a tolerant statesman, and he wished for union of the moderate parties in both kingdoms; on taking the coronation oath he refused to swear the clause binding him to root out heretics and enemies of the true worship of God. The claim of right, too, avoids any assertion of the *jus divinum* of Presbyterianism. But on 22d July, 1689, its declaration that prelacy had been an insupportable grievance was made into an Act by the convention of estates and all Acts in favor of Episcopacy were rescinded. In April, 1690, the Act of Supremacy was also rescinded, ministers ejected since 1661 were replaced and the Presbyterian government of 1592 (thus avoiding all mention of the covenants) restored; lay patronage was abolished, but pecuniary compensation was granted. On 16th October, 1690, the first general assembly since 1653 met, when the preliminary act was to receive into the national church the remaining three ministers of the Cameronians (Thomas Lining, Alexander Shields, and William Boyd). Their followers, however, regarded this as a compromise with Satan and kept themselves aloof.[1] Episcopalian ministers who subscribed the confession and obeyed the Presbyterian government retained their livings, and all sentences of Resolutioners and Protesters against one another were rescinded. Mr. Hetherington well says, "Without a clear conception of this point it is impossible to understand the subsequent history of the Church of Scotland. In consequence of the introduction of the prelatic party the church thenceforward contained within its pale two systems, that of the old and true Presbyterian, subsequently known as the 'evangelical,' and that of the new and semi-prelatical, subsequently known as the 'moderate.' Thenceforward the history of the Church of Scotland is the history of the protracted struggle between these two systems which were necessarily irreconcilable."

In the first case of friction with the crown, which occurred in 1691, a compromise was effected—the church successfully asserting its autonomy by granting only part of the privileges which William desired for the Episcopal clergy. The critical dispute occurred when parliament imposed a new oath of allegiance, the taking of which was made a necessary qualification for sitting in the assembly. The church denied the right of the crown to impose a civil oath as a condition of spiritual office, and a serious breach would have occurred but for the efforts of Carstares, who induced the king to give way at the last moment. Having thus asserted her independence, the church conceded to William nearly all he had asked for on behalf of the Episcopalians. In 1696 the parish schools were established. In 1698, to vindicate the church from the charges of backsliding, the general assembly published the *Seasonable Admonition*, which claimed in emphatic language the dependence of the church on Christ alone and repudiated the doctrine that the inclination of the people was the foundation of Presbyterianism. In 1701 the first condemnation of heresy took place.

The spirit of watchfulness on the part of the church increased during Anne's reign. In naming commissioners for the Union the parliament forbade them to mention the church. The extreme section indeed regarded the Union itself as a violation of the Solemn League and Covenant. The Act of Security provided that the *Confession of Faith* and the Presbyterian government should "continue without any alteration to the people of this land in all succeeding ages," and the first oath taken by the queen at her accession was to preserve it. The Union, however, tended to Anglicize the upper classes and thus to increase the latitudinarianism which was finding its way within the church. Politically speaking, the settlement of the Scottish Church was of great importance to the Government during the Jacobite intrigues, for its attitude was one of vigilance against all that was favorable to Prelacy, and its influence consolidated opinion against the Stuarts.

The High-Church revival of 1710, however, had its effect upon the church. In 1711 an Episcopalian named Greenshields used the English liturgy in Edinburgh. He was condemned by the Court of Sessions, but the House of Lords reversed the decision and imposed heavy damages on the magistrates who had closed his chapel. In 1712 a Bill of Toleration, which allowed Episcopalian dissenters to use the English liturgy, was hurried through both Houses, in spite of the urgent remonstrances of the Scottish commissioners, and on 22d April lay patronage was restored. This latter Act, as violating the Act of Security, has never been regarded as valid by the severer Presbyterians. That no further resistance was made than by protests and petitions shows how far the "moderatizing" spirit had spread. The remnant of the Cameronians, who were outside of and discouraged by the church, alone met and renewed the Covenant, after solemnly acknowledging the sins of the nation.

Schisms.

The progress towards Arminianism, due to the influence of Baxter's writings and to the training of the young ministers in Holland, may be seen in the treatment of Professor Simson and in the Auchterarder case. It was now that Neonomianism, or the doctrine that the gospel is a new law, promising salvation upon the condition of the abandonment of sin, began. Its first victory was when the general assembly condemned the doctrines of the *Marrow of Modern Divinity* and rebuked the twelve ministers who had sent in a representation against the decision. The Patronage Act was rapidly being accepted and was showing its effects chiefly in the neglect shown to the wishes of the congregations. In 1731 the right was given to the heritors and elders to "elect and call" instead of to "name and propose the person to the whole congregation to be approven or disapproven," and was made law without having first been submitted to the presbyteries according to the Barrier Act of 1639. This led to the first great schism. Ebenezer Erskine denounced the action of the assembly in two sermons. Being rebuked by the synod of Perth and Stirling, he appealed to the assembly, who approved the rebuke. With three other ministers he protested. The four were temporarily deposed by the assembly, and on 6th December, 1733, they formed the "Associate Presbytery." In 1737 their number was largely increased, and they published their manifesto, the "Declaration and Testimony." Their final deposition and the first schism occurred on 15th May, 1740.

For several years the wishes of congregations were ignored; wherever the presbytery refused to appoint at the will of the assembly, a "riding committee," often assisted by military force, carried out the decision. The civil courts were bound to obey the Act of Patronage, and therefore never upheld the congregation against a legal appointment. At length in 1752 the leader of the "moderate" party, Principal Robertson, seeing in this refusal of presbyteries the elements of endless confusion, and that temporary substitutes, *e.g.*, riding committees, were unconstitutional and bad in principle, determined that the presbyteries themselves should be compelled to carry out the decisions of the assembly. From the deposition of Thomas GILLESPIE (*q.v.*), a member of the presbytery of Dunfermline, who refused to act in accordance with the assembly's decision, is dated the second or "Relief" schism. Principal Tulloch says upon this: "The policy was so far successful; but the success was of that nature which is almost worse than defeat. It introduced order within the church. It crushed the revolt of presbyteries. It silenced in many cases popular clamor. But it quietly and gradually alienated masses of the people from the establishment." So rapidly did dissent spread that from a report presented to the general assembly in 1765 it appears that "there are now 120 meeting-houses erected, to which more than 100,000 persons resort, who were formerly of our communion, but have separated themselves from the Church of Scotland. This secession," the report adds, "is most extensive in the greatest and most populous towns." For the subsequent history of Presbyterianism in Scotland see FREE CHURCH, UNITED PRESBYTERIAN CHURCH, and SCOTLAND (CHURCH OF).[1]

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[1] They remained without a minister until 1707, when they were joined by John McMillan, minister of the parish of Balmaghie, who had been summarily deposed for principles akin to those of the Society People. The accession of Thomas Nairn, one of the ministers of the Secession Church, made a "Reformed Presbytery" possible in 1743; this became a synod of three presbyteries in 1811. The first "Testimony," published in 1761, was afterwards superseded by that of 1839, which thenceforward was regarded as one of the "subordinate standards" of the Reformed Presbyterian Church. In 1876, before the union with the Free Church (see vol. ix. p. 656) the denomination in Scotland numbered 6 presbyteries, 38 ministers and 40 congregations. It also had six missionaries in the New Hebrides. For the fortunes of the Reformed presbyteries in Ireland and the United States, see below.

Early movements.

England.—Several faint traces may be noted of the presence of Presbyterian ideas in England within a few years of the Reformation. During the reign of Edward VI., for instance, Bucer, with Cranmer's good-will, laid before the king a sketch of church discipline and reform of episcopal government. Each bishop was to have a council of presbyters, and provincial synods with a royal commissioner were to meet twice a year. Many English joined Lasky's foreign church, and when it was dispersed under Mary settled chiefly in Frankfort, where the dispute took place in which the adherents of the Prayer Book defeated Knox and his followers. These came to England filled with Calvinistic views regarding church and state, only to find the royal supremacy absolute, and uniformity enforced under crushing penalties. Even the foreign Protestants were compelled to choose the bishop of the diocese as their superintendent. The contest, which began after a scheme of reform had been lost in convocation by *one* vote in 1562, was ostensibly concerning vestments and ceremonies; really it rested on a far wider basis, one which found place even in Cambridge disputations, viz., "whether the civil magistrate has authority in ecclesiastical affairs." That the Puritans[2] did not look for a speedy setting up of "discipline" may be seen in Cox's letter to Gualter. "We have some discipline among us with relation to men's lives, such as it is; but if any man would go about to persuade our nobility to submit their necks to that yoke, he may as well venture to pull the hair out of a lion's beard." In 1566 took place the first separation of several deprived London ministers, who determined in future to use the Geneva service book, which they did until they were arrested in Plumbers' Hall on 19th June, 1567. During 1567 and 1568 the persecutions in France and Holland drove thousands of Protestants, chiefly Presbyterians to England. In 1570 the leading Presbyterian views found an exponent in Thomas Cartwright at Cambridge (the headquarters of advanced Puritanism); and the temper of parliament is shown by the Act of 1571 for the reformation of disorder in the church, in which, while all mention of discipline is omitted, the doctrinal Articles alone being sanctioned, ordination by presbyters without a bishop is implicitly recognized. It is to be observed that Cartwright and the leading Puritan theologians opposed the idea of separation. The voluntary association of bishop, ministers, and laity at Northampton is interesting as showing how earnest men were thinking. Their discipline was strict and their tone with regard to the state and to the existing constitution of the church was too bold to allow of indulgence. In spite, however, of constant deprivation, especially in the midland and eastern counties, the obnoxious doctrines spread; and in 1572 the first formal manifesto was put forth in the *Admonition to Parliament* of Field and Wilcox, with the assent of others. Equality of ministers, choosing of elders and deacons, election of ministers by the congregation, objection to prescribed prayer and antiphonal chanting, the view that preaching is a minister's chief duty and that the magistrate should root out superstition and idolatry, are leading points. The controversy which followed between Whitgift and Cartwright showed how impossible agreement was when the one side argued that the Holy Scriptures were the only standard as well for church government as of faith, and the other that a system of church government was nowhere laid down in Scripture, and might be settled by and accommodated to the civil government under which men happen to be living. On 20th November, 1572, the authors of the *Admonition* set up at Wandsworth what has been called the first presbytery in England. They chose eleven elders and put out a purely Presbyterian system, the *Orders of Wandsworth.* Similar associations were erected in London and in the midland and eastern counties. When, however, an attempt was made to join the foreign churches in London, the privy council forbade it. Jersey and Guernsey, whither large numbers of Huguenots had fled after the massacre of St. Bartholomew's, alone were Presbyterian by permission. Cartwright and Snape were pastors there, and from 1576 to 1625 a completely appointed Presbyterian church existed, confirmed by synods (held at Guernsey and Jersey on 28th June, 1576, and 17th October, 1577) and authorized by the governor. Meantime Cartwright and Travers had drawn up a scheme, never realized, by which ministers were bound to refuse ordination by a bishop unless they had previously been "called" by a congregation and approved by a church classis. Ceremonies in dispute might be omitted; should this cause danger of deprivation the classis was to decide. The doctrinal Articles might be subscribed, but not the Prayer Book. Churchwardens might easily be converted into elders and deacons; and classical, comitial, and provincial assemblies were to be held.

The suppression of independent life in the church at length drove numbers out, known in the future as Brownists or INDEPENDENTS (*q.v.*). Those who remained still strove for reform. They were met by a new court of high commission and the "ex officio" oath,—an increase of severity strongly opposed by Burghley and the privy council. These views are expressed in Travers's *Disciplina Ecclesiæ ex verbo Dei descripta*, printed at Geneva in 1574, translated with additions by Cartwright in 1584, then suppressed and not again published until 1644, when it was officially recognized as the *Directory of Government.*[3] Its leading principles were those of French Protestantism. It was signed by some 500 ministers, Cartwright among them. The action of the Commons in 1584, stimulated by the

Presbyterianism in England.

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[1] *Chief References.*—Calderwood, *Hist. of the Kirk*; Knox, *Hist. of the Reformation*, and *Works* (*ed. Laing*); Hetherington, *Hist. of the Church of Scotland*; M'Crie, *Life of Knox and Life of Melville*; Cunningham, *Historical Theology*; Rudloff, *Geschichte der Ref. in Schottland*; Neal, *Hist. of the Puritans*; *St. Giles Lectures* (1st ser.) *Records of the First Pan-Presbyterian Council* (Edinburgh, 1877); James Melville, *Diary*; Burton, *Hist. of Scotland*; Laing, *Hist. of Scotland*; Wodrow, *Church History* and *Miscellanies*; Baillie, *Letters and Journals*; *Records of Presbyteries of St. Andrews and Cupar*; Buckle, *History*; Burnet, *Hist. Reform.*; Robertson, *Hist. of Scotland*; Spottiswoode, *Hist. of the Church of Scotland*; Kirkton, *Hist. of the Church*; Stevenson, *Hist. of the Church*; Lamont, *Diary*; Gardiner, *History of England*, ch. 2; *Lauderdale Papers* (Camden Society).

[2] We use this word in its widest sense to include all who desired purity in church government and doctrine. They consisted at first of the returned exiles of the Marian persecution, and separated under the stress of Elizabeth's action into Independents and Presbyterians, the latter remaining inside the church.

[3] M'Crie, *Annals of Presbytery*, says that the *Orders of Wandsworth* were the *Directory*.

opposition of the Lords, shows that the principles of Presbyterianism were very strong in the country. Bills were introduced to limit the stringency of subscription, and to confine the penalties of suspension and deprivation to cases of heresy or scandalous life, to reduce the position of a bishop well nigh to that of merely *primus inter pares*, for placing the power of veto in the congregation, for abolishing the canon law and all spiritual courts, and for establishing a presbytery in every parish. All these proposals were, however, cut short by the unflinching exercise of the queen's prerogative; and, with some slackening during the great year of peril, the Puritans suffered extreme persecution. In 1588 they held a provincial synod at Warwick, and also again at Michaelmas. It is noticeable, as showing the growth side by side with Presbyterianism of the spirit directly its opposite, that on 12th January, 1588, Bancroft for the first time maintained the *jus divinum* of Episcopacy.

There seems no doubt that during the later years of Elizabeth Presbyterianism declined. The position of the conforming Puritan was in every way a weak one. He had sworn to the queen's ecclesiastical supremacy, and this supremacy was what he most hated; he was compelled to have recourse to the figment that, although she had this supremacy, she could not exercise it ecclesiastically, but could merely give her sanction to whatever was enacted by the church. On the other hand, in appearing to attack the church he appeared to attack the nationality of the country when the national spirit was most intense. The nation was rapidly becoming conscious of a vivid and energetic national life, and whatever impaired the national unity was regarded with impatience and resentment at a time when the political condition of Europe was fraught with such danger to England herself. The Scottish Presbyterian had triumphed over a hated and alien church, and the bishops whom he overthrew were evil-living and oppressive men; the English Presbyterian knew that his church was the symbol of freedom and that her bishops had been holy men martyred for the sake of that freedom. Finally, in England there had existed among the common people, as there had not in Scotland, an absence of interference and an independence of private life which would naturally form the strongest obstacle to the introduction of the longed-for Presbyterian discipline. The difference between English and Scottish Presbyterianism was clear to James when in the millenary petition the reforming clergy disclaimed all idea of affecting parity in the church or of attacking the royal supremacy, and merely requested the redress of certain abuses in rites and ceremonies. Even with regard to the "ex officio" oath they asked only that it might be more sparingly used. The Puritans had evidently lost faith in themselves and had been unable to spread their views. "Elizabeth had drained the life out of Puritanism by destroying the Armada and by her subsequent policy in taking the leadership of the Protestant interest in Europe." It needed the abuses of the reign of James I. to restore it. The king was still further encouraged by the servile support of the universities, which had quite lost their Puritan tone. At the Hampton Court Conference in January, 1604, Dr. Reynolds as spokesman of the Puritans desired permission for clerical assemblies every three weeks, "prophesyings" in rural deaneries, and that appeals might lie from the archdeacon's invitation to the diocesan synod, composed of the bishop *and his presbyters*. The coarse and menacing rejection of these demands made clear the weakness of the reforming party within the church as opposed to the cordial alliance between the High Church and the crown. The breach was wider than at any time under Elizabeth. The struggle was becoming political. Divine right of Episcopacy, Arminianism, and prerogative in the crown were becoming ranged against Presbyterianism in church government, Calvinism in creed, and moderate republicanism in politics.

Persecution of Puritans under the Stuarts.

In 1604 James put out the *Book of Canons*, by which every clergyman was forced to subscribe, "willingly and ex animo," (1) the spiritual and ecclesiastical supremacy of the crown, (2) the Book of Common Prayer, (3) the Thirty-nine Articles of 1562, as being all and every one of them agreeable to the word of God. The *Book* was passed under the great seal, but was never ratified by parliament. As the result, a large number of ministers, variously reckoned at from 45 to 300, were deprived of their benefices. Henceforward the persecution was steady and grievous, and an exodus took place to Holland, where the exiles erected Presbyterian churches which in their turn reacted continually upon opinion in England. By far the larger part of the Puritans, however, clung to the church. As late as 1607 they eagerly expressed their desire "above all earthly things" to continue their ministry "as that without which our whole life would be wearisome and bitter to us." And in 1605, in answer to the attacks from both the extreme parties, William Bradshaw published his *English Puritanism*. The system herein developed, so far from being Presbyterian, is Congregationalism under state control. While each congregation is to be entirely independent of all other ecclesiastical courts, the election of its officers and other important matters are ostentatiously given to the civil magistrate. Not the slightest intrusion by ecclesiastical officers upon civil authority may be allowed; and all church preferment is absolutely in the hands of the crown, which is supreme over the constitution and proceedings of synods, and whose commands may not be actively resisted. The king himself is subject to his own particular church alone, and even though apostate or an evil liver he retains his full supremacy. It is clear that the denial, in the Scottish sense, of the state supremacy is not expressed by the English Puritan: that which galled him was the jurisdiction of other ecclesiastics.

From the synod of Dort in 1618 Arminianism gained ground in England in spite of the fact that Abbot, the primate, was head of the "doctrinal" (or old Calvinist) Puritans. As soon as Laud came into power the Government attacked Presbyterianism wherever it was found. Guernsey was compelled to accept Episcopacy, as Jersey had been in 1605, and the ten foreign congregations in England were placed under the control of the English Church. The English congregations in Hamburg and the Netherlands were also ordered to relinquish their synods. The system of the church was aristocratic exclusiveness.

One effect of the Scottish outburst in 1638 and of the events which followed was of course largely to strengthen in especial the Presbyterian interest. The action of the church tended constantly to cut off waverers. Baxter, for instance, was led to examine and finally to throw off Episcopacy by the "et cætera" oath in 1640. Nevertheless at the opening of the Civil Wars, if he is to be believed, Nonconformity, and in especial Presbyterianism, was very weak. "Where I was bred before 1640, which was in divers places, I knew not one Presbyterian clergyman or layman. . . . About as many Nonconformists as counties were left, and those few stuck most at subscription and ceremonies, and but few of them studied or understood the Presbyterian or Independent disciplinary causes." Those who sat in the Westminster Assembly were almost all such as had conformed.

In 1640 Henderson, Baillie, Blair, and Gillespie came with the Scottish commission to London, the ministers there having written to the general assembly expressing their desire for the establishment of the Scottish system. They at once set themselves to turn the current of Puritanism into the Presbyterian channel, and to bring about a union on the Presbyterian basis. Their preaching attracted large crowds, and, by a common mistake, they judged of all England from the London ministry, which was largely Presbyterian and which in December, 1641, had petitioned for a synod (a desire expressed also in the Grand Remonstrance) to include ministers from foreign parts. The parties, however, which were to join issue at the assembly were already clearly recognizing one another, for we hear that "the separatists are like to be of some help to hold up the bishops through their impertinence." For the views of moderate men on church reform the speeches of Sir E. Deering are important. It is clear that had the bishops been willing to become the allies of a reforming parliament Presbyterianism would not have been seriously discussed.

The Westminster Assembly.

In September, 1642, the Long Parliament abolished Episcopacy, the abolition to date from the 5th November, 1643; the question what form of Puritanism should succeed it was that for which the Westminster Assembly was summoned by parliament on 12th June, 1643. The intervening months were marked by a great increase of sects, of whom all were by nature opposed to the iron domination of Presbyterianism, which in its turn found support in the English ministers of Dutch congregations. It is important at the outset to notice that the assembly was born in Erastianism, the spirit which, from the whole course of English history for several centuries, may be regarded as national. It was a mere council of advice to the parliament of England, a creature of the parliament alone. Its members, two from each county, though some counties had but one, were chosen by parliament, and "nearer agreement with the Church of Scotland" is one of the chief points in the ordinance. In 1643 also the Long Parliament, needing Scottish support, and willing to bid high, formed the Solemn League and Covenant. In this the English, struggling for civil liberty, cared only for a political league; moreover, "they were," says Baillie, "more nor we could consent to, for keeping of a doore open in England to Independencie. Against this we were peremptorie." To the Scots "its chief aim was the propagation of our church discipline to England and Ireland." The title was a compromise, utterly distasteful to the Scots, who refused to call it anything but the "Covenant."

The number summoned to the assembly was 151, 10 being lords, 20 members of the House of Commons, 121 ministers. About one-half attended regularly. Besides the Episcopalian clergy, who did not attend, there were four parties—(1) moderate Reformers of Presbyterian temper, (2) Presbyterians of Scottish views, (3) Erastians, and (4) Independents. At the request of the parliament six Scottish commissioners, without a vote, of whom five (the sixth was Maitland, afterwards the celebrated duke of Lauderdale) were informed with the intensest spirit of Scottish Presbyterianism, attended the assembly. To them their mission was a holy one, being no less than "to establish a new platform of worship and discipline for this people for all time to come." That this was to be Presbyterian was the one thought that possessed their minds,—at first with eager hope, changing to apprehension and then to disappointment so bitter that it broke the heart of Alexander Henderson and made Baillie bewail the distance of the Scotch army. They struggled with pathetic earnestness against influences whose strength they had not realized,—the hated sentiment of Erastianism and the still more hated sentiment of Independency. The first of these was chiefly in the background in parliament, where it did not express itself fully until late in the proceedings; within the assembly it was consummately represented by Lightfoot, Coleman, and Selden, who held that "parliament is the church." The Independents, numbering only ten or eleven in all, their principal representative being Nye, were also men of great ability and clear views, who knew that they could depend on the support of the party led by Cromwell.

The assembly began in September by considering what to substitute for the Thirty-nine Articles. On 12th October, however, in deference to Scottish pressure, the parliament instructed them to take up at once the questions of church government and a liturgy. Church officers were first discussed. The Independents disputed every inch of ground: "to the uttermost of their power they have studied procrastination of all things, finding that by tyme they have gained." The long discussion which they forced on the question of the identity of pastor and doctor (in which, holding the offices to be distinct, and that every congregation ought to have both, they were opposed both by the Scots on the latter and by the Anglicans on the former ground) was but one example of their skill in obstruction. The grand battle, however, began on 22d November, over the ruling eldership—the essence of the "Scots' discipline,"—against which Independents and Erastians alike did their best. All were willing to admit elders "in a prudential way," *i.e.*, as *expedient*, but "sundry of the ablest were flat against the institution of any such offices by divine right," and the Independents kept them "in a pitiful labyrinth these twelve days." In the end a compromise was effected, grievous to the Scots, by which it was merely declared "agreeable to, and warranted by, the word of God, that some others besides the ministers of the word should join in the government of the church." An attempt further to define their office failed. By the end of the year the Scots became anxious: "as yet a presbyterie to this people is conceaved to be a strange monster." In a minor point they had experienced a rebuff. They had done, as true Presbyterians, all they could to induce the assembly to sit on Christmas Day, church festivals being to them an abomination; but they only prevailed so far "that both houses [of Parliament] did profane that holy day, by sitting on it, to our joy and some of the assembly's shame." The observance of saints' days and holidays was not abolished until 8th June, 1647.

On 9th January, 1644, the pressing question of ordination was brought forward. The committee reported that preaching presbyters should alone ordain. To this the Independents of course objected and kept the assembly in debate until 21st January. The House of Lords pressing for a settlement, it was next day proposed that "certain ministers of the city be desired to ordain ministers in the city and vicinity *jure fraternitatis*." On this and on the essential question, how far the consent of the congregation should be necessary, the Independents kept up the struggle until 19th April, when the latter point was determined in the non-intrusionist sense. The bitterness of the Scots against the Independents increased daily; they were fairly puzzled at the want of enthusiasm for that which was the breath of their lives. "This stupid and secure people, . . . this fainting and weak-hearted people," Baillie calls them, and adds, "the humor of this people is very various, and inclinable to singularities, to differ from all the world and from one another, and shortly from themselves." No people, he says, had so much need of a presbytery. The hatred was fully returned. An intrigue[1] was set on foot for a union between the Independents and the moderate royalists to keep out Scots and Presbyterianism on the basis of the restoration of Charles. So anxious did this render the Presbyterians that they offered to make a compromise whereby to strengthen their cause in parliament; and, probably at the suggestion of their chiefs there, the five leading Independents published (February, 1644) their *Apologetical Narrative*, which traversed their whole controversy with the Presbyterians and was addressed, not to the assembly, but to the parliament. This manifesto, as well as the *Antapologia* and other answers from the Presbyterians, is well analyzed by Hetherington. From the moment of this publication there was no longer any object in delaying the main battle. "The Independents are resolute to give in their reasons to parliament against us, and that shall be the beginning of an open schism: lykelie we shall be forced to deal with them as open enemies." On 6th February it was proposed that "the Scripture holdeth forth that many particular congregations may be under one Presbyterian government." After six weeks' incessant debate, in which both Erastians and Independents used their utmost ability, and in which Nye ostentatiously and successfully appealed to the jealousy of the *imperium in imperio*, they were forced to yield. In this discussion the English Presbyterians were less disposed to compromise than the Scottish, who were keenly anxious for the success of their mission. The ruling eldership was then voted, and "on Fryday, after a week's debate, we carried, albeit hardlie (27 to 19) that no single congregation has the power of ordination." On 31st May, Baillie adds, "our church sessions, to which the Independents gave all, and their opposite nothing at all, we have gotten settled with unanimity in the Scots' fashion." The Presbyterians were, however, by no means easy; they felt their triumph to be yet but a barren one. "The chief point we wish were proven is the real authority, power, and jurisdiction of synods and classical presbyteries over any the members of the whole of a particular congregation; also I wish that the power of presbyteries classical to ordaine and excommunicate were cleared. Many beside the Independents are brought to give the rights of both these actions to the congregational presbyteries, much against our mind and practice." The great question, the power of parliament in ecclesiastical affairs, was yet unsettled; and here they looked anxiously at "Selden and others, who will have no discipline at all in any church *jure divino*, but settled only on the free will and pleasure of the Parliament," and they had forebodings that "Erastus' way will triumph." Their fears were soon realized. On 15th November, 1644, the assembly reported to parliament all that had been done, and the house at once debated the *jus divinum* question. Glynn and Whitelocke spoke vehemently and at great length, and then upon the question it was carried to lay aside the point of *jus divinum*, and the House gave them thanks for preventing a surprise. It was resolved, however, that the Presbyterian government should be established, and that if upon trial it was not found acceptable it should be reversed or amended.

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[1] For the first time investigated and brought to light by Professor S. R. Gardiner (*Camden Miscellany*, 1883).

Parliamentary action.

Cromwell, who had shortly before "expressed himself with contempt of the assembly of divines," terming them "persecutors" and saying that "they persecuted honester men than themselves," and who had told Manchester that "in the way they [Scots] now carried themselves he could as soone draw his sword against them as against any in the king's army," came to the rescue of the Independents in the assembly by procuring on 13th September an order from the parliament to refer to a committee of both kingdoms the accommodation or toleration of the Independents. This committee, lasting until 15th October, was no doubt intended to gain time, for time was against the Scots, and it did nothing else. The Independents then, with written reasons against the propositions respecting church government, with objections on the question of excommunication, with their "model" and their remonstrances, managed to protract discussion until March, 1646, and in the end to leave matters unsettled and without prospect of settlement. In January, 1645, the abortive negotiations at Uxbridge took place, at which each party asserted the *jus divinum*. The conditions proposed to the king had been drawn up by Johnston of Warriston and approved by the Scottish parliament; they included the acceptance of the Covenant. In the compromise offered by the king he assented to the limitation of the bishops' power by a council of the lower clergy, and even by laymen to be elected by this council, in each diocese.

In April (Self-Denying Ordinance) and again in October, 1645 (the battle of Naseby having been fought in June) the parliament passed a vote which was gall and wormwood to the Scots, for it provided a power of appeal from the national assembly to the parliament. It also insisted that there should be two ruling elders for each minister in a church meeting, and allowed censures to be passed only in cases which it enumerated. No way remained to stay the mischief, Baillie felt, except by "hastening up our army, well recruited and disciplined." On 20th February, 1646, they resolved that a choice of elders should be made throughout the kingdom; but on 14th March Baillie himself bewails that "the House of Commons has gone on to vote (by a majority of one) a committee in every shire to cognosce on sundry ecclesiastical causes, which will spoil all our church government." The fact was that, the king[1] being now very weak, Scottish friendship was daily growing of less importance. When the commissioners from the Scottish parliament urged the speedy erecting of presbyteries, the English expressed their dread of "granting an arbitrary and unlimited power to near 10,000 judicatories within this kingdom," and declared that, experience having shown that the parliament had preserved the Reformation and purity of religion, they had no reason "to part with this power out of the hand of the civil magistrate." On 30th April, 1646, the House proposed queries which practically challenged the *jus divinum* position from one end to the other. The assembly at once set themselves to answer these captious questions; but of questions and answers the parliament took care that for the present no more should be heard. When, however, on 1st December, 1646, the London ministers published their manifesto *Jus divinum regiminis ecclesiastici*, the House of Commons called for the assembly's answers, which do not appear to have been forthcoming. Throughout the contest the Scottish commissioners, especially Baillie, organized the opposition, immortalized in Milton's sonnet, of the London ministers against the parliament's action. The king, however, having fled in April to the Scots, parliament thought it needful to temporise. On 5th June, therefore, both houses ratified the ordinance establishing presbyteries; on the 9th they ordered it at once to be put into execution; and—a still more significant step—they rescinded the clause for provincial committees which had given Baillie such vexation. The order, however, remained a dead letter until 22d April, 1647. Twelve presbyteries were then erected for London; Lancashire and Shropshire were organized, and Bolton was so vigorous in the cause as to gain the name of the Geneva of Lancashire; but the system spread no farther in the ungenial soil and air of England. Even here the difference between Scottish and English Presbyterianism is shown by the fact that two-thirds of every classis or presbytery were necessarily laymen. The first meeting of the London synod was on 3d May, 1647, and it met half-yearly until 1655. That of Lancashire met at Preston in February, 1648. After all, however, it appeared that the votes of the houses were permissive only; for on 13th October, 1647, the Lords voted to ask the king for his sanction to the proviso that "no person shall be liable to any question or penalty only for Non-Conformity to the said government or to the form of the divine services appointed in the ordinances," while such as would not conform were to be allowed to meet for religious exercise in a fit place so long as the peace was not disturbed.[2] The language of the Commons was almost equally indulgent, while on 1st November the "agitators" declared that "matters of religion and the ways of God's worship are not at all entrusted by us to any human power." Presbyterianism was well-nigh as far from being established at the close of the assembly as in the days of Elizabeth. English Protestantism had been a protest, not against Roman Catholicism, but against papal supremacy; the country was as little disposed to accept Presbyterian supremacy. The reader will gain some idea of the particular forms of tyranny which England had declined in "The Harmonious Consent of the ministers of the province within the County Palatine of Lancaster, etc." (Halley, *Lancashire, its Nonconf.*, p. 467). In May, 1648, the parliament, now that army pressure was removed, passed the celebrated "ordinance against blasphemy and heresy." If ordinances could have fought against the inherited instincts of centuries Presbyterian government would have run riot. On 29th August it was again decreed that "all parishes and places whatsoever within England and Wales shall be under the government of congregational, classical, provincial or national assemblies," except royal chapels and peers' houses. In October, 1648, Charles at Newport offered to accept Ussher's scheme,[1] and, in answer to an address from London, consented to a temporary alienation of church property for the maintenance of Presbyterian ministers. In November, however, the army asserted itself; it afterwards purged the parliament when it found that there was an accommodation between Charles and the Presbyterians, and killed the king. With the foundation of the commonwealth the dream of Presbyterian supremacy passed away. The Presbyterians are henceforth to be regarded as a political far more than as a religious body. They now formed the nucleus of that party which desired the restoration of monarchy on good conditions. Opposing the toleration granted to all forms of Protestantism by Cromwell, they became his most dangerous opponents by their sympathy with the Scots and their refusal to take the "engagement," as is illustrated by the plot for which Love was executed. The parliament meanwhile secured them in their livings. As Cromwell said to the Scots, "The ministers in England are supported and have liberty to preach the Gospel, though not to rail at their superiors at discretion, nor under a pretended privilege of character to overtop the civil powers." In the Instrument of Government (1653) Cromwell expressly retained all the laws in their favor and appointed some of them on the list of triers. They had their classical presbyteries for ordination, but these, having no coercive power, gradually became merely meetings of ministers of all denominations. The position of Baxter and his followers is worthy of notice, and should be read in his own words (Orme's *Baxter*, vol. i. p. 92). Nominally a Presbyterian, he disliked the lay eldership; he disliked their intolerance; he disliked the subordinate position ascribed to the civil magistrate; in his own terse language, "Till magistrates keep the sword themselves, and learn to deny it to every angry clergyman who would do his own work by it, . . . the church will never have unity and peace." On the question of the independence of congregations he was an Independent in sympathy and practice. His absorbing idea was union; with Ussher, he says, he had agreed in half an hour; among rigidly defined parties it is not possible to find him a place; but in the light of that idea he appears perfectly consistent. John Owen was another man who illustrates the light and shade of English opinion. He opposed the London ministers, though he held a Presbyterian appointment. In 1644 he upheld Presbyterianism against Independency; in 1646 he became formally connected with the Independents. The Presbyterian was above all, on the political side, a hater of the army and a parliamentarian, and, therefore, especially after Richard Cromwell's resignation, a monarchist. Monarchy and parliaments were coordinated in the English mind. Baxter preaching before the Commons on 30th April, 1660, said: "Whether we should be loyal to our king is none of our differences. . . . For the concord now wished in matters of religion it is easy for moderate men to come to a fair agreement." To take advantage of this feeling Charles II. used all the resources of duplicity; the deputation of divines was easily and entirely tricked, and on his entry into London the Presbyterian ministers received him with acclamation. Until the actual Restoration the ascendency of Presbyterianism, subsequent to Monk's entry into London, had seemed complete. The council was almost exclusively Presbyterian; Presbyterians commanded the garrison towns and the fleet, and had possession of the universities. The last acts of the Long Parliament had been to establish Presbyterianism as the religion of the state. It was therefore necessary on the part of Charles and Clarendon to temporize. Promises were made from Breda; hopes of comprehension and preferment were placed before the Presbyterian ministers; conferences were arranged between them and the leading Episcopal clergy. There is no sign, however, that the most ardent Presbyterian hoped for more than Ussher's model. They were sufficiently bound over by the Covenant, the oath of allegiance, the traditional connection of parliament and monarchy, and, above all, by their jealousy of the Scots, to restore the king.

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[1] At Newcastle in November, 1646, the king offered to sanction the Presbyterian establishment, with all its forms and the order of public worship already adopted, for a period of three years, without prejudice to his own personal liberty.

[2] In December, 1647, Charles, at Carisbrooke, again agreed with the commissioners from the Scottish Kirk to the conditions formerly offered at Newcastle, in consideration of their promise to take up arms for his cause. The establishment of Presbyterianism, the extirpation of sectaries, and covenant uniformity were demanded by the English.

Under the Commonwealth.

Under Charles II.

The solemn farce began. Ten ministers were made royal chaplains, and Charles II. expressed his intention of doing his best to heal the differences in religion. He wished to know their desires. They asked for a resident ministry, Sunday observance, Ussher's model, the revision of the Prayer Book, extemporary prayer, that kneeling at communion and the observance of saints' days might not be enforced, and that bowing at the name of Jesus, making the sign of the cross in baptism, and the use of the surplice might be abolished. Baxter also suggested that the suffragan bishop should be elected by the clergy of the rural deanery. The bishops replied in writing, refusing all concession, except, perhaps, as regarded the cross, bowing, and the surplice, and taunting their opponents with "scruple-mongering." Charles now put out his declaration, which included a proviso that the presbyters' advice and assistance should be necessary to certain episcopal functions, and especially to church censures. This, and the Bill to turn it into a law, kept the Presbyterians in play; by Clarendon's influence the Bill was thrown out on the second reading, and the convention parliament was dissolved. The parliament which followed was Episcopalian. The church at once struck hard. The corporation Act, 20th December, 1661, destroyed Presbyterian influence in the large towns, the centres of its power; the Act of Uniformity, 19th May, 1662, compelling "assent and consent" to everything in the Book of Common Prayer, destroyed it in the church. Under circumstances of open deceit and flippant cruelty 2000 ministers were, on St. Bartholomew's day, deprived of their offices. It is important to notice that the Papists and other Dissenting bodies opposed toleration to the Presbyterians; they felt that the only chance of a general toleration was in the failure of the Presbyterians to obtain comprehension.

Between these two Acts the Savoy Conference had been held, beginning 25th March, 1662; it met apparently to signalize the church's triumph. It was intended to fail, as the Hampton Court Conference had been intended to fail, and is of interest merely as being the last attempt at union by conference.

With regard to toleration Charles II. and James II.

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[1] Ussher's scheme suggested (*a*) three synods, namely, one of the clergy of the rural deanery, meeting once a month; one of the clergy of the whole diocese, meeting once or twice a year; and representatives of the clergy of the province, meeting once in three years, the archbishop presiding; (*b*) if parliament were sitting, the two provincial synods were to unite, and the whole government of the church was to be in their hands. There was no representative of the laity in the scheme.

were Bourbons, and they wished to carry out the policy of their ancestor, Henry IV. of France. They hoped to use the gratitude and dependence of the sects whereby to sustain them against the church. Cromwell had done the same; toleration and military despotism had been parallel ideas. Charles desired that the church should *not* tolerate, but that he should. Thus he hoped to have a despotism founded upon the support of the sects. The greater part of his reign presents a constant struggle of the church and parliament to frustrate his views. To gain the power of suspending the penal laws was the great object in the comprehension scheme of 26th December, 1662. In an instant church opposition began; the primate and the parliament spoke with equal sternness, and the suggestion was dropped. As had happened in Scotland, the ejection of St. Bartholomew's Day had led to conventicles; the first Conventicle Act, 16th May, 1664, was an expression of the hatred of the Anglican Church to Charles's scheme.

In 1665 the plague occurred; the pulpits of London were deserted by the Episcopal clergy, with a few brilliant exceptions. The Presbyterians and Independents came forward to fill them. The jealousy of the church was aroused, and at its demand, and in return for a supply for the Dutch War, Charles passed the Five Mile Act.[1] The extent to which these successive acts of persecution affected the country varied greatly. In some parts the justices refused to convict, or were languid. Thus Seth Ward, in one of his reports to Sheldon from Exeter (in 1663), says, "Your Grace shall know that there are, in this county of Devon onely, . . . at least fourteen Justices of the peace who are accounted arrant Presbyterians." The bishop of Chester makes the same complaint in 1667.[2] With the fall of Clarendon the idea of toleration at once revived. In February, 1667, Charles recommended it to parliament and relaxed the penal laws. But the idea had taken possession of the English mind that what Charles wanted to tolerate was Popery; wherever Charles wrote "dissent" the English mind read "pope of Rome." Some questions drawn out by Sheldon against toleration may be seen in the Sheldon MSS., and are worth reading. It was this fear, and the belief that the integrity of the Church of England was the great safeguard against Popery, that had to answer for much of the persecution. By 176 votes against 70 parliament voted against comprehension, and by 144 against 78 for the continuance of the Conventicle Act, while on 2d March, 1670, a second Conventicle Act of special severity was forced from Charles.

On 15th March, 1672, the king made another attempt by his famous Declaration of Indulgence, in which he boldly claimed the suspensory power. This caused great searchings of heart among the Dissenters, for they must either refuse the indulgence or uphold an unconstitutional proceeding. Ought they to accept anything short of comprehension? Their doubts were cut short by the withdrawal of the Indulgence only three months after its utterance, and the Test Act signalized the victory of the church. The church became more and more exclusive; the parliament, drawing its life from the people, gradually changed its tone. In 1663 the Anglican Church wished to triumph over dissent; in 1673 Protestants wished only to secure themselves against Popery. The Commons therefore passed a Bill for the ease of Dissenters, which was, however, dropped in the Lords.

No further change occurred in the legal status of the Presbyterians. Their party continually increased in influence under Shaftesbury's guidance, and in 1680 the Commons agreed to a scheme of comprehension for all Dissenters who would subscribe the doctrinal Articles; the surplice was to be omitted except in cathedrals or royal chapels; and ceremonies were to be regarded as indifferent. This attempt at union came to nothing, however, through church opposition, as did a final attempt at toleration by Charles in 1684. Throughout his reign the church had held him in a never-relaxing grasp. The intervening years were a period of constant annoyance to the Presbyterians, who were discredited by the Rye House Plot. Such were the relations of the Presbyterians to the church. Their relations to the Independents were the old ones of jealousy and hostility. They themselves always looked for a position in the establishment; the principles of the Independents excluded the idea. Attempts at union occurred, but they were useless.

Merged in Dissent generally.

From this time the history of the Presbyterians is lost in that of Dissent generally. James refused to enforce the penal laws; but they enforced themselves, and Baxter was one of the first to suffer. Monmouth's attempt only increased their sufferings. In 1687 their prospects brightened. James II., following his brother's policy, issued his Declaration for Liberty of Conscience, as he had already done in Scotland and Ireland. The motive, as Hallam says, was that already mentioned, "to enlist under the standard of arbitrary power those who had been its most intrepid and steadiest adversaries." In the addresses of thanks sent up the leading Dissenters (except the Quakers) refused to join; indeed, at a general meeting of ministers a resolution was passed directly condemning the dispensing power. The action of James, by which the work of the Corporation Act was in a great measure undone and the power in corporations once more thrown into Dissenting hands, was equally unsuccessful. Throughout his reign the king failed to comprehend that the Dissenters were, first of all, Protestants. William III.'s declaration from Torbay recommended comprehension, and in March, 1689, he urged it upon parliament. A Bill was brought into the Lords for abrogating the oaths of allegiance and supremacy, and for abolishing the Test Act so far as Dissent was concerned. The High-Church party, however, was strong enough to secure its failure. Another Bill with the same intent, as well as attempts to relieve the Dissenters of kneeling at the sacrament and using the cross in baptism, and to explain away "assent and consent," as required by the Act of Uniformity, was also jealously and successfully opposed. By the Act of Toleration, however, all the penal laws, except the Corporation and Test Acts and those against the deniers of the Trinity, were removed. But it did not abrogate the statutes of Elizabeth and James I., which exacted certain penalties on such as absented themselves from the parish church. Heresy, too, was still subject to the church courts. A last attempt was made, by an ecclesiastical commission of thirty divines, to frame a scheme of comprehension. It was vehemently opposed in convocation; the High Churchmen withdrew from it; and it was never submitted to parliament. Thus ended the last of the fruitless attempts to comprehend Dissent within the establishment. During William's reign the hatred of the church to the Presbyterians had been obliged to lie dormant. Anne's accession, however, led at once to an attempt on the part of the churchmen to revenge themselves by the introduction of the Occasional Conformity Bill for the toleration which they had been compelled to practice. This, however, they were unable to carry through against the opposition, of which Burnet was the foremost champion.

Having secured toleration, the Dissenters began to think of their own internal condition. A coalition of Presbyterians and Independents was thought desirable. The mere mention of such a thing shows how profoundly the complexion of affairs had changed. Under

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[1] By this Act all who refused to declare that they "would not at any time endeavor any alteration in church or state" were made incapable of teaching in schools, and prohibited from coming within 5 miles of any city, corporate town, or parliamentary borough, or within 5 miles of any parish, town, or place, where they had since the Act of Oblivion been parson, vicar, or lecturer, or where they had preached in any conventicle, on any pretence whatever.

[2] Sheldon MSS., Bodleian Library.

Modern doctrinal tendencies.

the name of "United Brethren" about eighty ministers of London met and drew up heads of an agreement, in nine articles, on church government and ecclesiastical discipline. Article 8 provided that the union should not discuss doctrine, and named as auxiliaries to Scripture the Articles, the Savoy Confession, and the Westminster Catechism. Mutual concessions were now made. The Independents gave up the *necessity* of the consent of a church to the ordination of a minister, and only made it desirable; and the office of doctor, as distinct from pastor and ruling elder, was passed over. But the Presbyterians gave up far more, viz., the authoritative power of synods over individual churches. In other words, the Presbyterians gave up and the Independents retained each the kernel of their system. Excommunication was emasculated. The prerogative of synods was reduced to occasional meetings and a reverential regard for their judgment. But this arrangement only affected London and its neighborhood. Moreover, while their views of church government were so profoundly modified in the Independent direction, a change equally noticeable took place in their doctrinal views. From the beginning of the 18th century the greater number of their congregations became Unitarian, while those which remained orthodox joined themselves to the Scottish Church. The fact that at a time when full toleration was enjoyed the Presbyterian principle ever grew weaker shows how little it had penetrated into the English mind. During the present century a new establishment of Presbyterian congregations has taken place upon the Scottish models, and indeed at first as an offset of the Scottish Church itself. In May, 1836, however, the synod of the Presbyterian Church of England was established, in entire independence of, though in friendly union with, the Scottish Church, containing at the present time (1885) 10 presbyteries with 280 congregations.[1]

Ireland.

Established in Ulster.

Independency supreme.

Ireland.—Presbyterianism in Ireland dates from the plantation of Ulster, by which a large part of Ireland ceased to be Papist and was peopled afresh by Scotsmen and Englishmen. An independent Protestant church was settled in James I.'s reign, and at the convocation of 1615 the first confession of faith was drawn up by James Ussher, which implicitly admitted the validity of Presbyterian ordination and denied the distinction between bishop and presbyter. It was not, however, until 1626 that the beginning of the Presbyterian system was laid by Hugh Campbell, a Scot, who, having become converted, "invited some of his honest neighbors . . . . to meet him at his house on the last Friday of the month. . . . At last they grew so numerous, that the minister thought fit that some of them should be still with them to prevent what hurt might follow." Within the Episcopal Church, and supported by its endowments, Blair, Livingstone, and others maintained a Scottish Presbyterian communion. From 1625, however, to 1638 the history of Presbyterianism in Ireland is one of bare existence, not of progress. The ministers, silenced by Wentworth, fled finally to Scotland, after an ineffectual attempt to reach New England, and there took a leading part in the great movement of 1638. In 1639 the "black oath," which forbade the making of any covenants, was forced by Wentworth upon the Ulster Scots. His absence in 1640 raised hopes which were destroyed by the Irish rebellion of 1641, whereby the Protestant interest was for the time ruined. The violence of the storm had, however, fallen upon the Episcopal Church, and her desolation made the rise of Presbyterianism more easy. A majority of the Ulster Protestants were Presbyterian, and in the great revival which now took place the ministers who accompanied the Scottish regiments took a leading part. Sessions were formed in four regiments, and the first regular presbytery was held at Carrickfergus on Friday, 10th June, 1642, attended by five ministers and by ruling elders from the four regimental sessions. This presbytery supplied ministers to as many congregations as possible, and for the remainder the ministers were sent from Scotland with full powers of ordination. Many of the Episcopal clergy also joined the winning side, and by the end of 1643 the Ulster church was fairly established. Ireland was included in the Solemn League and Covenant, though the oath was not taken until March, 1644. So strong were the Presbyterians that their request that the whole army should be subjected to their discipline was at once granted; and, when a number of Episcopal ministers formed themselves into a presbytery of their own, but without lay eldership and subjection to higher courts, the jealous zeal of the Scots found means to break it up. Meanwhile they were in constant communication with Scotland, of whose system Ulster can best be regarded as a part. In 1645 they were strengthened by the Scots who fled from Montrose, and by the presence of the commissioners of the parliament, who ordered that the covenant should be tendered to all who had not yet taken it. The commissioners also gave the tithes of parishes to ministers who applied for them, and their sanction as a civil power to the presbyteries to censure and punish scandalous ministers. It should be noted that this assumption by the civil power was much scrupled by the ministers as savoring of Erastianism, and the commissioners had to explain away their action. The celebrated vote of the English House of Commons on 14th March, 1646, was the first check; the second was the crushing defeat of the Scottish troops at Benburb by O'Neill. Nevertheless by 1647 there were, besides the chaplains of Scottish regiments, nearly thirty ordained ministers with fixed charges in Ulster. When the affair of the "engagement" took place, both the Scottish parliament and the general assembly sent to secure the Irish vote. The presbyteries obeyed the church, the regiments the parliament. After the Scottish defeat at Preston the English parliament, now entirely anti-Presbyterian, determined to attack the Scots in Ulster. In this they were so well served by Monk that by the end of 1648 the Independents, as opposed both to Prelatists and Presbyterians, were superior, and by the end of the year were supreme. Independency became the state church, and the Presbyterian clergy were excluded from the garrison towns. In spite, however, of their downfallen condition, they absolutely refused to take the oath of the engagement, which bound men to be faithful to the Commonwealth without a king or House of Lords, whereupon the most important among them were arrested, while the rest fled to Scotland. During 1651 they were excluded from the pulpit and deprived of their tithes, and in March they were formally banished by a council of war, while the engagement oath was pressed on all classes.

Presbyterianism restored.

Upon Henry Cromwell's arrival, the Protector's object being to reconcile all parties to his sovereignty, the penalties for refusing the engagement were remitted; ministers were allowed to officiate without restraint; and the banished ministers returned. So rapidly did their number increase that by 1655 three bodies performing all the functions of regularly constituted presbyteries had been formed, acting under commission of the whole presbytery. Meanwhile, however, no settled maintenance was available, and it was with great difficulty that the council was induced to afford two years' salary. One illustration of the united state of this church and of its autonomy is to be found in its action regarding the schism in Scotland between Protesters and Resolutioners. At a general meeting at Bangor it was determined, by the Act of Bangor, 1654, that, "though some differed in opinion from the rest, yet there should be no mutual contestings about the differences in Scotland among themselves, nor any owning of them on either side in public preaching or prayer. But, whatever mention might indirectly be made of these divisions, it should be in order to healing them in Scotland." Under Henry Cromwell all sects pursued their course in peace, and the Presbyterians especially increased their strength until the Restoration, in which they heartily co-operated, assisting Sir C. Coote in the *coup de main* which secured Dublin for the king. There were now in Ulster seventy ministers in fixed charges, with nearly eighty parishes or congregations, containing 100,000 persons. These ministers were in five presbyteries, holding monthly meetings and annual visitations of all the churches within their bounds, and coming together in general synod four times a year. An entire conformity with the Scottish Church was maintained, and strict discipline was enforced by kirk sessions, presbyteries, and house-to-house visitations.

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[1] *Chief References.*—Neal, *Hist. of the Puritans*; Brook, *Cartwright*; Strype, *Whitgift*; Hetherington, *Hist. of Westminster Assembly*; Mitchell, *Hist. of Westminster Assembly*; Orme, *Baxter* and *Owen*; Halley, *Lancashire its Nonconformity*; Toulmin, *Hist. of Dissenters*; Marsden, *Puritans*; *Parl. Hist.*; Philip Henry, *Diary*; and the various English histories.

History since the Restoration.

At the Restoration the determination of the Government to put down Presbyterianism was speedily felt in Ireland. In January, 1661, the lords justices forbade all unlawful assemblies, under which head were placed meetings of presbyteries, as exercising ecclesiastical jurisdiction not warranted by the laws of the kingdom. In a discussion with Jeremy Taylor they upheld the *jus divinum* of Presbyterianism and refused to take the oath of supremacy without the qualification suggested by Ussher. At first their parishes were merely declared vacant and Episcopal clergy appointed to them; but shortly afterwards they were forbidden to preach, baptize, or publicly exhort. In Ulster alone sixty-one ministers were ejected; only seven out of seventy conformed. Conventicles, of course, arose, conducted chiefly by young Covenanting ministers from Scotland, of whom the ablest, most indefatigable, and most obnoxious to the authorities was Michael Bruce.

The abortive attempt of Blood, in which he endeavored to associate the Presbyterians, brought fresh trouble, and the Ulster ministers were with a few exceptions compelled to leave the kingdom. Ormonde, indeed, refrained from harassing them; but it was not until 1665 that the unmolested return of the ministers enabled them to revive their worship and discipline. Presbyteries without ruling elders were organized in private houses, parishes were regularly visited, chapels were built, baptisms were performed, help was sent to the brethren in Holland, and offenders once more came under the active discipline of presbyteries and kirk sessions. A committee which met in place of the regular synod went so far as to insist that all irregular baptisms should be regularly performed. The toleration afforded them is remarkable when compared with that in England and Scotland.

Hitherto, thanks to the wise Act of Bangor, the church had had peace within her own borders. It was not until 1671–72 that this was broken by David Houston, who showed an impatience of ecclesiastical restraint and opposed the settled ministry. This led to the drawing up in February, 1672, of a series of regulations as to conducting the trials, ordination, and settling of ministers. Houston left Ireland in 1673, but the schism created by him lasted till 1840 in the Reformed Presbyterian Church of Ireland. In 1672 the Presbyterian Church received from Charles II. a sum of £600 from the secret service fund.

For several years the church prospered, not only in the north, but in the south and west as well. In 1679 the rising in Scotland, which ended in the battle of Bothwell Brigg, brought trouble on the Irish Presbyterians, in spite of their loyal addresses disowning it. It was not, however, until 1682 that they again lost the privilege of public ministry and that oppression became so severe. They cordially concurred with the Episcopalians against James II., though they had benefited by his Declaration of Indulgence, and were the first to congratulate William III. on his arrival in England. During the war several of them took an active part in the siege of Londonderry; the rest fled to Scotland. A list sent in by them to the general assembly shows that there were then in Ireland a hundred congregations, seventy-five with fixed ministers, and that there were eighty ministers under five presbyteries. With the close of the war came the close of their troubles, as under William they enjoyed complete toleration. So hopeful were they of regaining supremacy that they sent up a petition to the crown that, since the north of Ireland was almost entirely peopled by Scottish Presbyterians, Episcopacy might be done away with in that part. In 1731 again a deputation of ministers and elders went to Dublin with the vain request that their church might receive legal recognition and be placed on an equal footing with the Episcopal Church. Irish Presbyterianism presents no feature of note until 1840, when the original synod of Ulster and all seceding Presbyterian churches united themselves in the "General Assembly of the Presbyterian Church of Ireland." In 1881 there were 36 presbyteries with 552 congregations, containing 101,403 communicants, with 621 ministers. Their synods meet in Belfast. Entirely independent of other churches, they, like those in England, live in friendly union with the Scottish Church. Both English and Irish Churches are in sympathy with the Free Church on the questions which brought about the Disruption of 1843.[1]

Organization of French churches.

France.—The extension of the Genevan system on the synodal side became necessary as soon as it was applied to a large community. Up to 1555 the organization of the French churches had been incomplete: there had been no settled clergy nor regular administration of the sacraments. In that year, however, at the suggestion of De la Ferrière, a church was formed at Paris on the Genevan plan, complete in all points, with La Rivière for pastor; and in a few years the organization was set up in Meaux, Angers, Poitiers, Bourges, Nîmes, Blois, Tours, and Orleans. By 1559, according to Théodore de Bèze, there were in France 2150 organized churches; in 1562 Cardinal St. Croix reckoned the Huguenots as being one-half of the population. These churches were isolated, and therefore weak. The step needed to repair their weakness was taken as it were by accident. Antoine Chandieu, minister at Paris, while at Poitiers in 1558, found there several ministers from the neighborhood. It struck them that it would be serviceable to have a common confession of faith and system of government. Thereupon the consistoire of Paris summoned a synod, *not, however, to attribute to this church any special pre-eminence or dignity.* On 26th May, 1559, the representatives of eleven churches met in the first national synod and laid down a confession of faith (drawn up by Chandieu) and a system of discipline. The confession, in forty articles, was purely Calvinistic. The emphasis with which the right and duty of the magistrate to interfere on behalf of the truth are insisted upon is important. Foremost in the discipline, as in the confession, comes the fundamental statement of perfect equality: "Aucune église ne pourra prétendre primauté ni domination sur l'autre; ni pareillement les ministres d'une église les uns sur les autres; ni les anciens, ou diacres, les uns sur les autres." A breach of this law was sternly condemned by the synod of Orleans in 1562.

Next to the *consistoire*, which, as being well understood, is not mentioned, came the *colloque* (not finally settled until 1572), consisting of the minister and an elder from each church of the district. In 1637 a colloque was composed of representatives from about ten churches. This met twice a year at least and took cognizance of disputes, but had no initiative power. Each province contained in 1637 three or more colloques. Above the colloque was the *provincial synod*, also containing a minister and an elder or deacon for each church in the province. This synod met once a year. Finally, there was the *national synod*, which met every year if possible.

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[1] See Reid, *Hist. of Presby. in Ireland;* Carte, *Ormond.*

Church officers.

(1) Ministers were not elected by the congregation (not even by a minister and his consistoire), but by two or three ministers with their consistoires, by the provincial synod, or by the colloque. If the congregation objected, the consistoire was to inquire how far the objection was valid; if the consistoire upheld the congregation, the provincial synod had the final right of decision (art. 7). In 1572, however, the synod of Nîmes laid down the principle that no minister might be imposed upon an unwilling people. (2) In the first forming of a church the elders and deacons were elected by the people; but here the power of the congregation ceased. Future vacancies were filled up by the votes of those remaining. The eldership was *not* to be for life; but there was always a tendency to make it so. In 1565 the synod of Paris warned the churches not to change without urgent cause, so too in 1572 at Nîmes. In 1596, however, it was decided that they were to be changed whenever expedient. (3) The office of deacon was of great importance; besides having the charge of the poor and sick, he might catechize and, if the minister were ill, offer prayer and read a written sermon. He was a member of the consistoire, but apparently without the right to vote. In 1572 his dignity was increased, and (compare "readers" in Scotland) he was regarded as preparing for the ministry. As regards the consistoire, —if a parish was without one, it must be created; if a great lord had a congregation in his own family, one must be formed from it. In 1565 the power of excommunication was given to it, and it might depose elders and deacons, with appeal to the provincial synod. Its right to manage the affairs of its own church was strongly asserted in 1563, 1565, and 1571 at the synods of Lyons, Paris, and La Rochelle. One of the ministers was president, but only as *primus inter pares*. Over all marriage and baptismal questions it had jurisdiction so long as it avoided interference with the civil Government by dissolving marriages. The attention paid to marriage by Presbyterianism in all countries is worthy of notice. The ruling idea is the intense sanctity of the tie. Only in case of adultery might it be broken in France. A contract of marriage was declared indissoluble by the synod of Lyons (art. 44) in 1563, though the woman averred that she had been forced into it and that the man had a loathsome disease. Still more remarkable examples might be quoted.[1] The office of elder was far more limited than in Geneva; his supervision over morals was, for example, confined to reporting scandals to the consistory; but in 1572 this was greatly extended. The remarkable feature of the French system is its aristocratical nature; the consistory, by the method of co-optation, was a purely aristocratic council, and the greatest pains were taken by the various synods to crush all attempts towards giving power to the congregations (*e.g.*, the condemnation of Jean Morelli, 1562–72, and the synods of Verteuil in 1567 and La Rochelle in 1571).

Synods.

In the national synods, also, the aristocratic formation soon asserted itself. Up to 1565 every church sent a minister with one or two elders or deacons. On questions of discipline elders or deacons might vote, on doctrinal questions only as many laymen as ministers. In 1565, however, to avoid overcrowding, the national synod of Paris determined that for the future only one or two ministers and one or two elders, chosen by each provincial synod, should be admitted. Thus the national synod, which had hitherto represented single churches, now represented only the provincial synods, which of course gained immensely in importance. The church disclaimed any encroachments upon the civil authority (compare the national synods of Lyons, Figeac, La Rochelle, Montauban, 1563, 1579, 1581, 1594). But in M. Borrel's work, especially valuable as showing what went on in a single church, we find that so early as 1561 Presbyterianism was following its natural bent. "A mesure que son pouvoir grandit, il impiéta sur le domaine du gouvernement civil, et crut pouvoir prendre des mesures pour la défense . . . pour ordonner, qui plus est, les levers d'argent. . . . En un mot, la police, la garde de la ville, l'inspection de la conduite des habitants, . . . devinrent graduellement l'objet de ses déliberations et de ses règlements." And a stern stand was made against the supremacy of the state. In 1571 the minister of Bordeaux reported to the synod of La Rochelle "qu'un médecin soutient que le magistrat est le chef de l'église et que ce que les ministres entreprennent n'est que tirannie." The synod rejected "l'erreur du dit médecin et de tous autres qui veulent abolir la discipline de l'église en la confondant avec le gouvernement civil." The language of the synods will be found to vary as their political prospects vary.

Relations to the state.

Progress of Protestantism.

The cause of the astonishing progress of Protestantism and the extent to which it was but one phase of a general movement for reform may be seen in the proceedings of the states-general at Orleans in December, 1560, where, both in the noblesse and in the tiers-état, loud complaints were uttered against the clergy (Félice, p. 117), and freedom of worship was demanded. Only a few months afterwards a proposal was made by a magistrate of Autun to sell all the church lands, to retain a fourth of the sum for the support of the priests, and with the rest to pay off the crown debts and encourage agriculture and commerce. The disbelief in the possibility of two widely varying religions living side by side is shown in the proposals of all the speakers for a national council to settle variances. "Otons ces noms diaboliques," said De l'Hôpital, "ces noms de partis, factions, et séditions —*Luthériens*, *Huguenots*, *Papistes*—ne changeons pas le nom de Chrétien."

Great forces were contending for Protestantism; it had the good-will of three-fourths of the nobles and of the bourgeoisie in the principal towns. But against it were ranged the strength of tradition and of habit; the craft of Catherine de' Medici, to whom all religions were equally matters of policy; the ambition of the Guises, backed by Spain; the interests of the clergy, backed by the pope; and the Paris mob. And there was another influence, perhaps still more powerful. One of the greatest obstacles to the success of a new religious movement in a country of strong national feeling will be the existence of a strong national church. The church of France was Gallican, anti-papal, practically and essentially national. In spite of manifold corruptions she had become the centre of much national attachment. As was the case in England, she represented the idea of nationality in a concrete form, and in this lies to a great measure the explanation of the fact that the Huguenots had so long to fight for the right to exist.

Struggles against Roman Catholicism.

By September, 1561, the situation had become intolerable. The colloquy of Poissy then met, as desired by De l'Hôpital. It made but one thing clear: union was impossible; extermination for one of the conflicting faiths, or their concurrent existence, were the alternatives. The edict of January, 1562, marked the conditions on which the latter was adopted. One remarkable provision was that ministers should swear *before the civil magistrate* to preach according to the word of God and the Nicene creed. By March war had begun; the peace of Amboise in March the next year gave the Protestants some privileges, which, however, were afterwards much restricted, especially in the matter of synods, in August, 1564; and the armed truce lasted until 1567. During these years the churches consolidated themselves. At Nîmes, for example, the Genevan discipline was established in full rigor. The tendency of the consistory to encroach on the civil domain was shown in many ways, while the closely aristocratic nature of the French system appeared from the fact that at each annual election the outgoing members formed a body called the "old consistory," which was joined with the new consistory for election of ministers and all ordinary affairs. Its ministers were of two classes—the one ordinary and perpetual, the other temporary, such as the professors at the theological college.

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[1] For the method of constituting a consistory, for its supervision of private life and public morals, see Borrel, *Histoire de l'Église de Nîmes*, pp. 61, 96, 117.

The wars of 1567 displayed the value of the facility for union, which was one of the most important features of the Presbyterian polity. During three years of horrors meetings both of consistories and of provincial synods were held. In April, 1571, at the peace of St. Germain en Laye, the seventh national synod at La Rochelle reaffirmed the confession of faith. In May, 1572, a very important synod was held at Nîmes, in which the whole church system was carefully revised and developed in many important respects, some of which have been mentioned. The rigidity of the Calvinistic faith was illustrated by the sentence of excommunication against ministers or elders who caused any dispute touching doctrine, ceremonies, or discipline, and the Puritan temper by the prohibition "assister aux spectacles profanes, comme aux danses de théâtre, aux comédies," etc. The church senate, the difference of which from the consistory it is difficult to trace, was now merged in it, and care was taken to get rid of wandering and uncertificated ministers by drawing up a "rôle des vagabonds."

By the end of 1573 the positions of the Catholics and of the "religion prétendue réformée," as it was henceforward officially known, had greatly altered. Against the Italian and Spanish influences, as represented by Catherine and the Guises, there had after St. Bartholomew's Day arisen a patriot Catholic party; while the Presbyterians had become sharply divided into two bodies,—one the Consistoriaux (the Covenanters of France), careful only for the purity and free exercise of their religion, and the other the Aristocracy (as in Scotland), who, having become Presbyterians for political purposes, were now fearful of seeing themselves excluded from political life, and were therefore anxious for union and compromise. This party formed a league with Catholic patriots, and, as the "tiers-parti," was so threatening that Henry III., to sever the alliance, offered to the Calvinist Aristocracy the free exercise of their religion, and, what they were far more anxious about, full participation in public employments and the re-establishment of their chiefs in their former positions. Fighting, however, again broke out in the beginning of 1577, and was adverse to the Presbyterians, who nevertheless held a national synod at Sainte Foy in 1578, attended by a commissioner from Henry of Navarre. Very remarkable is the strictness with which in a time of desolation the laws of the church were maintained. The lukewarmness of the Presbyterian Aristocracy had made the ministers stern and unyielding, and they now gained great influence. In this respect too the course of things was very analogous to that in Scotland. In both countries the ministers threw themselves upon the lower middle classes as distinct from and opposed to the aristocracy. In 1585 Henry III. came to terms with the Guise faction at Nemours on condition of exterminating Calvinism. This, however, was under the stress of circumstances; his policy was to play off one party against the other, and he soon became lukewarm in persecution. Along with Henry of Navarre he was excommunicated by the pope; he replied by defiance, murdered Guise, was compelled by the abhorrence thus created to join the Protestants, marched with Navarre on Paris, and was there, in 1589, assassinated. To gain the Catholics and to retain the Presbyterians was Henry IV.'s task after Ivry. To secure the latter he put out an edict of toleration; to gain the former he was "converted" to Catholicism in 1593. The Presbyterian Aristocracy now took a most important step. In May, 1594, they held a *political* meeting at Sainte Foy and formally established a political *imperium in imperio* of the most decided character. France was divided into ten sections for administrative purposes. There was a general council of four nobles, four bourgeois, two clergy,—the numbers being afterwards raised to twelve, twelve, and six. Under the general council were the provincial councils of five or seven members, of whom only one was necessarily a minister. The general council acted as an intermediary between the whole body of the Calvinists and the king. Owing doubtless to its operation Henry, whose leading idea was national unity, in April, 1598 ("l'an de salut") put forth the edict of Nantes, which practically conceded entire liberty of conscience to the Presbyterians. The truce lasted during the rest of Henry's reign. Synods were regularly held, and the language of controversy became more bitter. At Gap, in 1603, the pope was declared to be Antichrist, and this declaration was in force until 1637, when the synod of Alençon was compelled to expunge it. At the synod of Gap it was reported that there were 760 organized churches, with 565 ministers. The ministry now received from the king a subsidy of 40,000 crowns, the distribution of which took up a large part of the time of subsequent synods. In spite of the confirmations of the Edict which followed Henry's death, the anxious Presbyterians held another political synod at Saumur in 1611, when they swore faith to the crown, "le souverain empire de Dieu demeurant toujours en son entier." In 1620 the political assembly met at La Rochelle, when they confiscated all property belonging to Catholic churches, struck a great seal, levied arms and taxes, organized the church, and divided France into eight military districts. The austerity and intolerance displayed at the synods at this time were intense (see Buckle, vol. ii. p. 57, ed. 1867). The war, however, was disastrous to the Presbyterians, and at the peace of Montpellier the cessation of political meetings was insisted upon. The policy of Richelieu was that of Henry IV.,—protection as regarded religion, and a steadfast refusal to permit any political "league" which tended against the concentration of French nationality. The result of his treatment of combined conciliation and repression and of the attractions of the court on the nobility was that the Presbyterians, as a political party, ceased to exist. The number of churches, too, greatly diminished; in 1603 there were 760, in 1619 only 700. Mazarin pursued the same course; and his assent in 1660 to the synod of Loudun was the last favor they received.

Political Presbyterian party.

The action of the fourteen synods held since 1600 had been (as was also the case in Scotland) in the direction of increasing the power of the minister and diminishing that of the elders and congregations (Vitré in 1603, La Rochelle in 1607, and Gap in 1617), and to define the relations with the state. From 1623 (Charenton) a royal commissioner was always present, and year by year the increasing subserviency of their language shows that the national synods were coming more and more under royal control. In 1637 (Alençon) the royal commissioner, who openly taunted them with their powerlessness, forbade not only the provincial synods but even intercourse of the national synods with the provinces. In 1657 meetings for the choice of ministers were prohibited, and then the colloques were suppressed. At Loudun in 1659 the national synod was forbidden and the provincial synods were restored. The greatest jealousy, too, was shown by the crown in respect of communication with other countries. No one might be a minister who was not born in France, or who had studied in Geneva, Holland, or England,

Period of persecution.

the hot-beds of republicanism. The Presbyterians showed a corresponding desire for union with other Protestants. In 1620 they accepted the confession of the synod of Dort; in 1631, for the first time, they held out the hand of fellowship to the Lutherans. In 1614 an attempt had been already made to convene a general council of orthodox churches from all Protestant countries; and an oath of union was taken among themselves, repeated at Charenton in 1623. With two parties alone they would accept no union, Roman Catholics and Independents.

Of the time of horrors which reached its climax in the revocation of the Edict of Nantes in 1685 we can give no account here. The provincial synods were held continuously and were of great importance in preserving the vitality and spirit of the church. Thus in 1661 the provincial synod of Nîmes checked defection by compelling every minister within its bounds to swear that he had not thought of joining "light to darkness and God to Belial."[1] It is reckoned that under the persecution, in addition to the killed, from four to five millions of French Protestants left the country. Armed resistance took place, but no settled struggle until 1702, when the war of the Camisards took place in Languedoc,—a war of uneducated peasants without arms or leaders of rank. Like the Cameronians, they believed that they received direct communications from God; they had their prophets or "inspirés"; they lived in a state of religious ecstasy, and bore with patient defiance spoliation, the galleys, and death: and, when opportunity offered, they exercised against their enemies reprisals as cruel as was the persecution itself. For three years every effort to crush them was made in vain; and they yielded at last only to the moderate measures of Villars.

Antoine Court.

To abolish the undisciplined rule of the "inspirés" and to restore Presbyterianism, which had ceased since the revocation, was the work of Antoine Court, the most notable figure produced by Protestant France. From 1715 to 1730, without a day's rest, this man accomplished a work truly marvellous. He was but eighteen years old when he began it. In momentary peril of death for fifteen years, he restored in the Vivarais and the Cevennes the Presbyterian constitution in all its integrity. On 21st August, 1715, he assembled his first colloque, consisting of the preachers of the Cevennes and several laymen. In 1718 he held a synod of forty-five members and again in 1723, when the old discipline was restored. In 1726 he held another synod attended by three ministers and forty-four elders, and again in the next year; and in 1744, in a remote spot of Bas Languedoc, the first national synod since 1660 brought together representatives from every province formerly Protestant. This alarmed the government, and persecution again began. From 1760, however, thanks to the gradual spread of the skeptical spirit and to the teachings of Voltaire, more tolerant views prevailed: synods were held without disturbance; and in 1787 Turgot, whose great object was to separate the civil and the spiritual domains, put out the Edict of Tolerance. In 1789 all citizens were made equal before the law, and the position of Presbyterianism improved up to 1791. Napoleon in 1801 and 1802 took into his own hands the independence of both Catholic and Protestant churches. The consistory was abolished and replaced by an "église consistoriale," uniting several churches. Representation on the "premier consistoire" of this "église" was now determined by taxation instead of by choice of the people. Five "églises consistoriales" formed a "synode d'arrondissement," which superseded the provincial synod. It consisted of ten members only, and was absolutely under state control. The national synod was abolished. "C'était une liberté interne et murée dans les temples. Il y avait rigoureuse défense de faire aucun bruit, aucun mouvement dans les choses de réligion, ni journaux, ni associations, ni controverse, ni prosélytisme; et si quelqu' idée ou action réligieuse osait franchir l'enceinte oú elle était emprisonnée, la main de fer de Napoléon l'y refoulait immédiatement." Its life was taken from the church, and in 1807 it numbered less than 200 ministers.

Napoleon's organization.

Constitution of 1852.

In 1848, however, all but three of the ninety-two "églises consistoriales" sent a deputy to an assembly at Paris. From this assembly, when it refused to discuss points of doctrine, a secession took place, and the secessionists with the independent churches which had sprung up formed the "Union des églises évangéliques de France." This society held a synod in 1849 and there laid down a confession of faith and an ecclesiastical discipline. Meanwhile the established church set itself to the work of reconstitution on the basis of universal suffrage (with restrictions), the particular church being an essential element, with provincial synods, and a general synod meeting at regular intervals; but no result was arrived at. In 1852 a change took place in its constitution. The "églises consistoriales" were abolished, and in each parish a presbyterial council was erected, the pastor being president, with from four to seven elders chosen by the people. In the large towns there were consistories composed of all the pastors and of delegates from the various parishes. Half the elders in each assembly were subject to reelection every three years. Above all was the central provincial council, consisting of the two senior pastors and fifteen members nominated by the state in the first instance. All property qualification for eldership was abolished. In 1858 there were 617 pastors, and the subvention from the state amounted to 1,375,936 francs [$275,187.20]. The "Union des églises évangéliques" numbered twenty-seven churches.[2]

Position in the Netherlands.

The Netherlands.—From the geographical position of the Netherlands Presbyterianism took there from the beginning its tone from France. In 1562 the *Confessio Belgica* was revived, according to the French *Confession* of 1559, and publicly acknowledged; and in 1563 the church system was similarly arranged. In 1572, however, in the northern provinces alone, which had been chiefly Lutheran or Melanchthonian, serious schisms took place. The invasion of Alva of course destroyed all Protestant order, and it was not until the Union of Utrecht in 1579 that the exiled Presbyterians returned. Previous to this, however, in 1574, the first provincial synod of Holland and Zealand had been held; but William of Orange would not allow any action to be taken independently of the state. The Reformed churches had established themselves in independence of the state when that state was Catholic; when the Government became Protestant the church had protection, and at the same time became dependent: it was a state church. The independence of the church was not consistent with that of the communes and provinces, each of which by the Union of Utrecht had the regulation of its own religion. Thus the history of the church is one of constant conflict. Both church and state were divided, the former into Zwinglian and Calvinist, the latter into those who desired and those who refused a non-Erastian church. In most cases it was insisted on as necessary that church *discipline* should remain with the local authority. In 1576 William, with the support of Holland, Zealand, and their allies, put forth forty articles, by which doctors, elders, and deacons were recognized and church discipline given to the elders, with appeal to the magistrate, but which placed the church in absolute dependence on the state. These articles, however, never came into operation; and the decisions of the synod of Dort in 1578, which made the church independent, were equally fruitless. In 1581 the Middleburg synod divided the church, created provincial synods and presbyteries, but could not shake off the civil power in connection with the choice of church officers. Thus, although Presbyterian congregations remained the rule, the civil Government retained overwhelming influence. As the Leyden magistrates said in 1581, "If we accept everything determined upon in the synods, we shall end by being vassals of the synod. We will not open to churchmen a door for a new mastership over Government and subjects, wife and child."

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[1] See Borrel for this and for a most interesting account of the action of the consistory of Nimes in 1663.

[2] For Presbyterianism in France, see De Félice, *Hist. des Protestants de France*; Aymon, *Synodes Nationaux des Églises de Réformées de France*; Borrel, *Hist. de l'Église Réformée de Nîmes*; Bèze, *Hist. Ecclésiastique*; Weber, *Geschichtliche Darstellung*, etc.; Coquerel, *Hist. des Églises du Désert*; Vincent, *Vue sur le Protestantisme en France*; Buckle, *History*.

The contest between Zwinglian and Calvinist came to a decision at the synod of Dort, 1618. Arminius, on the one hand, inveighed against church autonomy as a new popedom; Gomarus defended it. The oligarchy supported Arminius; the democratic party, headed by the stadtholders, held with the Calvinists. The question at first was whether synods should be provincial or general. The independent provinces were naturally for provincial synods, as Arminius wished, the states-general for a national synod. The synod of Dort, wherein were represented all Reformed churches, decided against Arminius. When that was settled, the church system, as laid down in 1586 at the synod of The Hague (called by the earl of Leicester), and including general synods, was confirmed. This, however, was accepted only in Utrecht and Guelders; and from 1619 to 1795 there were seven church republics with more or less state interference. The synodal form predominated, except in Zealand, and the Presbyterian form also, except in a few congregations which did not choose elders. As a rule elders held office for only two years. The "kerke raad," or kirk session, met weekly, the magistrate being a member *ex officio*. The colloque consisted of one minister and one elder from each congregation. At the annual provincial synod, held by consent of the states, two ministers and one elder attended from each colloque. Every congregation was annually visited by ministers appointed by the provincial synod. The old controversy broke out again in the middle of the 17th century, Johann Cocceius and Gisbert Voet being the Arminian and Calvinist champions. The state made good its power in every case.

In 1795, of course, everything was upset; and it was not until after the restoration of the Netherland states that a new organization in 1816 was formed. Its main features were that it was strictly synodal, with a national synod, and Presbyterian. But the minister was greatly superior to the elder, and the state had wide powers, especially in the nomination of higher officers. In 1827 a new organ was brought into play, viz., a permanent commission of the general synod, consisting of seven members, chosen by the king from twice their number nominated by the synod, meeting twice a year. This was revived in 1847. In 1851 the system now in force was formed. In every congregation sufficiently large there is a church council of all the officers. In large congregations with three or more ministers the ministers and elders alone form one college, the deacons another. The congregation chooses all officers. There are 43 presbyteries in 10 provincial districts; in 1850 there were 1273 congregations with 1508 ministers and over 1,500,000 people. The special provincial synod (1619–1795) has ceased. In its place is the provincial authority of as many ministers as presbyteries in the province; it chooses its own president. It meets three times a year, and has general superintendence, with power of examining, placing, and deposing ministers. A general synod meets at The Hague every July; the ten provincial authorities send each one minister and three elders, chosen by each of those authorities in turn, and a deputy from each of the three theological colleges of Leyden, Utrecht, and Groningen. The commissions for the Walloon, East and West Indian, and Limburg churches also send each a representative. The permanent commission is chosen by the synod itself, and altogether the church is independent of the state.

Rhine provinces.

Rhine Provinces.—In the Palatinate the spirit of the Presbyterian organization, though not the thing itself, had been active since the middle of the 16th century; and in 1568 Wither of Heidelberg, an Englishman, urged the establishment of the eldership. In 1570 Frederick III. established a church college in every congregation. Elders were for life. Besides the college or kirk session there was the church council in Heidelberg, consisting of three theologians and three laymen; one of the latter presided. These were all nominated by the Government. Between the church council and the various colleges were superintendents or inspectors. Finally there were synods, provincial and general, of ministers only. This arrangement was a compromise between the Lutheran and Presbyterian systems. From 1576 to 1583, after Frederick's death, the system was again Lutheran, but was made Presbyterian once more by John Casimir, tutor to Frederick IV., and so it remained. The churches of the lower Rhine were formed at first entirely by foreign refugees. Walloons fled from Charles V.'s persecution in 1545, and again in 1553–54. In 1564 the Heidelberg catechism was introduced. Thousands of Protestants were driven hither by Alva in 1567–68, and in the latter year a synod was held at Wesel of forty-six preachers and elders from twenty Netherland churches. The Presbyterian system was now fully introduced. For the election of ministers and elders, until synods could be regularly established, twice as many were to be nominated as were wanted, and then the congregation was to choose by individual voting. A "collegium prophetarum" was to be formed of all the officers and learned laymen for Bible exposition every week or fortnight. In 1571 the synod of Emden determined that half the elders and deacons were to give up office every year, but might be re-elected. Readers, on the Scottish plan, were appointed, and entire parity among all the church officers and the congregation insisted on. The synods are as in France, the members of the general synod being chosen from the provincial synod. The system was in fact partly French and partly Scottish. The congregations were in three divisions—(1) Germany and East Friesland, (2) Netherlands, (3) England. In 1586 a synod was held at Nassau, and the system was partially introduced in Westphalia in 1588; in general, however, in Lutheran countries Presbyterianism made but little way against the consistories. Its prevalence in Germany generally was too partial and obscure, and it partook too much of the consistorial character, to require notice here.

Poland.

Poland, etc.—The Polish nobility and all of Slav blood accepted the "Reformed" doctrine and discipline, the aristocratic republican system suiting the national polity. The German element, however, retained Lutheran sympathies. The first synod was held at Pinkzow in 1550; from 1556 John Lasky worked in the interests of Calvinism; in 1570 all parties were united at the synod of Sandomir. By this a common confession was agreed to, but church government was left to be settled by each church. Another general synod was held at Cracow in 1573. In spite of the earnest endeavors of the church leaders, it was found impossible to introduce stringent discipline in the congregations; on the synodal side, however, the system flourished, and the nobles were able to convert the synods into new aristocratic assemblies. It must be remembered that the Reformation was confined to the nobility, the serfs being neglected. Many of the nobles relapsed to Romanism; this and internal divisions weakened the Reformed cause. In 1634 a synod was held to meet the taunt of the Catholics that no two churches had the same system. From 1655, when the Swedes were in Poland, the influence of synods practically ceased.

Bohemian Brethren.

The Bohemian Brethren were known of in 1450; in their statutes (1457) discipline, entirely managed by the whole congregation, had an important place; in the 16th century it was specialized, elders being chosen to act with the minister. After the Schmalkald War in 1544 the Brethren were driven to Prussia and Poland. During the 16th century they developed rapidly: their system, sanctioned in 1609, had many peculiarities; it placed, for instance, the supervision of the women with female elders. In 1630 they printed at Lissa their *Ratio disciplinæ ordinisque.* The Thirty Years' War destroyed them, except in Great Poland, where they were led by Comenius. Just as different civil governments—*e. g.*, monarchical, aristocratic, democratic—suited different peoples, he said, so it was with religious governments, *e. g.*, Episcopal, Consistorial, Presbyterian. Let all three be welded into one, and we shall have unity from the first, association from the second, propagation from the third. Accordingly their system was a combined one of Episcopacy, consistories, and synods.

Hungary.

In Hungary up to 1550 the Lutherans were supreme; but in 1557 the Calvinists had the majority, and their system was accepted in its entirety in 1558. The race division here also decided the ecclesiastical system. All of German blood in Hungary and Transylvania remained true to Lutheranism, whilst the Magyars and Slavs accepted Calvinism. Continual contests with both Unitarians and Jesuits prevented the free development of Presbyterianism; hence it was confined to the synodal side, and the synods, in which the nobles had special rights, were entirely clerical.

Waldenses.

In 1689 the Waldenses introduced Presbyterianism of a peculiar type. The consistory was the civil authority as well as the church authority. For choice of elders each urban district chose three laymen, from whom the consistory chose the district elders for supervision of manners and of the poor. The consistory itself was subject to a church council, consisting of three spiritual and two lay members, which had supreme authority, especially when no synod was sitting. Synods were called by consent of the congregations and of the king. Two laymen were present for each ecclesiastic. (O. A.)

UNITED STATES.

Presbyterianism in the United States is a reproduction and further development of Presbyterianism in Europe. It differs from the latter in that the various types produced in Great Britain and on the continent of Europe combined to produce a new American type.

Colonial period.

1. *The Colonial Period.*—The earliest Presbyterian emigration consisted of French Huguenots under the auspices of Admiral Coligny, led by Ribault in 1562 to the Carolinas and in 1565 to Florida. But the former enterprise was soon abandoned, and the colonists of the latter were massacred by the Spaniards. The Huguenots also settled in Nova Scotia in 1604 under De Monts. The later Huguenot colonists mingled with the Dutch in New York and with the British Presbyterians and Episcopalians in New England and the Carolinas. A Huguenot church was formed on Staten Island, New York, in 1665; in New York city in 1683: at Charleston, South Carolina, in 1686; at Boston, Massachusetts, in 1687; at New Rochelle, New York, in 1688; and at other places. The Charleston church alone maintains its independence at present.

English Puritanism emigrated under the auspices of the Virginia Company to the Bermudas in 1612. In 1617 a Presbyterian church, governed by ministers and four elders, was established by Lewis Hughes, and the liturgy of the isles of Guernsey and Jersey was used. From 1620 onwards English Puritanism colonized New England. This was of the two types which developed from the discussions of the Westminister Assembly (1643–48) into Presbyterianism and Congregationalism. They co-operated in New England as they did in Old England in the county associations. The Plymouth colony was more of the Congregational type, the Massachusetts Bay colony more of the Presbyterian type. A mixed system was produced which has been happily called by Henry M. Dexter "a Congregationalized Presbyterianism or a Presbyterianized Congregationalism . . . which was essentially Genevan within the local congregation and essentially other outside of it." Presbyterianism was stronger in Connecticut than in Massachusetts. Thence it crossed the borders into the Dutch settlements on the Hudson and the Delaware, and mingled with other elements in Virginia, Maryland and the Carolinas. Nine of these Puritan Presbyterian churches were established on Long Island, New York, from 1641 to 1670, and three in Westchester county, New York, from 1677 to 1685. In New York city Francis Doughty in 1643 ministered to a congregation of Puritan Presbyterians, and was succeeded by Richard Denton in 1650. Francis Doughty also preached in Virginia and Maryland from 1650 to 1659, and was followed by Matthew Hill in 1667 and others subsequently. Francis Doughty was the father of British Presbyterianism in the middle colonies, but he left it in an unorganized condition.

Dutch Presbyterianism was planted in New Amsterdam, New York, in 1628, when the first Reformed Dutch church was organized by Jonas Michaelius with two elders and fifty communicants. This had a strong Huguenot and Walloon representation. Services were held in the Dutch and the French languages, and subsequently in the English language also. The Dutch churches spread along the valleys of the Hudson, the Mohawk, the Raritan and the Passaic, and also on the Delaware. They continued in subordination to the classis of Amsterdam, Holland, until 1747.

Irish Presbyterianism was carried to America by an unknown Irish minister in 1668, by William Traill in 1683, and especially by Francis Makemie in the same year, an ordained missionary of the presbytery of Laggan, who was invited to minister to the Maryland and Virginia Presbyterians. He was a merchant and a man of executive ability, and was the chief instrument in establishing the presbytery of Philadelphia, and interesting the Presbyterians of London, Dublin and Glasgow in the feeble state of their church in America. In 1704 he obtained aid from the London ministers and returned to America with two ordained missionaries, John Hampton (Irish) and George Macnish (Scotch).

Presbytery of Philadelphia.

Meanwhile the New England ministers had sent several missionaries to the banks of the Delaware: Benjamin Woodbridge and Jedidiah Andrews went to Philadelphia in 1698–1700; John Wilson became pastor of a Presbyterian church at New Castle, Delaware, in 1698; Samuel Davis and Nathaniel Taylor supplied other churches in the vicinity. Seven of these ministers organized the presbytery of Philadelphia in 1706. It was a meeting of members for ministerial exercise "to consult the most proper measures for advancing religion and propagating Christianity." The presbytery only gradually learned to exercise oversight over the churches. The ministers constituting it were from many lands and of many types of Presbyterianism, and could agree only in a loosely organized body. During the existence of the original presbytery the chief sources of support were London, Glasgow and Dublin in the United kingdom, and Boston, Massachusetts, and Fairfield county, Connecticut, in New England. Its Presbyterianism was of the broad, tolerant type that we might expect from a happy union of English, Irish, Scottish and Welsh Presbyterians, with a few

Dutch, Germans and French. In 1716 the presbytery divided itself into four "subordinate meetings, or presbyteries," after the Irish model, and increased its number by a large accession of Puritan churches and ministers from eastern New Jersey and New York.

The synod remained without a constitution and without subscription until 1729. It assumed the functions of Presbyterian government and discipline only gradually, as circumstances required. It developed naturally from its own inherent vitality, and adapted itself to the circumstances of the New World without anxiety as to its conformity to stereotyped models in the Old World. However, two parties developed with the growth of the church. The stricter section urged the adoption of the Westminster standards and conformity thereto; the broader party were unwilling to sacrifice their liberty. The former followed the model of the Church of Scotland; the liberal party sympathized with the London and Dublin Presbyterians. The result of the conflict was union under the Act of 1729, which adopted the Westminster symbols "as being, in all the essential and necessary articles, good forms of sound words and systems of Christian doctrine." It allowed scruples as to "articles not essential and necessary in doctrine, worship or government." The presbytery was to judge in the case and not the subscriber. This Adopting Act (largely influenced by the Irish pacific articles of 1720) established the American Presbyterian Church on a broad generous basis; but the happy union was brief. In 1730 the stricter party in the presbyteries of Newcastle and Donegal insisted on full subscription, and in 1736, in a minority synod, carried a deliverance interpreting the Adopting Act according to their own views. The liberal men paid no attention to it, except to put themselves on guard against the plotting of the other side. Friction was increased by a contest between Gilbert Tennent and his friends, who favored Whitefield and his revival measures, and Robert Cross and his friends, who opposed them. The Tennents erected the Log College to educate candidates for the ministry; and the synod passed an arbitrary Act, aimed at the Log College, that all students not educated in the colleges of New England or Great Britain should be examined by a committee of synod, thus depriving the presbyteries of the right of determining in the case. The presbytery of New Brunswick declined to yield, and the body became more and more divided in sentiment. The Cross party charged the Tennents with heresy and disorder; the Tennents charged their opponents with ungodliness and tyranny. Passions were deeply stirred when the synod met in 1741. The moderate men remained away. The Cross party brought in a protestation to the effect that the Tennent party were no longer members of the synod; and thus the synod suddenly broke in two. The New York presbytery declined at first to unite with either party, and endeavored to bring about a union, but in vain. The Tennent party were found at length to be more reasonable, and the New York presbytery combined with them in establishing the synod of New York, which was called the New Side in contradistinction to the synod of Philadelphia, which was called the Old Side.

New Side and Old Side.

During the separation the New Side established Nassau Hall at Elizabethtown in 1746, and the Log College of the Tennents was merged into it. It was removed to Princeton in 1755,[1] large funds being received from England, Ireland and Scotland in its aid. Thus the Presbyterians of Great Britain showed their sympathy with the broad and tolerant Presbyterians of the synod of New York; and the college at Princeton was based upon the pledges of Davies and Tennent as to liberal subscription in terms of the original Adopting Act. The Old Side adopted the academy at New London, which had been organized by Francis Alison in 1741, as their own. Thus each side gained an important institution of learning. The division continued until 1758. During this period the synod of Philadelphia decreased from twenty-six ministers to twenty-two, whereas the synod of New York increased from twenty to seventy-two. The New Side reaped all the fruits of the wonderful revival that spread over the colonies under the influence of Whitefield and his successors. The barriers to union were the different views as to subscription and discipline, and the arbitrary act of excision; but they were after a while happily removed, and the Adopting Act was re-established in its original breadth as the foundation of the reunited church. The reunion was signalized by the formation of the presbytery of Hanover in Virginia. The synod increased with great rapidity, by the reception of new ministers, new churches, and also entire presbyteries, until the outbreak of the Revolution and the close of the colonial period, when the synod numbered 11 presbyteries and 132 ministers.

The synod of New York and Philadelphia embraced only a portion of the Presbyterian ministers of the middle colonies. In the Carolinas Presbyterianism had an independent development. There was a considerable Scottish emigration between 1684 and 1687. William Dunlop ministered to them until 1688, when he returned to become principal of the university of Glasgow. A mixed congregation of English Puritans and Scottish Presbyterians was organized at Charleston in 1690. In 1710 there were five churches, which combined to form the presbytery of James Island in 1722–23. This presbytery went through the same struggle with reference to subscriptions as the synod of Philadelphia, and the parties separated in 1731 into subscribers and non-subscribers.

In 1718 Irish Presbyterianism from Ulster established itself at Londonderry in New England. The church at Londonderry grew into a presbytery in 1726–29, including the Huguenot church of Boston. A second presbytery was organized at Salem in 1745. The original presbytery became extinct owing to internal strife in 1765; but the presbytery of Salem grew into the synod of New England, 31st May, 1775, composed of three presbyteries and sixteen ministers. Besides this synod the presbytery of the Eastward was organized at Boothbay, Maine, in 1771 and remained independent. A presbytery of the Puritan type was organized at Grafton, New Hampshire, and continued from 1776 to 1796 independent of other presbyteries.

The Scottish Presbyterians from the established church combined with the American Presbyterian Church, but the separating churches of Scotland organized independent bodies. The Reformed Presbyterian Church ("Covenanters") sent Cuthbertson in 1751 (or 1752); he was joined by Lind and Dobbin from the Reformed presbytery of Ireland in 1774, and they organized an American Reformed presbytery. The Anti-Burgher synod sent Alexander Gellatly and Andrew Arnot in 1752, and they organized the Associate presbytery of Pennsylvania in 1754; they were joined by the Scotch Church in New York city in 1757, a split from the American Presbyterian Church; they had grown to two presbyteries and thirteen ministers in 1776. The Burgher synod sent Telfair and Clark in 1764; the latter settled at Salem, New York; they united with the Associate presbytery of Pennsylvania.

Dutch Presbyterianism in 1747 formed a cœtus which grew into a classis in 1755 independent of the classis of Amsterdam. A minority adhered to the mother classis and organized under its supervision a conference which grew into an assembly in 1764. In 1770 Queen's (now Rutgers) College was organized at New Brunswick, New Jersey. A union of the two parties was accomplished through the efforts of Dr. J. H. Livingston in 1772, and a synod of five classes was organized, of 100 churches and 34 ministers. At the outbreak of the Revolution they numbered 44 ministers and 105 churches.

German Presbyterians began to emigrate into Pennsylvania in 1684, but not in large numbers until 1709, when a tide of emigration set in from the Palatinate and Switzerland. These attached themselves to the Dutch churches, but, where such did not exist, they organized churches of their own. In accordance with the advice of the German mother churches, in 1730 they put themselves under the care of the classis of Amsterdam, Holland. In 1747 the German churches organized a cœtus under the influence of Schlatter, who had found forty-six churches scattered over a wide region in Pennsylvania, but only four ordained ministers. He acted as general superintendent and was very efficient. He sought aid from all quarters, but this excited internal jealousies and controversies. At the outbreak of the Revolution it is estimated that the German churches numbered twenty-five ministers and sixty churches.

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[1] [Nassau Hall was erected in 1756. College transferred thither from Newark on the death of Pres. Burr in 1757.—Am. Ed.]

The classis of Amsterdam had a magnificent opportunity at the opening of the 18th century. The Dutch, German, and French churches in America were under its care. If it had organized them into classes and a synod at an early date the Reformed Church of America would have been the strongest Presbyterian body in the country, but by keeping them in pupilage it separated the various nationalities and prevented closer union with British Presbyterians. The strength of Presbyterianism in the colonies which became the United States of America may be estimated at the close of the period as 3 synods, 20 presbyteries, 5 classes, 1 cœtus, and 260 ministers. The synod of New York and Philadelphia was a trifle stronger than all the others combined.

From the Revolution to the Civil War.

2. *From the Revolution to the Civil War.*—During the war of the Revolution the Presbyterians churches suffered severely. The ministers and people, with scarcely an exception entered upon the struggle for constitutional liberty with all their souls. The Presbyterian Church was the church of constitutional government and orderly liberty. The Presbyterians exerted great influence in the construction of the constitution of the United States, and the government of the church was assimilated in no slight degree to the civil government of the country.

At the close of the war the Presbyterian bodies began at once to reconstruct themselves on more solid bases. In 1782 the presbyteries of the Associate and Reformed Churches united and formed the Associate reformed synod of North America. But there were a few dissenters in both bodies, so that the older Associate and Reformed presbyteries were still continued. The Associate presbytery of two members, Marshall and Clarkson, continued to exist until 1801, when it was subdivided and became the Associate synod of North America. In 1798 the Reformed presbytery of North America was reconstituted by M'Kenney and Gibson from Ireland; it grew into a synod of three presbyteries in 1809, and in 1823 into a general synod. In 1781 the Dutch Reformed organized themselves into a synod and classes. In 1784 they founded a theological seminary, which was settled at New Brunswick, and in 1792 adopted a constitution with general synod, particular synods, and classes. In 1792 the German Reformed declared themselves independent of the classis of Amsterdam, and adopted a constitution in 1793 having 150 churches and 22 ministers.

In 1785 the synod of New York and Philadephia took steps for the organization of a general assembly and also with a view to the union of all the Presbyterian bodies into one. In 1789 the synod resolved itself into a general assembly of four synods, which, after revising the chapters relating to church and state, adopted the Westminster symbols as their constitution, "as containing the system of doctrine taught in the Holy Scriptures," and they made them unalterable without the consent of two-thirds of the presbyteries and the general assembly. In 1798 another effort was made for union with the Reformed Dutch and the Associate Reformed, which failed. Three years afterwards a plan of union with the general association of Connecticut was agreed upon by the general assembly, and the work of home missions in the western section of the country was prosecuted jointly. The result was mixed churches in western New York and the new States west of the Allegheny Mountains, which grew into presbyteries and synods having peculiar features midway between Presbyterianism and Congregationalism.

Cumberland Presbytery.

The revivals in Kentucky brought about differences which resulted in the high-handed exclusion of the revivalists. These formed themselves into the presbytery of Cumberland, 4th February, 1810, which grew in three years into a synod of three presbyteries. In 1813 they revised the Westminster confession and excluded, as they claimed, fatalism and infant damnation. If they had appealed to the general assembly they might have received justice, or possibly the separation might have been on a larger scale. In 1822, under the influence of John M. Mason, the Associate Reformed synod combined with the general assembly of the Presbyterian Church, but the majority was too slender to make the union thorough. The greater part of the ministers decided to remain separate, and accordingly three independent synods were organized—New York, Scioto, and the Carolinas. In 1858 the Associate synods of the north and west united with the Associate synod as the United Presbyterian Church. In 1833 the Reformed Presbyterian Church divided into New Lights and Old Lights in a dispute as to the propriety of Covenanters exercising the rights of citizenship under the constitution of the United States.

Period of revivals.

A great and widespread revival marked the opening years of the century, resulting in marvellous increase of zeal and numbers in the churches. New measures were adopted, doctrines were adapted to the times and occasions, and ancient disputes were revived between the conservative and progressive forces. Theological seminaries had been organized at Princeton in 1812, at Auburn in 1820, at Hampden Sydney in 1824, Allegheny in 1827, Columbia in 1828, Cincinnati in 1829, and Union Seminary, New York, in 1836. Differences in doctrine as well as polity and discipline became more and more prominent. Puritan theology had developed in New England into Edwardism, and then into Hopkinsianism, Emmonsism, and Taylorism. A new theology had sprung up which was held to be an improvement and adaptation of Calvinism to modern thought. This new theology had entered the Presbyterian Church in the form of a milder Calvinism, which was represented to be more in accordance with the original type. On the other side the scholastic type of Calvinism, as represented by François Turretin and the Zurich *Consensus*, was insisted on as the true orthodoxy. The doctrinal differenc[illegible]me to a head in the trials of Albert Barnes, Ge[illegible]e Duffield, and Lyman Beecher, which, however, [illegible]sulted in the acquittal of the divines, but increased friction and ill-feeling. The differences developed were chiefly between general atonement and atonement for the elect only and between mediate imputation and immediate imputation. But there was a middle party which regarded these differences as forced, and held that the rival views were alike inadequate if taken alone and that they were really complementary.

Old and New Side.

The agitation with reference to African slavery threw the bulk of the Southern Presbyterians on the Old Side, which was further strengthened by the accession of the Associate Reformed. The ancient differences between Old and New Side were revived, and once more it was urged that there should be (1) strict subscription, (2) exclusion of the Congregationalized churches, and strict Presbyterian polity and discipline, (3) the condemnation and exclusion of the new divinity and the maintenance of scholastic orthodoxy. In 1834 a convention of the Old Side was held in Philadelphia, and the "Act and Testimony" was adopted charging doctrinal unsoundness and neglect of discipline upon the New Side, and urging that these should be excluded from the church. The moderate men on both sides opposed this action, and strove for peace or an amicable separation, but in vain. In 1837 the Old Side obtained the majority in the general assembly for the second time only in seven years. They seized their opportunity and abrogated the "Plan of Union," cut off the synod of Western Reserve, and then the synods of Utica, Geneva, and Genesee, four entire synods, without a trial, and dissolved the third presbytery of Philadelphia without providing for the standing of its ministers. This revolutionary proceeding brought about the second great rupture in the Presbyterian Church. The New Side men met in convention at Auburn in August, 1837, and adopted measures for resisting the wrong. In the general assembly of 1838 the moderator refused to recognize the commissioners of the four exscinded synods. An appeal was made to the assembly and the moderator's decision reversed. A new moderator was chosen, while the assembly adjourned to another place of meeting. The Old Side remained after the adjournment and organized themselves, claiming the historic succession. Having the moderator and clerks from the assembly of 1837, they retained the books and papers. Thus two general assemblies were organized, the Old and the New School. An appeal was made to the civil courts, which decided in favor of the New School; but this decision was overruled on a technical point of law by the court in banc and a new trial ordered. It was deemed best, however, to cease litigation and to leave matters as they were.

Several years of confusion followed. In 1840 we have the first safe basis for comparison of strength.

	Ministers.	Churches.	Communicants.
Old Side	1308	1898	126,583
New Side	1234	1375	102,060

The churches remained separate throughout the remainder of this period. The North was especially agitated by the slavery question, and the anti-slavery element became so strong that the Southern synods of the New School assembly felt constrained to withdraw in 1858. They organized the United Synod of 4 synods, 15 presbyteries, 113 ministers, 197 churches, 10,205 communicants. Just before the outbreak of the Civil War in 1861 these churches numbered:

	Synods.	Presbyteries.	Ministers.	Churches.	Communicants.
Old Side	33	171	2656	3581	292,927 (1860)
New Side	22	104	1523	1482	134,933 (1860)
United Synod..	4	15	113	197	10,205 (1858)
Cumberland Presbyterian	23	96	890	1189	82,008 (1859)

The several branches of the Scottish separating churches continued to grow independently until the year 1858, when the United Presbyterian Church was formed by a union of three synods—one of the Associate and two of the Associate Reformed Churches.

	Presbyteries.	Ministers.	Churches.	Communicants.	Theological Seminaries.
Associate ...	21	197	293	23,505	1
Associate Reformed (4 synods)	28	225	383	32,118	3
(5 synods)	49	422	676	55,623	4

The Dutch Reformed increased, though not without slight internal struggles; in 1822 there was a secession of thirteen ministers. The name "Dutch" was dropped in 1867 because it was found hurtful to the progress of the denomination. At the outbreak of the Civil War they numbered 1 general synod, 3 particular synods, 31 classes, 387 ministers, 370 churches, 50,427 communicants.

The German Reformed in 1816 improved their organization. In 1819 the constitution was revised and the church divided into synods and classes. In 1824 they were divided into two independent synods. In the next year they established a theological seminary at Carlisle, which was removed to Mercersburg, and finally to Lancaster (all in Pennsylvania). This institution became the centre of the liturgical party in the church. The Ohio synod established Heidelberg College in 1850. At the outbreak of the Civil War this denomination numbered 2 synods, 24 classes, 391 ministers, 1045 churches, 92,684 communicants.

In 1826 the first Calvinistic Methodist Church in America was organized in Oneida county, New York, and a presbytery was constituted a few years afterwards. This little denomination which is in entire sympathy with other Presbyterian bodies, is composed almost exclusively of Welshmen, who have settled in communities by themselves.

3. *From the Civil War to* 1885.—The Civil War in separating the people of the North from the people of the South also brought about a separation of churches. Some of the breaches have been healed, others remain until now.

Period since the Civil War.

In 1861 the Southern section of the Presbyterian Church withdrew from the Northern and organized the general assembly of the Presbyterian Church in the Confederate States of America, with 11 synods, 47 presbyteries, about 700 ministers, 1000 churches and 75,000 communicants. In 1865 this body united with the United Synod of the South, and increased its strength by 120 ministers, 190 churches, and 12,000 communicants. After the close of the war, the name of the denomination was changed to "the Presbyterian Church in the United States." In 1867 this church was joined by the presbytery of Patapsco, in 1869 by the synod of Kentucky, and in 1874 by the synod of Missouri, all of which had separated from the Northern church.

The war also united the Northern churches more closely together, and there was an increasing desire for organic union. An effort was made to combine all the Presbyterian bodies of the North in 1867, but in vain. In 1869, however, the Old and New School churches of the North combined on the basis of the common standards. A memorial fund of $7,883,983 was raised, and the church entered with renewed strength upon a fresh career of usefulness. An effort to unite the Dutch and German Reformed Churches failed, as also the effort to combine the Presbyterian Churches of the North and the South. The German Reformed synods in 1863 united in a general synod with 26 classes, 447 ministers, and 98,775 communicants. Ursinus college was founded by it in 1869. All branches of Presbyterians have increased with the growth of the United States The present strength of the churches is shown in the table on next page.

The American Presbyterian churches have always been marked by a zeal for missions. John Eliot, the apostle to the Indians in New England, was a Puritan Presbyterian. The synod of New York carried on mission work among the Indians through David Brainerd and others, with the help of the Society in Scotland for the Promotion of Christian Knowledge. The Presbyterian churches generally co-operated with the Congregationalists in the work of the American Board of Commissioners for Foreign Missions, established in 1710, until 1832, when the Reformed Church in America set the example of organizing a denominational board. Each denomination now has its board

	General Assemblies.	Synods.	Presbyteries.	Ministers.	Churches.	Communicants.	Theological Seminaries.
Presbyterian Church in U. S. A.	1	23	182	5,218	5,858	600,695	12
Presbyterian Church in U. S.	1	18	67	1,070	2,040	127,017	2
Cumberland Presbyterian Church	1	27	116	1,439	2,591	130,000	1
United Presbyterian Ch.	1	9	60	730	839	85,443	3
Reformed Presbyterian Church, N. A.	...	1	6	37	48	6,700	1
Reformed Presbyterian Church, U. S. A.	...	1	11	112	124	10,625	1
Associated Reformed Ch. of the South	...	1	8	79	72	6,648	1
Reformed Ch. in America	1[1]	4	34[2]	569	516	80,156	2
Reformed Ch. in U. S. A.	1[1]	7	52[2]	783	1,465	169,580	3
Calvinistic Methodist	1	6	16	84	175	9,563	...
Totals	...	92	552	10,121	13,728	1,226,377	26

of missions. The summary of missionary operations, as reported to the council of the Reformed churches holding the Presbyterian system which met at Belfast in June, 1884, was 230 ordained missionaries, 25 male lay agents, and 359 female, all sent out by the societies. These were aided by 138 ordained converts, and 1115 other agents from among the converts, and there was a total of 25,235 communicants and 29,060 day-school pupils. The work of home missions is equally extensive, and is especially important in the United States, where the church has to attend to the wants of an immense population constantly flowing from Europe, and the natural increase of population in the country itself also enlarges the older towns and States and creates new ones with astonishing rapidity.

The tendency of Presbyterianism in the United States is to adapt itself to the circumstances of the country. The divisions are chiefly the result of differences of nationality, and traditional doctrines and modes of worship brought by the immigrants from the countries of Europe. These are gradually wearing off and the churches are assimilating themselves to the country and its institutions, and thus are growing close together. We may expect at no very distant date a combination of them all into one organism.

The chief authorities for the study of American Presbyterianism are—Charles Hodge, *Constitutional History of the Presbyterian Church in the United States of America*, 1706–1788 (2 vols., Philadelphia, 1840); *Records of the Presbyterian Church in the U. S. A. from* 1706 *to* 1788 (Philadelphia, 1841); Richard Webster, *History of the Presbyterian Church in America* (Philadelphia, 1857); E. H. Gillette, *History of the Presbyterian Church in the U. S. A.* (2d ed., Philadelphia, 1873); *Presbyterian Reunion* (New York, 1870); E. B. Christman, *Origin and Doctrines of the Cumberland Presbyterian Church* (St. Louis, 1877); E. T. Corwin, *Manual of the Reformed Church in America* (New York, 3d ed., 1879); *Reformation Principles* (Philadelphia, revised ed., 1863); C. A. Briggs, *American Presbyterianism*, New York, 1885.

(C. A. BR.)

PRESCOT, a market-town of Lancashire, is situated on rising ground on the Liverpool and Wigan branch of the London and Northwestern Railway, 8 miles east of Liverpool and 28 west of Manchester. It is of considerable antiquity, and received a grant for a market and fair in the 7th year of Edward III. A church existed in the 13th century. The present edifice, in various styles, with a lofty tower and spire and carved timber roof, underwent extensive restoration in 1875–76. Among the other public buildings are the town-hall (1765) and the market-hall (1859). The chief industry is the making of watch hands and wheels, etc., first introduced in 1730 by John Miller from Yorkshire. Coarse earthenware is also manufactured. The population of the urban sanitary district (area 268 acres) in 1871 was 5990, and in 1881 it was 6419.

PRESCOTT, WILLIAM HICKLING (1796–1859), historian, was born in Salem, Massachusetts, on 4th May, 1796, his ancestors, of the old Puritan stock, having migrated from Lancashire about 1640 and established themselves in Middlesex county, Massachusetts. He received his earlier education in his native city until the removal of his family in 1808 to Boston, where he was placed under the tuition of Dr. Gardiner, a pupil of Dr. Parr. His school-days appear to have been in the main typical rather than prophetic, though in his passion for mimic warfare and for the narration of original stories some indication of the historical bias may perhaps be discerned. A healthy aversion to persistent work, which even in later years broke at times through his rigorous system of self-discipline, did not hinder him from making a good if somewhat desultory use of his permission to read at the Boston athenæum,—an exceptional advantage at a time when the best books were by no means readily accessible in any part of the United States. He entered Harvard College in the autumn of 1811, therefore, with a fairly thorough mental equipment, but almost at the outset his career was interrupted by an accident which affected the whole subsequent course of his life. A hard piece of bread, flung at random in the Commons Hall, struck his left eye with such force that he fell to the ground; and, though the first shock speedily passed, the sight was irremediably destroyed. He resumed his college work, however, with success in classics and literature, though he abandoned the study of mathematics as one in which he could not attain even an average proficiency. After graduating honorably in 1814 he entered his father's office as a student of law; but in January, 1815, the uninjured eye showed dangerous symptoms of inflammation, which for some time refused to yield to remedies. When at last in the autumn he was in condition to travel, it was determined that he should pass the winter at St. Michael's and in the spring obtain medical advice in Europe. His visit to the Azores, which was constantly broken by confinement to a darkened room, is chiefly noteworthy from the fact that he there began the mental discipline which enabled him to compose and retain in memory long passages for subsequent dictation; and, apart from the gain in culture, his journey to England, France, and Italy (April, 1816 to July, 1817) was scarcely more satisfactory. The verdict of the physicians consulted by him was that the injured eye was hopelessly paralyzed, and that the preservation of the sight of the other depended upon the maintenance of his general health. His further pursuit of the legal profession seemed out of the question, and on his return to Boston he remained quietly at home listening to a great deal of reading, but with no fixed object in view. On 4th May, 1820, he was married to Miss Susan Amory. Prior to his marriage he had made a few experiments in composition which had obtained no further publicity than that of his own circle of friends, but he now finally decided to devote his life to literature. It must be admitted that he had not hitherto displayed any remarkable aptitude; but having once determined his future occupation he set himself strenuously to the task of self-preparation. With almost amusing thoroughness he commenced the study of Murray's *Grammar*, the prefatory matter of Johnson's *Dictionary*, and Blair's *Rhetoric*, reading at the same time for general purposes of style a series of the standard English writers from the period of Elizabeth onwards. A review of Byron's *Letters on Pope* in 1821 constituted his first contribution to the *North American Review*, to which he continued for many years to send the results of his slighter researches. He next turned to French literature, the irksomeness with which he regarded his studies in this subject being mitigated by incursions into the early English drama and ballad literature. Of the direction and quality of his thought at this time he has left indications in his papers on *Essay-Writing* (1822) and on *French and English Tragedy* (1823). In pursuance of his method of successive studies he began in 1823 the study of Italian literature, passing over German as demanding more labor than he could afford; and so strongly did he feel the fascination of the language that for some time he thought of selecting it as his chief sphere of work. In the following year, however, he made his first acquaintance with the literature of Spain under the influence of his friend and biographer, Ticknor, who was then lecturing upon it; and while its attractiveness proved greater than he had at the outset anticipated, the comparative novelty of the subject as a field for research served as an additional stimulus.

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[1] "General Synods."

[2] "Classes."

In the meantime his aims had been gradually concentrating. History had always been a favorite study with him, and Mably's *Observations sur l'Histoire* appears to have had considerable influence in determining him to the choice of some special period for historic research. The selection, however, was not finally made without prolonged hesitation. The project of a history of Italian literature held a prominent place in his thought and found some tentative expression in his article on *Italian Narrative Poetry* (1824) and in the reply to Da Ponte's criticism (1825); but he had also in contemplation a history of the revolution which converted republican Rome into a monarchy, a series of biographical and critical sketches of eminent men, and a Spanish history from the invasion of the Arabs to the consolidation of the monarchy under Charles V. It was not till the 19th of January, 1826, that he recorded in the private memoranda begun by him in 1820 his decision "to embrace the gift of the Spanish subject." The choice was certainly a bold one. On the one hand, he had no great liking for, if he had not, as he alleged, an absolute detestation of the investigation of latent and barren antiquities, while, on the other, he had not the visual power which others besides Milton have deemed indispensable to an historian. The first he might and did overcome, but the second seemed likely to prove a permanent disqualification. He could only use the eye which remained to him for brief and intermittent periods, and as travelling affected his sight prejudicially he could not anticipate any personal research amongst unpublished records and historic scenes. He was happy, however, in the possession both of ample means and admirable friends to supply so far as might be the necessary materials, and of a wide leisure in which to give them literary shape and polish; and he sketched with no undue restriction or hesitancy the plan of the *History of the Reign of Ferdinand and Isabella*—his first great work. Mr. English, one of his secretaries, has furnished a picture of him at this period seated in a study lined on two sides with books and darkened by green screens and curtains of blue muslin, which required readjustment with almost every cloud that passed across the sky. His writing apparatus—a noctograph—lay before him, and he kept his ivory style in his hand to jot down notes as the reading progressed. In accordance with his general method these notes were in turn read over to him until he had completely mastered them, when they were worked up in his memory to their final shape. So proficient did he become that he was able to retain the equivalent of sixty pages of printed matter in his memory, turning and returning them as he walked or drove. The rate of progress in preparation was therefore necessarily slow, apart from any liability to interruption by other undertakings and failures in bodily health. He still continued his yearly experimental contributions to the *North American Review*, elaborating them with a view as much to ultimate historical proficiency as to immediate literary effect, the essays on *Scottish Song* (1826), *Novel-Writing* (1827), *Molière* (1828), and Irving's *Granada* (1829) belonging to this preparatory period. The death of his eldest daughter in 1828 also led him aside to the study—afterwards renewed in the interval between the *Ferdinand and Isabella* and the *Conquest of Mexico*—of Christian evidences, with the result that he convinced himself of the fundamental truth of Christianity, though he did not accept all the tenets of orthodoxy. On the 6th of October, 1829, he began the actual work of composition, which was continued without more serious interruptions than those occasioned by the essays on *Asylums for the Blind* (1830), *Poetry and Romance of the Italians* (1831), and *English Literature of the 19th Century* (1832), until 25th June, 1836, when the concluding note was written. Another year, during which his essay on *Cervantes* appeared, was spent in the final revision of the *History* for the press, in which the author was ably assisted by two friends, of whom Gardiner, the son of his old schoolmaster, criticised the style and Folsom verified the facts. Its success upon its publication in Boston was immediate, the five years' contract being discharged in a few months. Arrangements were speedily made for its publication in England, and there its success was not less marked. From the position of an obscure reviewer Prescott suddenly found himself elevated to the first rank of contemporary historians. Daniel Webster spoke of him as a comet which had suddenly blazed out upon the world in full splendor, and American, British, and Continental reviewers were equally laudatory. Its reception determined the nature of all his subsequent work. Hitherto he had still inclined towards the history of literature rather than to that of polity and action, on the ground that the former was more consonant with his previous studies and a more suitable sphere for the display of his special powers. A close examination of his work in the department of literary criticism does not, however, bear out this estimate of his own genius, and the popular voice in approving his narrative faculty gave him the required impetus in the right direction. After coquetting for a short time with the project of a life of Molière he decided to follow in the track of his first work with a *History of the Conquest of Mexico*. Washington Irving, who had already made preparations to occupy the same field, generously withdrew in his favor; and in May, 1838, Prescott began his first reading in the subject. The work was completed in August, 1843, the five years' labor having been broken by the composition of reviews of Lockhart's *Life of Scott* (1838), Kenyon's *Poems* (1839), *Chateaubriand* (1839), Bancroft's *United States* (1841), Mariotti's *Italy* (1842), and Madame Calderon's *Life in Mexico* (1843), and by the preparation of an abridgment of his *Ferdinand and Isabella* in anticipation of its threatened abridgment by another hand. On 6th December, 1843, the *Conquest of Mexico* was published with a success proportionate to the wide reputation won by his previous work, the contracted number being sold off in four months and London and Paris editions meeting with a similar reception. The careful methods of work which he had adopted from the outset had borne admirable fruit. While the consultation of authorities had been no less thorough, his style had become more free and less self-conscious; and the epic qualities of the theme were such as to call forth in the highest degree his powers of picturesque narration. It was only a step from the conquest of Mexico to that of Peru, and scarcely three months elapsed before he began to break ground on the latter subject, though the actual composition was not commenced until the autumn of 1844. While the work was in progress and before the close of the year his father died,—a heavy blow to him, inasmuch as the elder and younger members of the family had continued to share the same home upon almost patriarchal terms, and the breach was therefore in a chain of constant association extending over a period of forty-eight years. In February, 1845, he received the announcement of his election as corresponding member of the French Institute in place of the Spanish historian Navarrete, and also of the Royal Society of Berlin. The winter found him arranging for the publication in England of the selection from his articles and reviews which appeared in 1845 under the title of *Critical and Historical Essays*, and which was issued almost contemporaneously at New York under the title of *Biographical and Critical Miscellanies*. After some minor interruptions—his removal from the old mansion house in Bedford Street to the house in Beacon Street, visits to friends, and a renewed failure of sight—the *Conquest of Peru* was completed in November, 1846, and published in March following. His misgivings as to its reception were at once set at rest, and it was speedily issued in translations into French, Spanish, German, and Dutch, in addition to the English editions of New York, London, and Paris. He was now over fifty and his sight showed serious symptoms of enfeeblement. Although during the composition of the *Ferdinand and Isabella* it had been of very intermittent service to him, it had by his careful regimen so far improved that he could read with a certain amount of regularity during the writing of the *Conquest of Mexico*, and also, though in a less degree, during the years devoted to the *Conquest of Peru*. Now, however, the use of his remaining eye had been reduced to an hour a day, divided into portions at wide intervals, and he was driven to the conclusion that whatever plans he made for future work must be formed on the same calculations as those of a blind man. He had been for many years collecting materials for a history of Philip II., but he hesitated for some time to attempt a work of such magnitude, occupying himself in the meantime with the slighter labors of a memoir of Mr. John Pickering for the Massachusetts Historical Society and the revision of Ticknor's *History of Spanish Literature*. But in March, 1848, he set himself with characteristic courage to the accomplishment of the larger project, though with the intention of writing memoirs rather than a history, as admitting a more rambling style and less elaborate research. He had been fortunate in obtaining the aid of Don Pascual de Gayangos, then professor of Arabic literature at Madrid, by whose offices he was enabled to obtain material not only from the public archives of Spain but from the muniment rooms of the great Spanish families. With an exceptional range of information thus afforded him, he wrote the opening of his history at Nahant, his summer residence, in July, 1849; but, finding himself still unsettled in his work, he decided in the spring of the following year to carry out a long projected visit to England. His reception there was of the most cordial and gratifying kind, and he returned reinvigorated to his work. The idea of writing memoirs was dismissed in favor of the more elaborate form, and in November, 1855, the first two volumes of his uncompleted *History of Philip II.* were issued from the press, their sale eclipsing that of any of his earlier books. This was his last great undertaking; but as Robertson's *Charles V.*, in the light of new sources of information, was inadequate to take its place as a link in the series, he republished it in an improved and extended form in December, 1856. A slight attack of apoplexy on the 4th of February, 1858, foretold the end, though he persevered with the preparation of the third volume of *Philip II.* for the press, and with the emendation and annotation of his *Conquest of Mexico*. On the morning of the 27th of January, 1859, a second attack occurred, and he died in the afternoon of the same day in his sixty-third year.

In personal character Prescott possessed many admirable and amiable qualities, his courageous bearing and persistent labor being by no means without their heroic element, though the greater portion of his life was passed with his friends and his books. A certain habit of striving to be habitual is curiously prominent from his boyhood till his death, the desire for an objective stimulus finding expression in numberless formal resolutions and in frequent wagers with his secretaries or friends. Necessarily a valetudinarian, the smallest details of life had to be considered by him, even to the adjustment of the weight of his dress to the state of the weather and the thermometer. Yet the formalism, whether voluntary or enforced, was never obtrusive, and the final impression made upon his contemporaries was that of a frank, spontaneous, and thoroughly manly life. As an historian he stands in the direct line of literary descent from Robertson, whose influence is clearly discernible both in his method and style. But, while Robertson was in some measure the initiator of a movement, Prescott came to his task when the range of information was incomparably wider and when progress in sociologic theory had thrown innumerable convergent lights upon the progress of events. He worked, therefore, upon more assured ground; his sifting of authorities was more thorough and his method less restricted both in the selection of details and in their graphic presentation. At the same time he cannot be classed as in the highest sense a philosophic historian. His power lies chiefly in the clear grasp of fact, in selection and synthesis, in the vivid narration of incident. For extended analysis he had small liking and faculty; his critical insight is limited in range, and he confines himself almost wholly to the concrete elements of history. When he does venture upon more abstract criticism his standards are often commonplace and superficial, and the world-scheme to which he relates events is less profound than the thought of his time altogether warranted. If these things, however, indicate failure from the point of view of ideal history, they at least make for popularity. Few historians have had in a higher degree that artistic feeling in the broad arrangement of materials which ensures interest. The course of his narrative is unperplexed by doubtful or insoluble problems; no pretence at profundity or subtlety saps the vitality of his characters or interrupts the flow of incident with dissertation and digression. The painting is filled in with primary colors and with a free hand; and any sense of crudity which may be awakened by close inspection is compensated by the vigor and massive effectiveness of the whole. Though he did not bring to his work the highest scientific grasp, he brought to it scientific conscientiousness and thoroughness within his limitations, while his dominant pictorial faculty gave to his treatment a super-scientific brilliancy. The romance of history has seldom had an abler exponent, and the large number of editions and translations of his works attests their undiminished fascination at certain stages of popular culture. (R. M. W.)

PRESCRIPTION in the broadest sense of the word denotes the acquisition or extinction of rights by lapse of time. The term is derived from the *præscriptio* of Roman law, originally a matter of procedure, a clause inserted before the *formula* on behalf of either the plaintiff or, in early times, the defendant, limiting the question at issue. (See Pleading.) It was so called from its preceding the *formula*.[1] One of the defendant's *præscriptiones* was *longi temporis* or *longæ possessionis præscriptio* (afterwards superseded by the *exceptio*), limiting the question to the fact of possession without interruption by the defendant for a certain time (see Possession). It seems to have been introduced by the prætor to meet cases affecting aliens or lands out of Italy where the *usucapio* of the civil law (the original means of curing a defect of title by lapse of time) could not apply. The time of acquisition by *usucapio* was fixed by the Twelve Tables at one year for movables and two years for immovables. *Præscriptio* thus constituted a kind of prætorian *usucapio*. In the time of Justinian *usucapio* and *præscriptio* (called also *longi temporis possessio*), as far as they affected the acquisition of ownership, differed only in name, *usucapio* being looked at from the point of view of property, *præscriptio* from the point of view of pleading. By the legislation of Justinian movables were acquired by three years' possession, immovables by ten years' possession where the parties had their domicile in the same province (*inter præsentes*), twenty years' possession where they were domiciled in different provinces (*inter absentes*). Servitudes could not be acquired by *usucapio* proper, but were said to be acquired by *quasi usucapio* probably in the same time as sufficed to give a title to immovables. There was also a *longissimi temporis possessio* of thirty years, applicable to both movables and immovables, and requiring nothing but *bona fides* on the part of the possessor. Where the right sought to be established was claimed against the church, a still longer period of forty years (at one time a hundred) was necessary. Immemorial prescription was required in a few cases of a public character, as roads.[1] *Præscriptio* was also the term applied to lapse of time as barring actions upon contracts or torts under various provisions corresponding to the English Statutes of Limitation. The prescription of Roman law (and of modern systems based upon it) is thus both acquisitive and extinctive. It looks either to the length of time during which the defendant has been in possession, or to the length of time during which the plaintiff has been out of possession. In English law the latter kind of prescription is called LIMITATION (*q.v.*). The tendency of law is to substitute a definite for an indefinite period of prescription.

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[1] "Præscriptiones autem appellatas esse ab eo quod ante formulas præscribuntur" (Gaius, iv. § 312).

In English law prescription is used in a comparatively narrow sense. It is acquisitive only, and is very limited in its application. A title by prescription can be made only to incorporeal hereditaments—that is, in legal language, hereditaments that are or have been appendant or appurtenant to corporeal hereditaments—and to certain exemptions and privileges.[2] The rights claimable by prescription for the most part consist of rights *in alieno solo*. The most important are advowsons, tithes, commons, ways, watercourses, lights, offices, dignities, franchises, pensions, annuities, and rents. Land or movables cannot be claimed by prescription. The foundation of prescription is the presumption of law that a person found in undisturbed enjoyment of a right did not come into possession by an unlawful act (see Williams, *Rights of Common*, 3). In the English courts this presumption was, perhaps it may be said still is, based upon the fiction of a lost grant, viz., that at some time in the past there had been a grant of the hereditament by a person capable of granting it to a person capable of taking it, and that the grant had been lost. The jury were instructed to find the loss of a once existing grant in whose existence no one really believed. The enjoyment of the right must have been from a time whereof the memory of man runneth not to the contrary. The period of legal memory was after a time necessarily fixed for purposes of convenience at a certain date. The date adopted varied at first with the time during which the demandant in a writ of right must have proved seisin in himself or his ancestors. After one or two previous enactments the date was finally fixed by the Statute of Westminster the First (3 Edw. I. c. 39) at the reign of Richard I., which was interpreted to mean the first year of the reign of Richard I. The inconvenience of this remote date, as time went on, led to the gradual growth of a rule of evidence that proof of enjoyment for twenty years was *prima facie* evidence of enjoyment from time immemorial. But evidence of the beginning of the enjoyment at however remote a date, if subsequent to 1 Richard I., was sufficient to destroy the claim. This is still the law with respect to claims not falling within the Prescription Act, mostly rights in gross—that is, where there is no dominant or servient tenement, *e. g.*, a right to a pew or to a several fishery in gross. The twenty years' rule was of comparatively late introduction ; it does not seem to have been known in the time of Elizabeth and was perhaps introduced in analogy to the Statute of Limitations, 21 Jac. I. c. 16. With respect to claims of profits *à prendre* and easements a change was made by the Prescription Act 2 and 3 Will. IV. c. 71 (extended to Ireland by 21 and 22 Vict. c. 42, but not to Scotland). By that act claims to rights of common and other profits *à prendre* are not to be defeated after thirty years' enjoyment by any person claiming right thereto without interruption for thirty years by showing only the commencement of the right, and after sixty years' enjoyment the right is absolute and indefeasible unless had by consent or agreement by deed or writing (§ 1). In claims of rights of way or other easements the periods are twenty years and forty years respectively (§ 2). The right to access and use of light is absolute and indefeasible by twenty years' enjoyment without interruption unless by consent or agreement by deed or writing (§ 3). The before-mentioned periods are to be deemed those next before suits, and nothing is to be deemed to be an interruption unless acquiesced in for one year (§ 4). In pleading, the enjoyment as of right may be alleged during the period mentioned in the Act, and without claiming in the name or right of the owner of the fee (§ 5). No presumption is to be made in favor of a right exercised for a less period (§ 6). The time during which a person otherwise capable of resisting a claim is an infant, idiot, *non compos mentis*, *femme covert*, or tenant for life, or during which an action or suit has been pending until abated by the death of a party, is to be excluded in the computation of the periods unless where the right or claim is declared to be absolute and indefeasible (§ 7). In the period of forty years a term of life or more than three years is to be excluded in case the claim be resisted by the reversioner within three years after the determination of the term (§ 8). An Act to define the period of prescription for a *modus decimandi*, or an exemption from tithes by composition, was passed the same year (2 and 3 Will. IV. c. 100; see TITHES). The Prescription Act is only supplemental to the common law, so that a claim may be based upon the Act or, in the alternative, upon the common law. Nor does the Act alter the conditions necessary at common law for a good claim by prescription. The claim under the statute must be one which may be lawfully made at common law. The principal rules upon the subject are these. (1) The title is founded upon actual usage. The amount of actual usage and the evidence necessary to prove it vary according to the kind of claim. For instance, in continuous easements (such as a watercourse) the enjoyment may go on without any active interference by the person claiming the right ; in discontinuous easements (such as a right of way) the right is only enjoyed at intermittent periods. (2) The enjoyment must (except in the case of light) be as of right, a rule sometimes expressed by the words *nec vi nec clam nec precario*, derived from Roman law—that is to say, peaceable, openly used and not by license. These words bear a meaning less strict than they did in Roman law. The enjoyment in Roman law must (except in the case of *jus aquæ ducendæ*) have been *ex justo titulo* in order to found *usucapio* or *quasi usucapio* ; in English law there is no doubt that enjoyment may be good by prescription, even though it began in trespass, as a footpath or a rent. (3) The prescription must be certain and reasonable. Examples of claims by prescription which have been held to be bad on this ground are a claim to take out of the land of another as much clay as is required for making bricks at a certain kiln, and a claim to a marriage fee which, though reasonable now, would have been an unreasonable amount to have been paid in the reign of Richard I., looking to the difference in the value of money. Inhabitants cannot claim by prescription, as they are an uncertain and fluctuating body, unless under a grant from the crown, which constitutes them a corporation for the purposes of the grant. (4) The prescription must be alleged in a *que estate* or in a man and his ancestors. Prescription in a *que estate* lies at common law by reason of continuous and immemorial enjoyment by the claimant, a person seised in fee, and all those whose estate he has (*toux ceux que estate il ad*). The Prescription Act fixes a definite period and does away with the necessity which existed at common law of prescribing in the name of the person seised in fee. Prescription in a man and his ancestors is not of ordinary occurrence in practice. "I am not aware of more than two cases in modern times," says Mr. Joshua Williams (*Rights of Common*, 9), "where a prescription of this kind, viz., a prescription of enjoyment by a man and his ancestors, irrespective of the possession of land, has been set up." Corporations, however, occasionally claim by a prescription analogous to this, viz., in the corporation and its predecessors. Such claims by either a person or a corporation are not within the Prescription Act, which applies only where there are dominant and servient tenements. By 32 Henry VIII. c. 2 no person can make any prescription by the seisin or possession of his ancestor unless such seisin or possession has been within threescore years next before such prescription made. (5) A prescription cannot lie for a thing which cannot be granted, as it rests upon the presumption of a lost grant. Thus a lord of a manor cannot prescribe to raise a tax or toll upon strangers, for such a claim could never have been good by any grant.

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[1] "Viæ vicinales, quarum memoria non extat" (*Dig.*, xliii. 7, 3.)

[2] Prescription seems at one time to have borne a wider meaning. A claim by prescription to land is mentioned in 32 Hen., VIII. c. 2. And it seems that tenants in common may still make title to land by prescription (Littleton's *Tenures*, § 310.)

Prescription and Custom.—Prescription must be carefully distinguished from custom. Prescription, as has been said, is either in a *que estate* or in a man and his ancestors—that is to say, it is a personal claim; custom is purely local—that is to say, it is a usage obtaining the force of law within a particular district. In the time of Littleton the difference between prescription and custom was not fully recognized (see Littleton's *Tenures*, § 170), but the law as it exists at present had become established by the time of Sir Edward Coke. "J. S. seised of the Mannor of D. in fee prescribeth thus: That J. S. his ancestors and all those whose estate he hath in the said Mannor have time out of mind of man had and used to have Common of pasture &c. in such a place &c. being the land of some other &c. as pertaining to the said Mannor. This property we call a Prescription. A custome is in this manner; a copyholder of the Mannor of D. doth plead that within the same Mannor there is and hath been for time out of mind of man used, that all the Copyholders of the said Mannor have had and used to have Common of pasture &c. in such a waste of the Lord, parcel of the said Mannor &c." (*Coke upon Littleton*, 113b). A custom must be certain, reasonable and exercised as of right. Like prescription at common law, it must have existed from time immemorial. On this ground a custom to erect stalls at statute sessions for hiring servants was held to be bad, because such sessions were introduced by the Statute of Laborers, 23 Edw. III. st. (1 Simpson *v.* Wells, *Law Reports*, 7 Queen's Bench, 214). Some rights may be claimed by custom which cannot be claimed by prescription, *e. g.*, a right of inhabitants to dance on a village green, for such a right is not connected with the enjoyment of land. On the other hand, profits *à prendre* can be claimed by prescription, but not by custom, unless in two or three exceptional cases, such as rights of copyholders to common in the lord's demesne, or to dig sand within their tenements, rights to estovers in royal forests and rights of tin-bounders in Cornwall.

United States.—The law of the United States (except in Louisiana) is based upon that of England, but the period of enjoyment necessary to found a title by prescription varies in the different States. An easement or profit *à prendre* is acquired by twenty years' enjoyment in most States, following the English common law rule. In Michigan the term is twenty-five years, Pennsylvania twenty-one years, Connecticut and Vermont fifteen years, South Carolina five years. In Louisiana the period varies according to the subject from three to thirty years, and property other than incorporeal hereditaments may be claimed by prescription as in Roman law (see *Kent's Comm.*, vol. iii. 442). In the case of ancient lights the tendency of the decisions of many of the State courts seems to have been against the English doctrine, that a prescriptive right to light may be gained by mere enjoyment not necessarily under a claim of right (*Washburn's Law of Real Property*, vol. ii. 318).

International law uses the term "prescription" in its wider or Roman sense. "The general consent of mankind has established the principle that long and uninterrupted possession by one nation excludes the claim of every other" (Wheaton, *Int. Law*, § 165). Historic instances of rights which were at one time claimed and exercised by prescription as against other nations are the sovereignty of Venice over the Adriatic and of Great Britain over the Narrow Seas, and the right to the Sound dues long exacted by Denmark. But such claims were rejected by the highest authorities on international law (*e.g.*, Grotius), on the ground that they were defective both in *justus titulus* and in *de facto* possession. There is no special period fixed, as in municipal law, for the acquirement of international rights by lapse of time. In private international law prescription is treated as part of the *lex fori* or law of procedure. (See LIMITATION.) (J. WT.)

Scotland.—In the law of Scotland "prescription" is a term of wider meaning than in England, being used as including both *prescription* and *limitation* of English law. In its most general sense it may be described as the effect which the law attaches to the lapse of time, and it involves the idea of possession held by one person adverse to the rights of another. Though having its basis in the common law, its operation was early defined by statute, and it is now in all respects statutory. The most appropriate mode of treating the prescription of Scotch law is to regard it (1) as a mode of acquiring rights—the positive prescription; (2) as a mode of extinguishing rights—the negative prescription; (3) as a mode of limiting rights of action—the shorter prescriptions. It must, however, be observed with reference to this division that the distinction between (1) and (2) is rather an accidental (due to a loose interpretation of the language of the Act 1617, c. 12) than a logically accurate one. It is, moreover, as will immediately be seen, strictly confined to heritable rights, having no application in the case of movable property. But, though the distinction has been complained of by the highest authority as tending to create embarrassment in the law (see opinion of Lord Chancellor St. Leonards in Dougall *v.* Dundee Harbor Trustees, 1852, 24 *Jurist*, 385), it is now too well settled to be departed from.

1. *Positive Prescription.*—The positive prescription was introduced by the Act 1617, c. 12,—a statute which has been described by Lord Kames as "the palladium of our land proprietors." After setting forth in the preamble the inconvenience resulting from the loss of titles and the danger of forgery after the means of improbation are lost by the lapse of time, it enacts that whatever heritages the lieges, their predecessors or authors, have possessed by themselves or others in their names peaceably, in virtue of infeftments for the space of forty years, continually and together, from the date of their said infeftments, and without any lawful interruption during the said space, they shall not be disturbed therein, provided they produce a written title on which their possession has proceeded. Such written title must be either a charter and sasine preceding the forty years, or, when no charter is extant, instruments of sasine proceeding upon retours or precepts of *clare constat*. Though the statute in its literal construction only applied to such heritable subjects as had been conveyed by charter and sasine, it was at an early date interpreted so as to include other heritable rights, as servitudes, tacks, public rights of way, etc., where no charter could be supposed to exist. Thus forty years' possession of a road by members of the public is held to establish a right of way. And any member of the public who uses or may have occasion to use the road is considered to have a good title to plead prescription. Thus in the celebrated Glen Tilt case a path through Glen Tilt was established as a right of way in an action at the instance of three gentlemen, one of whom was a residenter in Edinburgh and another in Aberdeen (see Torrie *v.* Duke of Atholl, 1849, 12 Dunlop's *Reports*, 328; affirmed in House of Lords, 1852, 1 Macqueen's *Reports*, 65). This valuable Act of 1617 was so well framed that it continued to regulate the prescription of land rights till the year 1874. By the Conveyancing Act of that year (37 and 38 Vict. c. 94, s. 34) the period of prescription was shortened from forty years to twenty. It was provided that possessions for twenty years upon "an *ex facie* valid irredeemable title recorded in the appropriate register of sasines" should in future give the same right as forty

years' possession upon charter and sasine under the earlier law. This Act of 1874 does not, however, apply to all the cases which fell under the Act of 1617. Thus it has been decided that twenty years' possession on a charter of adjudication followed by sasine and a declarator of expiry of the legal is insufficient to give an unchallengeable right, an adjudication not being an "*ex facie* irredeemable title." (Hinton *v.* Connel's Trustees, 1883, 10 Rettie's *Reports*, p. 1110). It is further specially provided by the Act of 1874 that the twenty years' prescription is not to apply to servitudes, rights of way, and public rights generally. The following rules apply to the positive prescription. (*a*) The possession which is required for it must be peaceable, continuous ("continually and together," as the Act of 1617 has it), and uninterrupted. (*b*) The prescription runs *de momento in momentum*. (*c*) The person against whom the prescription runs must be major and *sui juris*,—a rule which, as regards minority, was specially provided for by the Act of 1617, and as regards other cases of incapacity by the application of the principles of the common law. Under the Conveyancing Act, however, it is provided that in all cases where the twenty years' prescription applies, the lapse of thirty years is to exclude any plea on the ground of minority or want of capacity.

2. *Negative Prescription.*—This prescription was introduced by the Act, 1469, c. 28, and re-enacted with some modification by 1474, c. 55. At first restricted to personal claims of debt, it was gradually extended in practice and ultimately made applicable to heritable bonds and other heritable rights by the above-mentioned Act of 1617. By the Act of 1469 it is declared that the person having interest in an obligation must follow the same within the space of forty years and take document thereupon, otherwise it shall be prescribed. The negative prescription accordingly extinguishes *in toto* the right to demand performance of an obligation after forty years, the years being reckoned from the day on which fulfilment of the obligation can be first demanded. The lapse of this period of time creates a conclusive presumption—one incapable of being redargued—that the debt or obligation has been paid or fulfilled. But it must be kept in view that the negative prescription does not *per se*—without the operation of the positive—establish a right to heritable property (Erskine, *Inst.*, b. iii. tit. 7, § 8). Thus, as has been observed, "If A has possessed for a hundred years but was not infeft, any competitor who has neglected his right for that time may completely establish it, if his right was better than A's" (*per* Lord Corehouse, in Cubbison *v.* Hyslop, 183, 16 Shaw's *Reports*, p. 112). So a right of patronage has been held incapable of being lost by the negative prescription; but, on the other hand, it is settled that servitudes and public rights of way may be so extinguished. As regards the character of the prescription, it is requisite, in the same way as in the case of the positive, that the years shall have run continuously and without interruption, *i.e.*, without any act done on the part of the creditor which indicates his intention to keep alive the right. Such interruption may, for instance, take place by the payment of interest on the debt, or citation of the debtor in an action for the debt, or by a claim being lodged in the debtor's sequestration. In the same way as in the positive, the currency of the negative prescription is suspended by the debtor being minor or *non valens agere*.

3. *Shorter Prescriptions.*—There are certain short prescriptions recognized by Scotch law—corresponding to the limitations of English law—which operate not as extinguishing rights but as excluding the ordinary means of proving them The following require to be noticed. (*a*) Vicennial prescription. By the Act 1617, c. 13, a vicennial prescription of retours was introduced, and in modern practice the same prescription is applicable to an extract decree of service which has taken the place of a retour (31 and 32 Vict. c. 101, § 37). This prescription protects a person who has been served as heir for twenty years against action by any other person claiming to be heir. By the Act 1669, c. 9, holograph missive letters and bonds in compt books also prescribe in twenty years. The debt, however, is not in this case extinguished, as within forty years it may be proved by the defender's oath. (*b*) Decennial prescription. By the Act 1669, c. 9, all actions by minors against their tutors and curators, and *vice versa*, must be prosecuted within ten years from the expiration of the guardianship (Erskine, *Inst.*, iii. 7, 25). (*c*) Septennial prescription. By the Act 1695, c. 5, it is provided that no person binding himself for and with another, conjunctly and severally, in any bond or contract for sums of money shall be bound for more than seven years after the date of the obligation. But it is necessary that the cautioner either be bound expressly as such in the bond, etc., or, if bound as co-principal, that there be either a clause of relief in the bond or in a separate back bond duly intimated (*i.e.*, notarially or in some formal way) to the creditor. This prescription does not apply to guarantees for the fulfilment of an office, or to security for a bill of exchange, or to judicial bonds. (*d*) Sexennial prescription. This prescription applies to bills and promissory notes, so as to deprive them of their privileges. After the lapse of six years the holder of the bill or note can no longer found on it except as an adminicle of evidence to prove his debt. This prescription was first introduced by 12 Geo. III. c. 72. (*e*) Quinquennial prescription applies to bargains concerning movables, such as sales of goods, loans, deposits, etc.—in short, to all mercantile transactions except such as pass into current accounts and fall under the triennial prescription noticed below. By the Act 1669, c. 9, such bargains prescribe in five years, and can thereafter only be proved by the debtor's writ or oath. The same statute also made ministers' stipends, multures, and maills and duties prescribe in five years unless proved by writ or oath. (*f*) Triennial prescription. This valuable prescription was introduced so far back as the year 1579. By the Act 1579, c. 83, it was provided that "actions of debt for house maills, men's ordinaries, servants' fees, merchants' accounts, and others the like debts not founded on written obligations" shall prescribe in three years. Under the terms "like debts" have been held to fall such debts as workmen's wages, law agents' accounts, and rents due on verbal lease. All such debts must be pursued within three years, otherwise they cannot be proved except by the writ or oath of the party sued. The period from which this prescription begins to run is the date of the last item in the account. With regard to all the minor prescription it is to be observed generally that the respective periods of time must have run without interruption, and that, except when the contrary is expressed in the Act constituting the prescription, the years of minority and *non valentia agere* are not taken into account. (H. GO.)

PRESERVED FOOD. The perfect preservation of any substance for use as food implies the retention of its full nutritive power, sapidity, and digestibility, with its natural odor and color unimpaired, for such length of time as may be required. The process employed must be sufficiently cheap to allow of the preserved food being placed in the market at a price which will insure a demand for it. The operations connected with the preparation of many food-substances are partly directed to the production of food in a new and more convenient form from that in which it is yielded by nature, and partly with the view of preserving the alimentary body. Cheese is an example of such a food-preparation, and to a smaller extent so also are butter and other edible fats and oils, as well as fruit and vegetable jellies and conserves. Concentrated foods and extracts, such as Liebig's extract of beef, belong to the same category, consisting of certain essential principles of animal food easily preserved, and prepared partly on that account.

Many of the most important food-staples require nothing more than favorable natural conditions for their preservation, till they are ordinarily required for consumption. Such is the case with the cereal grains, which are sufficiently ripened and dried in the harvest field, and with all hard farinaceous and oleaginous seeds, nuts, and fruits. Most soft succulent fruits and vegetables, on the other hand, and all varieties of animal food require artificial preservation, and it is to these that the various processes in use are applied. These processes resolve themselves into four groups,—(1) drying, (2) use of antiseptics, (3) exclusion of air, and (4) refrigeration. Several hundreds of patents have been obtained in the United Kingdom alone for preservative processes coming under one or more of these heads; but in reality the methods of preservation in practical operation are not many.

1. *Drying* is the most ancient and primitive of all processes for preserving food, and, although it answers but imperfectly for most animal substances, yet in dry hot countries it is very extensively practiced. In the River Plate regions of South America a large quantity of beef is annually prepared for export to Brazil and the West Indies under the name of "tasajo" or "charqui dulce," principally by drying. The meat is simply cut into pieces, freed from fat, bone, and tendon, powdered with maize meal, and dried hard by exposure to the sun, care being taken to keep it pro-

tected from rain. The dried product has about one-fourth the weight of fresh meat, and is of a dark color. It requires to be soaked in water and cooked for a long time, yielding at best a tough indigestible meat; but it makes a well-flavored nutritive soup. The greater part of the charqui or jerked beef of South America is, however, slightly salted as well as sun-dried; and among many races where drying is practiced the use of salt and smoking are also appreciated. Many attempts have been made to introduce dried meat in the form of powder or meal. For this purpose fresh meat, deprived of fat, is cut into thin slices and slowly dried at a low heat in an oven or heated chamber till the meat is hard, crisp, and dry. When powdered, such a preparation keeps well if it is not exposed to damp; but it cannot be said to offer any advantages for general use, although it might be of value to an army during a campaign. Nevertheless a company, under the name of the Carne Pura Company, has been established in Berlin within the last few years for the manufacture of such meat-powder. Of an analogous nature are the concentrated soup tablets or cakes, prepared, principally in Russia, by the rapid evaporation of rich soups, with which dried vegetables and flour are sometimes incorporated in proportion sufficient to yield a good soup on dilution with boiling water. These soups are generally deficient in aroma and have frequently an unpleasant gluey consistency and taste. Concentrated meat biscuits, in which flour and extract of beef are prepared in a thoroughly dry condition, and which were largely used in the American Civil War, the German pea sausage ("Erbsenwurst"), made famous during the Franco-Prussian War, and pemmican are examples of food in which dried meat may be well preserved in conjunction with farinaceous substances. Preservation by simple drying is extensively practiced among the Chinese for their gelatinous foods, such as trepang, dried tendons, skins, mussels and other molluscs, and fish. Milk also may be preserved in the form of a dry powder, but the result is not sufficiently attractive to command a market.

Succulent fruits and vegetables are satisfactorily preserved by simple drying. The principal dried saccharine fruits of commerce are raisins, currants, figs, dates, and prunes. These differ in their nutritive properties considerably from the natural fruits they represent, as do also the farinaceous fruits and vegetables preserved by drying, such as the banana, bread-fruit, mandioc, etc. A process of drying and compressing ordinary pot-vegetables and potatoes, invented by M. Masson about 1845, is now carried out on a large scale by Messrs. Chollet & Co. of Paris. The vegetables to be treated are carefully picked, plunged into boiling water to coagulate the vegetable albumen, shred, and promptly dried in a current of heated air. They are then submitted to powerful hydraulic pressure, condensing them into thin dense cakes, which retain from 9 to 15 per cent. of the weight of the original green substances, or 20 per cent. of the weight in the case of potatoes, but all in greatly reduced compass. The saving of space is, equally with the preservation, of the utmost importance for use on board ship or by soldiers in the field. Within the space of a cubic metre 25,000 rations of Chollet's compressed vegetables can be packed, each ration weighing 25 grammes [882 oz. av.], and representing about 200 grammes [7056 oz. av.] of green vegetables. As anti-scorbutics such preserved vegetables are inferior; but they are nevertheless exceedingly useful, and when well cooked almost equal in taste to the fresh vegetables.

2. *Use of Antiseptics.*—The variety of antiseptic substances which have been experimented with for the curing of food is numberless. Bodies solid, liquid, and gaseous have been proposed, and these have been variously recommended for superficial application, for injection, and for forming an artificial atmosphere around the substance to be preserved; and further, it has been suggested that the creature whose flesh is to be preserved should, before killing, be impregnated with the antiseptic by inhalation or otherwise. In practice the antiseptics used are very few in number, since many of them have a physiological effect on the digestive and other internal organs into which they are introduced with the food, and so must injure the health. Besides, many proposed antiseptics are either in themselves unpleasant in smell or taste, or alter the appearance, color, taste, or consistency of the food preserved. The least objectionable are substances which enter into human food themselves, such as certain salts, sugar, vinegar, and alcohol. The most ancient, most commonly used, and throughout most effective is common salt. Salt acts on meat by withdrawing the animal juices, the place of which it takes, and by hardening the muscular tissue. Consequently it seriously lessens the nutritive value of animal food, and renders it much less digestible than fresh meat. It appears to be least injurious in the case of pork, the fat of which it renders more digestible, and, as a consequence, no animal food is more largely preserved by the process of salting. A certain proportion of other saline bodies, notably saltpetre (nitrate of potash), and of sugar is frequently combined with salt in curing, and so also are other antiseptic and preservative agencies. Bacon, for example, is both salted and smoked, while tongues and fish are not only salted and smoked but also dried. Smoking alone is very effective in preserving and flavoring fish intended for consumption within a limited time after curing. The quantity of fish prepared for human food by salting, smoking, and drying, together or separately, is incalculably great. Of other antiseptics which have been suggested, and which may be used effectively for the preservation of food, few possess any advantage whatever over common salt, which is certain in its action, abundant, cheap, and, within limits, harmless. Among the substances which have of recent years come into prominent notice are bisulphide of lime and various preparations of boracic acid, notably that known as "glacialin" salt and the boro-glycerin introduced by Professor Barff. Boracic acid is a powerful, inodorous, and tasteless preservative; but in repeated small doses it exercises a specific influence on the excretory organs which must be detrimental to health. Salicylic acid has also been extensively tried as a food-preserver, more especially for milk, but, in addition to the unpleasant taste it communicates to the substances, there are physiological objections to its use.

The use of non-saline preservative agents is exemplified on a large scale in the pickling in vinegar of succulent fruits and vegetables (see PICKLES, p. 89 above). Sugar plays a similar part in the preparation of jams, jellies, candied fruits, etc., and alcohol is also occasionally employed as a medium for the preservation of fruits. Oil acts as a preservative more by its power of excluding atmospheric air than from any antiseptic influence it possesses, and therefore comes under the next category.

3. *Exclusion of Air.*—The principal method of food preservation dependent on the exclusion of air is the invention of François Appert and dates from 1809. It consists essentially in securing cooked food in hermetically sealed vessels from which the atmospheric air is as far as possible driven off before sealing, and in killing by heat or otherwise such germs or ferments as may remain within the vessel either before or after it is sealed up. The process does not depend for its success on the perfect exclusion of air,—indeed, originally there was no attempt to drive it off, but air sealed up with the food was immediately submitted to a temperature sufficiently high to kill all germs introduced with it and existing in the food itself. Quite recently experiments have been conducted by Mr. J. J. Coleman, the inventor of the cold-air process described below, with the view of preserving food in hermetically sealed vessels, which, instead of being exposed to heat, are subjected to an intense cold, supposed to be suffi-

cient to kill all minute putrefactive organisms; but he has found that a cold of 130° Fahr. below freezing-point is insufficient to destroy all organic germs. At present the innumerable varieties of tinned foods, both animal and vegetable, are entirely the result of the application of Appert's principle. In practice there are several processes of "tinning" food, but the general method adopted is everywhere uniform in principle.

The tins used are manufactured with the greatest care, and most ingenious machinery has been devised for their thorough and expeditious preparation. The proper quantity of meat, generally, though not necessarily, free from bone, tendon, and undue proportion of fat, is weighed out and placed raw in the tin, over which the cover is soldered. In the cover a small "pin-hole" is left, and the tins are placed in a bath or boiler of solution of chloride of calcium, which boils at a temperature of from 260° to 270° Fahr. Each tin is immersed to within an inch or two of the top, and as the heat is gradually raised steam issues from the pin-hole, carrying off the atmospheric air from within the tin. When all the air has been expelled the pin-hole is promptly closed with a drop of solder, and the tin, hermetically sealed, is entirely immersed for some time in the superheated solution. When withdrawn and cooled, the tins are placed in a heated testing-house, in which after a few days those that have been imperfectly treated manifest their defects by a bulging of the sides, due to the generation of gases from the putrefying mass they contain. Those which have been successfully preserved generally show both ends collapsed or depressed by the pressure of the air outside; and usually on a well-preserved tin being pierced the air is audibly sucked in.

The process is applicable to all classes of food, vegetable as well as animal, which may without destruction be submitted to a temperature sufficient to render putrefactive organisms inert, and in experience the amount of heat to which different substances must be exposed varies very considerably. The variety of substances preserved by tinning is now very great, and the total weight of human food so stored is enormous. Numerous modifications of the air-exclusion principle, effectual within certain limits, are in use. The preservation of sardines is due partly to cooking them in oil and surrounding them with it and partly to sealing them in tins, and potted meats, the "conserves fines" of the French, are partly preserved by the use of fat. The most effective means of preserving eggs consists in coating the shells, as soon as they are laid, with butter or some other fat, gum, or varnish. Such coating prevents the transfusion of water from the egg which ordinarily goes on, the place of the water being taken by atmospheric air, rendering the egg specifically lighter and promoting its putrefactive change. Processes for the exclusion of air by the substitution of an atmosphere of some inert gas have not proved successful, neither has the method proposed and patented by Dr. Redwood, which consisted in coating meat with a layer of paraffin.

4. *Refrigeration.*—That cold checks putrefaction has long been known from ordinary experience. Bodies of the prehistoric mammoth have been found in the ice of the Siberian tundra so well preserved that the flesh was eaten by dogs. Ice is much used by fish merchants and other provision dealers for the temporary preservation of their perishable stores; but the cost and inconvenience of the process in temperate, and still more in hot, climates render it applicable only for brief spaces of time and to the more costly of food-products. But about the year 1875 ice began to be used on a large scale for the preservation of fresh meat during its transit from America to the European markets. This, the first practically successful method of preserving fresh meat for such a period as enabled it to be sold in remote markets, consisted in cooling a large meat chamber hung full of carcasses by continually blowing into it air which had previously been cooled to near the freezing point by being made to pass through reservoirs of ice. The process was not all that could be desired, but it successfully solved a question which had previously been attempted many times and ways. It continued to be the method by which large quantities of fresh meat were brought in good condition to the European market, till in 1879 Mr. J. J. Coleman inaugurated a new era by the introduction, in conjunction with Mr. H. Bell and Mr. J. Bell, of his Bell-Coleman dry-air refrigerator.

In the Bell-Coleman machine atmospheric air is compressed to one-fourth or one-third of its normal bulk in an air-pump by means of a steam cylinder. The air so condensed becomes hot, and is cooled by injecting water into the air-compressor, after which it is still further reduced in temperature and freed from moisture by passing it through a range of pipes in the cold air of the chamber that is being refrigerated. Being then conveyed to the expanding cylinder, the work or energy it contains in virtue of its compression is expended in moving a piston which forms part of the machinery. From the piston the air, now cooled as much as 50° to 100°, or even 200° Fahr., according to the degree of compression to which it has been subjected, is distributed through the cold chamber by suitable pipes. Mr. A. Seale Haslam has since brought out a refrigerator in which the temperature of the air is lowered by passing it through pipes cooled externally, instead of by injecting water into the tubes containing it.

Numerous other machines have also been produced, the principle and action of which are illustrated in the article ICE, vol. xii. p. 646. By means first of the Bell-Coleman and subsequently of the Haslam method, fresh meat has been regularly imported into Europe from America since March, 1879, when the Anchor liner "Circassia" delivered the first cargo. In February, 1880, the first shipment from Australia, consisting of 34 tons of beef and mutton, was delivered in London by the "Strathleven," and in June, 1882, the sailing ship "Dunedin," brought from New Zealand to London, after a passage of ninety-eight days, 4909 carcasses of sheep and twenty-two pigs, all in perfect condition, notwithstanding the prolonged voyage and the excessive heat encountered during the passage. The dry-air refrigerators have also been largely adopted in passenger and emigrant vessels for preserving fresh provisions for daily use throughout their voyages, and preserving chambers and freezing chambers have been erected on land at the ports of lading and delivery. The machinery at present in use is capable of freezing upwards of 300,000 tons of meat per annum, and it is rapidly being added to; and it may be said that these machines have accomplished a perfect solution of the great problem of fresh-meat preservation and distribution.

Commerce.—It is impossible to tabulate any reliable figures relating to the trade in products which are properly classed as preserved food. Within the first five years in which the Bell-Coleman machine was in use there were brought from America by its agency alone 563,568 quarters of beef and 113,633 carcasses of mutton. The following figures illustrate the development of the frozen-mutton trade from the great sheep-growing localities, giving the number of carcasses imported.

	1881.	1882.	1883.	1884.
New Zealand......	...	8,840	98,754	398,859
Australia..........	13,771	55,087	60,717	167,437
River Plate........	...	...	...	54,369

As these imports bear only an insignificant relation to the supplies which might be drawn from the several countries at the present moment, it is obvious that a most important factor has been introduced into the meat trade which will exercise a powerful influence on the markets. (J. PA.)

PRESSBURG (Hung. *Pozsony*, Lat. *Posonium*), capital of the county of the same name and in former times also of the country, is a royal free town in Hungary, situated on the left bank of the Danube, in 48° 8′ N. lat. and 17° 6′ E. long. Pressburg is the see of an evangelical bishop, and the headquarters of one of the fifteen army-corps of the Austrian-Hungarian army and of a honved district; its civil departments include finance, posts, land-surveying, state forestry, public instruction, river regulation, and Government buildings; it has also a district court of justice, a superior law court, and a chamber of trade and commerce. Among its numerous educational and benevolent institutions the following are specially worthy of mention—the academy of jurisprudence and philosophy, a Roman Catholic upper gymnasium, an evangelical lyceum, an evangelical seminary, an upper real school, a Government training school for governesses and another of midwifery, schools of music and drawing, two free libraries, a lazaretto, a lunatic asylum, six hospitals, two workhouses, two public kitchens, etc. The most prominent buildings are—a fine cathedral, dating from the 11th century (in which many of the Hungarian kings were crowned), twelve other Roman Catholic churches, two evangelical churches, two synagogues, the ancient town-hall, the parliament house (which served for this purpose until 1848), the now uninhabited palace of the archbishop of Esztergom (Gran), a number of palaces of nobles, and the theatre. On the Schlossberg there stood a royal castle (destroyed by fire in 1811), which was a strong fortress during the wars with the Turks. The inhabitants in 1881 numbered 48,326, of whom 8000 were Protestants, 5000 Jews, and the rest Roman Catholics; as to nationality, 30,000 were Germans, 9000 Slavs, and the rest (chiefly the upper classes) Hungarians. The inhabited houses numbered 2015. The town has five newspapers (three in Hungarian and two in German). A large business is carried on in tobacco and cigars, paper, ribbons, leather wares, chemicals, liqueurs, confectionery, biscuits, etc. There is also a good trade in corn and wine. The Danube, here of considerable width, is crossed by a pontoon bridge. There is a large traffic by water with both Vienna and Budapest. Pressburg is the terminus of the Vale of Vág Railway and is also one of the most important stations on the Austrian-Hungarian State Railway system. Although one of the finest towns in the country, its chief charm is its vicinity, which is of singular beauty. Eastwards and southwards stretches a long fertile plain, whilst to the north and west the town is enclosed by the lovely hills of the Little Carpathian range.

Little is known of the early history of Pressburg. The name does not occur before the 9th century. In 1042 it was destroyed by the Germans, but was soon afterwards rebuilt and so strongly fortified that it sustained two other attacks and was not taken again until 1271. From its strategic situation it has always been an important place. When in 1541 Buda was taken by the Turks, Pressburg became the Hungarian capital, place of coronation, and seat of all the Government offices, and it remained so a good while after the Turks were driven from the country. It was here that the Austrian and Hungarian malcontents concluded the treaty with Archduke Matthias against Rudolf II. In 1619 Pressburg was taken by the Protestant leader Bethlen Gabor; but it was recovered by the imperialists in 1621. It was also the scene of that memorable session of parliament, 1687, at which the Hungarians renounced their right of choosing their king and accepted the hereditary succession. In 1784 the capital was removed to Buda. Peace was made here between Napoleon and Francis I. after the battle of Austerlitz, 26th December, 1805, and in 1809 Davoust bombarded the place for a whole month. It continued to be the seat of parliament until 1848, and it was the scene of the great reform debates during the session of 1847–48.

PRESS LAWS. The liberty of the press has always been regarded by modern political writers as a matter of supreme importance. "Give me liberty to know, to utter, and to argue freely according to conscience, above all other liberties," says Milton in the *Areopagitica*. At the present day the liberty of the press in English-speaking countries is (with perhaps the single exception of Ireland) a matter of merely historical importance. The liberty was a plant of slow growth. Before the invention of printing the church assumed to control the expression of all opinion distasteful to her. (See BIBLIOGRAPHY, vol. iii. pp. 569, 570, INDEX LIBRORUM PROHIBITORUM, INQUISITION.) The authority of parliament was invoked in England to aid the ecclesiastical authority. There is an ordinance as early as 1382, 5 Ric. II. st. 2, c. 5 (not assented to by the Commons, but appearing upon the parliament roll), directed against unlicensed preachers. After the invention of printing the ecclesiastical censorship was still asserted, but only as collateral with the censorial rights of the crown, claimed by virtue of its general prerogative. After the Reformation the greater part of the rights of censorship passed to the crown, which at the same time assumed the power of granting by letters patent the right of printing or selling books as a monopoly. The grant, if made to the author himself, was an equivalent of copyright; if made to a person other than the author, it seems to have always been subject to the author's copyright as it existed at common law.

Censorship was either restrictive or corrective, *i.e.*, it interfered to restrict or prevent publication, or it enforced penalties after publication. Repression of free discussion was regarded as so necessary a part of government that Sir Thomas More in his *Utopia* makes it punishable with death for a private individual to criticise the conduct of the ruling power. Under Mary printing was confined to members of the Stationers' Company, founded by royal charter in 1556. Under Elizabeth the Star Chamber, the great censorial authority of the Tudor period, assumed the right to confine printing to London, Oxford, and Cambridge, to limit the number of printers and presses, to prohibit all publications issued without proper license, and to enter houses to search for unlicensed presses and publications (Order of 1585, Strype's *Whitgift*, App. 94). The search for unlicensed presses or publications was entrusted to an officer called the "messenger of the press." The Stuart kings followed the example of their predecessors. Thus in 1637 was issued a stringent order of the Star Chamber forbidding the importation of books printed abroad to the scandal of religion or the church or the Government, and the printing of any book not first lawfully licensed. Law books were to be licensed by one of the chief justices or the chief baron, books of history and state affairs by one of the secretaries of state, of heraldry by the earl marshal, of divinity, philosophy, poetry, and other subjects by the archbishop of Canterbury or the bishop of London, or the chancellors or vice-chancellors of the universities. There were to be only twenty master printers and four letter-founders. The punishment was at the discretion of the court (Rushworth, *Historical Collections*, vol. iii., App. 306). The same principle of press restriction was carried out by the Long Parliament after the abolition of the Star Chamber, and it was an ordinance of that body issued in 1643 that called forth Milton's *Areopagitica, a Speech for the Liberty of Unlicensed Printing*, itself an unlicensed book. The parliament appointed committees for printing, who appointed licensers, but the licensing was really left in a great measure to the wardens of the Stationers' Company. At the Restoration Sir John Birkenhead acted as licenser, appointed apparently under the general prerogative. It was, no doubt, too, under the general prerogative that Charles II., by a proclamation in 1660, called in and suppressed Milton's *Defensio pro Populo Anglicano*. Then followed the Licensing Act of 1662 (13 and 14 Car. II. c. 33), limited to two years. The provisions as to importation of books, the appointment of licensers, and the number of printers and founders were practically re-enactments of the similar provisions in the Star Chamber order of 1637. Printing presses were not to be set up without notice to the Stationers' Company. A king's messenger had power by warrant of the king or a secretary of state to enter and search for unlicensed presses and printing. Severe penalties by fine and imprisonment were denounced against offenders. The Act was successively renewed up to 1679. Under the powers of the Act

Sir Roger L'Estrange was appointed licenser, and the effect of the supervision was that practically the newspaper press was reduced to the *London Gazette*. (See Newspapers, vol. xvii, pp. 425, 426.) The objections made to lines 594–599 of the first book of *Paradise Lost* by the archbishop of Canterbury's chaplain, acting as licenser are well known. The Act expired in 1679, and for the remainder of the reign of Charles II., as in the reign of George III., the restrictions on the press took the form of prosecutions for libel. The twelve judges resolved in 1680 "that all persons that do write or print or sell any pamphlet that is either scandalous to public or private persons, such books may be seized and the person punished by law; that all books which are scandalous to the Government may be seized, and all persons so exposing them may be punished. And further, that all writers of news, though not scandalous, seditious, nor reflective upon the Government or the state, yet, if they are writers (as there are few else) of false news, they are indictable and punishable upon that account" (Harris's case, *State Trials*, vii. 929). In 1685 the Licensing Act was renewed for seven years (1 Jac. II. c. 8, § 15). No mention of the liberty of the press was made in the Bill of Rights. On the expiration of the Licensing Act in 1692 it was continued till the end of the existing session of parliament (4 and 5 Will. and Mary, c. 24, § 14). In 1695 the Commons refused to renew it. The immediate effect of this was to lay authors open to the attacks of literary piracy, and in 1709 the first Copyright Act (8 Anne, c. 19) was enacted for their protection. The power of a secretary of state to issue a warrant, whether general or special, for the purpose of searching for and seizing the author of a libel or the libellous papers themselves—a power exercised by the Star Chamber and confirmed by the Licensing Act—was still asserted, and was not finally declared illegal until the case of Entick *v.* Carrington in 1765 (*State Trials*, xix. 1030). In 1776 the House of Commons came to a resolution in accordance with this decision. The compulsory stamp duty on newspapers was abandoned in 1855 (18 Vict. c. 27), the duty on paper in 1861 (24 Vict. c. 20), the optional duty on newspapers in 1870 (33 and 34 Vict. c. 38). From that time the English press may be said to date its complete freedom, which rests rather upon a constitutional than a legal foundation. It is not confirmed by any provision of the supreme legislative authority, as is the case in many countries. A declaration in favor of the liberty of the press is usually a prominent feature in the written constitutions of foreign states. Its legal aspect in England cannot be better expressed than in the words of Lord Wynford:

> "My opinion of the liberty of the press is that every man ought to be permitted to instruct his fellow-subjects; that every man may fearlessly advance any new doctrines, provided he does so with proper respect to the religion[1] and government of the country; that he may point out errors in the measures of public men, but he must not impute criminal conduct to them. The liberty of the press cannot be carried to this extent without violating another equally sacred right, the right of character. This right can only be attacked in a court of justice, where the party attacked has a fair opportunity of defending himself. Where vituperation begins, the liberty of the press ends" (Rex *v.* Burdett, Barnewall and Alderson's *Reports*, iv. 132).

The few existing restrictions on the liberty of the press are presumed to be imposed for the public benefit. They are in some cases of great historical interest. The rights of private persons are in general sufficiently protected in one direction by the law of Libel (*q.v.*), in another by the law of Copyright (*q.v.*), while the criminal law provides for the cases of press offences against morality, public justice, etc. Thus the courts have power to punish summarily as a contempt the publication of comments upon proceedings *sub judice* or reflections upon the conduct of judicial officers. (See Contempt of Court). The last relic of the censorship before publication is to be found in the licensing of stage plays. By 6 and 7 Vict. c. 68 no new plays or additions to old plays can be acted for hire at any theatre in Great Britain until they have been submitted to the lord chamberlain, who may forbid any play or any part of a play. The penalty for acting a play before it has been allowed or after it has been disallowed is a sum not exceeding £50 for every offence and the forfeiture of the license of the theatre in which the offence occurred. This jurisdiction is exercised by an official of the lord chamberlain's department called the "examiner of stage plays." The last relic of the monopoly of printing formerly granted to licensees of the crown is found in the exclusive right of the queen's printer and the universities of Oxford and Cambridge to print the Bible[2] and the Book of Common Prayer, and of the queen's printer to print Acts of parliament and other state documents. The privileges of the universities are confirmed by 13 Eliz. c. 29. The rights of the queen's printer are protected by severe penalties. A maximum term of seven years' penal servitude is incurred by any person who prints any Act of parliament or other Government document, falsely purporting to be printed by the queen's printer or under the authority of Her Majesty's stationery office (8 and 9 Vict. c. 113; 45 Vict. c. 9). The rights of the printers of the journals of either House of parliament are protected by 8 and 9 Vict. c. 113. The publication of parliamentary debates in any form by any other persons than the printers of the journals of the two Houses is still in theory a breach of privilege, but in practice they have been fully reported since 1771. The other restrictions upon the press are to a great extent those imposed for police purposes. By 32 and 33 Vict. c. 24 (confirming in part previous enactments applying to Great Britain) the printer of any paper or book for profit is required under penalties to print thereon his name and address or the name of a university press, and is to keep a copy of everything printed, with a few exceptions. Penalties must be sued for within three months, and no proceeding for penalties can be commenced unless in the name of the attorney-general or solicitor-general of England or the lord advocate of Scotland. By the Newspaper Libel and Registration Act, 1881 (44 and 45 Vict. c. 60, which applies to England and Ireland, but not to Scotland), newspaper proprietors are, except in the case of joint-stock companies, to be registered and to make annual returns of the title of the newspaper and the names of all the proprietors, with their occupations, places of business, and places of residence. By the Corrupt Practices Prevention Acts, 1883 and 1884 (46 and 47 Vict. c. 51, s. 18, and 47 and 48 Vict. c. 70, s. 14), the name and address of the printer must be printed on all bills, placards, etc., referring to a parliamentary or municipal election. By 6 and 7 Vict. c. 68, s. 7, the name and place of abode of a manager of a theatre are to be printed on every play-bill announcing a representation at such theatre. Offences against decency by the press are provided for by 20 and 21 Vict. c. 83, 25 and 26 Vict. c. 101, s. 251 (for Scotland), and 2 and 3 Vict. c. 47, s. 54 (for the metropolis). The importation of obscene literature into the United Kingdom is forbidden by 39 and 40 Vict. c. 36, s. 42. By the Larceny Act, 1861, any person who prints or publishes an advertisement offering a reward for the return of stolen goods without questions asked is subject to a penalty (24 and 25 Vict. c. 96, s. 102). This penalty cannot, however, be sued for without the sanction of the attorney-general or solicitor-general of England or Ireland (33 and 34 Vict. c. 65). The advertisement in the United Kingdom of foreign or illegal lotteries is prohibited by 6 and 7 Will. IV. c. 66, betting advertisements by 16 and 17 Vict. c. 119, s. 7, and 37 Vict. c. 15.

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[1] This is to be read subject to the remark of Lord Coleridge that the application of the principles of law is to be changed with the changing circumstances of the time (Reg. *v.* Ramsay, in Cox's *Criminal Cases*, xv. 235). What was blasphemous in law a hundred years ago is not necessarily so now.

[2] The monopoly of the queen's printer does not extend to any translation other than the authorized version, and not to that if it be accompanied by new notes or marginal readings.

The right of an author or publisher to the full profits of his undertaking was at one time restricted by the Copyright Act of Anne (8 Anne, c. 19, s. 4), by which the archbishop of Canterbury and other authorities were empowered to lower the price of a book upon complaint that the price was unreasonable. The only restriction of the kind now existing is the obligation of delivering (without request) to the British Museum a copy of any work published within the United Kingdom, and of delivering (on request) copies for the use of the university libraries at Oxford and Cambridge, the library of the faculty of advocates at Edinburgh, and the library of Trinity College, Dublin (5 and 6 Vict. c. 45, ss. 6-10).

Scotland.—Printing became, as in England, a royal monopoly. The exclusive right of printing was granted by James IV. to Walter Chepman, who printed the first book in Scotland. The monopoly of printing Acts of the Scottish parliament was granted by James V. to the printer chosen by the clerk register and specially licensed by the king (1540, c. 127). Printers are forbidden by 1551, c. 27, to print, whether in Latin or English, without license from ordinaries deputed in that behalf by the crown. No book treating of religion or of the kirk was to be printed without a license from the general assembly (1646, c. 164), or of the kingdom without a license from one of the judges or the secretary (c. 165). The council were empowered to prohibit presses at their discretion by the order of 30th March, 1655. The importation of "famous" books and libels in defence of the pope was prohibited by 1581, c. 106. Press offences were treated with the utmost severity. By 1585, c. 1, the author of a libellous writing against the king was punishable with death. It is scarcely necessary to say that since the Union the press of Scotland has enjoyed no less liberty than that of England.

In the case of Bibles, Old and New Testaments, Psalm Books, the Book of Common Prayer, the Confession of Faith, and the Larger and Shorter Catechisms a license for printing is still required. The licensing authority is the lord advocate, but all proposed publications are submitted for approval to the body officially known as "Her Majesty's sole and only Master Printers in Scotland," consisting of the lord advocate, the solicitor-general, the moderator of the general assembly, and four other members. A license is also required for printing Acts of parliament; but a general license granted in 1848 to a firm of printers in Edinburgh is still operative, and their publications are not submitted for approval. As its work is practically confined to Bibles and the other religious publications enumerated, the above-mentioned body commonly receives the name of the Bible Board.

Ireland.—This is the only part of the United Kingdom in which the press cannot be said to be free. The policy of successive Governments has generally been in favor of restrictions. By the Prevention of Crime Act, 1882 (45 and 46 Vict. c. 25), the lord-lieutenant was empowered to order the seizure of any newspaper appearing to contain matter inciting to the commission of treason or of any act of violence or intimidation (§ 13). He may also by warrant direct the search for and seizure of any papers or documents suspected to be used or to be intended to be used for the purpose of or in connection with any secret society existing for criminal purposes (§ 14).

United States.

The constitutions of Pennsylvania, Delaware, Maryland, and North Carolina, all enacted in 1776, are interesting as containing the earliest declarations of any legislative authority in favor of the liberty of the press. The same principle was afterwards adopted in the constitution of the United States. By art. i. of the amended constitution, "Congress shall make no law . . . abridging the freedom of speech or of the press." Art. iv. secures against warrants for the seizure of papers, except on probable cause supported by oath or affirmation and particularly describing the thing to be seized. The constitution of Louisiana is that in which the right of liberty of the press is declared with the greatest minuteness. By art. vi. s. 21 of the constitution of that State, "Printing presses shall be free to every person who undertakes to examine the proceedings of the legislature or any branch of the government, and no law shall ever be made to restrain the right thereof. The free communication of thoughts and opinions is one of the invaluable rights of man, and every citizen may freely speak, write, and print on any subject, being responsible for the abuse of that liberty." The Acts of Congress dealing with the press are not numerous, as each State has for the most part its own legislation on the subject, dealing generally with, among other matters, the registration of newspapers, the monopoly of the State printer, and the right of giving the truth in evidence in defence to proceedings for libel. The Act of 18th August, 1856, forbids diplomatic or consular officers of the United States to correspond with any foreign newspaper in regard to the affairs of a foreign state. The Act of 3d March, 1873, prohibits the printing and circulation of obscene literature. By the Act of 23d June, 1860, the congressional printer has, except where otherwise provided by law, the monopoly of printing for the Senate or House of Representatives and the executive and judicial departments. State prosecutions for seditious libel were not infrequent in the early years of the republic; examples will be found in Wharton's *State Trials.*

Press Laws in the British Colonies and India.

Colonies.—In the British colonies the press is as free as it is in England. Each colony has its special legislation on the subject for police and revenue purposes. Where there is a Government printer, his monopoly is protected by the Documentary Evidence Act, 1868 (31 and 32 Vict. c. 37), which imposes a maximum penalty of five years' penal servitude upon any person printing a copy of any proclamation, order, or regulation which falsely purports to have been printed by the Government printer, or to be printed under the authority of the legislature of any British colony or possession. The Act is, however, subject to any law made by the colonial legislature.

India.—During the governor-generalship of Lord Lytton was passed the "Act for the better control of publications in Oriental languages," Act ix. of 1878. (1) By this Act copies of newspapers published out of British India are liable to forfeiture and seizure by warrant throughout the whole of British India if the papers "contain any words, signs, or visible representations likely to excite disaffection to the Government established by law in British India, or antipathy between any persons of different races, castes, religions, or sects in British India." The governor-general may, by notification in the *Gazette of India*, exclude newspapers, books, etc., from British India. (2) In places to which the Act is extended by order of the governor-general in council, a magistrate may require the printer and publisher of a newspaper to enter into a bond, with a deposit, not to publish a newspaper containing "any words, signs," etc. (as in 1), or to use or attempt to use it for the purpose of extortion or threat. The consequences of offending are forfeiture of the deposit, papers, press, etc. Books used for the illegal purposes above-mentioned are subject to forfeiture, but no bond or deposit is required previous to publication of books, as in the case of newspapers.

Foreign Press Laws.

Liberty of the press is the rule in most European states. This liberty is in almost every case secured by a constitution or organic law, the earliest being those of Sweden and Spain in 1812 In some states there is a tax upon newspapers and advertisements; in others, as in Sweden and Norway, there is none. In most states there is a Government official newspaper, and a Government printer, enjoying peculiar privileges.[1]

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[1] The writer wishes to take this opportunity of acknowledging the assistance rendered him by representatives of several foreign Governments.

Austria-Hungary.—Restraints upon the press were formerly very stringent, especially in the Italian provinces. Severe penalties against unlicensed printing were denounced by the penal code of 1808. For a second offence the offender was forbidden to deal in books. Private printing presses were forbidden under a fine of 500 florins. Inciting to emigration was one of the most remarkable press offences contained in this code. Two censors of the press were appointed in 1810. Booksellers were put under police supervision in Hungary in 1847. In 1848 the press became free for a time, until a restrictive law was again imposed in 1852. Strict censorship ceased in 1863. By the fundamental law concerning the rights of citizens, 21st December, 1867, art. 13, every one has the right of freely expressing his thoughts by the press within the limits imposed by law. The press cannot be controlled by censorship, or restrained by the system of authorization. Administrative and postal interdiction is never to extend to matters printed in the realm. By the law of the same date on judicial authority, art. 11, press offences are to be tried by jury. The constitution of 1867 (on the basis of that proposed in 1848) secures liberty of the press in Hungary.

Belgium—It was the prosecution of political writers by the Dutch Government that directly led to the independence of Belgium in 1830. By the Belgian constitution of 7th February, 1831, art. 18, it is declared that the press is free, that censorship shall never again be established, that sureties cannot be exacted from writers, editors, or printers, and that when the author is known and domiciled in Belgium the printer or bookseller cannot be prosecuted. By art. 98 press offences are to be tried by jury. The penal law of the press is contained in the decree of 20th July, 1831, made perpetual in 1833. By this law it is made an offence, apart from the penal code, (1) to incite to the commission of a crime by placards or printed writings in a public meeting; (2) to attack the obligatory force of the laws, or to incite to disobedience of them; (3) to attack the constitutional authority or inviolability of the king, the constitutional authority of the dynasty, or the authority and rights of the chambers. Every copy of a journal must bear the name of the printer and the indication of his domicile in Belgium. Proceedings for offences against the law must be taken in some cases within three months, in others within a year.

Brazil.—By art. 179 of the constitution of 1824 every one is entitled to express his thoughts by words and writings and publish them in print without liability to censure, but he is answerable for abuses committed in the exercise of this right.

(In most, if not all, of the Central and South American republics liberty of the press is one of the rights secured by the constitution. Thus in Chili it is secured by the constitution of 1833, in the Argentine Republic by that of 1860.)

Denmark.—Press offences were at one time punished with great severity. By the code of Christian V. (1683) libel was punished with infamy and hard labor for life, and, if against a magistrate, with death. Censorship was abolished and the press declared free by art. 86 of the constitution granted by Frederick VII. on 5th June, 1849, and confirmed by Christian IX. in 1866. Art. 81 forbids the search for or seizure of printed matter in a dwelling-house, unless after judicial proceedings.

France.—The Government began early to impose stringent restrictions upon printing. An edict of Henry II. in 1559 made it punishable with death to print without authority. The university of Paris originally claimed the right of licensing new theological works, a jurisdiction vested in the crown by an ordinance of 1566. Offences against religion were severely punished by the secular authorities. Thus the parliament of Toulouse sent Vanini to the stake in 1619 for the crime of publishing a heretical work. A few years later, in 1626, Cardinal Richelieu declared it a capital offence to publish a work against religion or the state. In 1723 appeared a regulation forbidding any but licensed booksellers to deal in books. Many later regulations were directed against unlicensed presses, the employment of more than a certain number of workmen, etc. At the Revolution all these restrictions were abolished, and the assembly declared it to be the right of every citizen to print and publish his opinions. This new liberty quickly needed a check, which was attempted as early as 1791, but no effectual restraint was imposed until the law of 5th February, 1810, established a direction of the press. The charter of Louis XVIII. in 1814 gave liberty to the press in express terms, but restrictions soon followed. In 1819 a system of sureties (*cautionnements*) replaced the censorship. The Revolution of 1830 was caused by, *inter alia*, one of the ordinances of St. Cloud (25th July, 1830) for suspension of the liberty of the press. Restrictions on the liberty were removed for the time in 1830 and 1852, only to be succeeded as usual by the press laws of 1835 and 1852. During the second empire Government prosecutions for libel were used as a powerful engine against the press. The proceedings against Montalembert in 1858 are a well-known instance. Between 1858 and 1866 many newspapers were suppressed by proclamation. With the republic liberty of the press was completely re-established. A decree of 27th October, 1870, submitted press offences to trial by jury.[1] The law of 29th July, 1881, by which the French press is now regulated, begins by asserting the liberty of the press and of bookselling. The principal limitations of this liberty are the prohibition to publish criminal proceedings before hearing in public, or lists of subscriptions for indemnifying an accused person, and the power of forbidding the entrance of foreign newspapers under certain circumstances (see vol. xvii. p. 438). The order of responsibility for printed matter is (1) the manager or editor, (2) the author, (3) the printer, (4) the vendor or distributor. Proceedings for breaches of the law must be taken within three months. As to taxation, the decree of 5th September, 1870, abolished the stamp duty upon newspapers, but it is still imposed upon public notices (*affiches*) other than those of public authorities. None but the notices of public authorities may be printed on white paper.

Germany.—Censorship was introduced by the diet of Spires in 1529. From that time till 1848 there were numerous restrictions on the liberty of the press. One of the most important was a resolution of the diet of 20th September, 1819, by which newspapers were subject to license and police supervision in each state. Liberty dates, as in Austria and Italy, from 1848. Soon after that year, however, it became necessary to establish press laws in most of the German states, as in Bavaria in 1850, Prussia and Baden in 1851. Since the establishment of the new empire censorship has disappeared. By art. 74 of the constitution of the empire (1871) every one attacking the empire or its officers through the press is liable to punishment in his own state. By art. 4 the laws relating to the press are under imperial and not local control. The press law of 7th May, 1874, is therefore in force throughout the whole empire. At its beginning it affirms the liberty of the press. Its main provisions are these. The name and address of the printer must appear on all printed matter. Newspapers and periodicals must in addition bear the name of some one person, domiciled in the empire, as responsible editor, and a copy of every number must be deposited with the police authorities of the district in which it is published. Foreign periodicals may be excluded by proclamation of the imperial chancellor for two years, if twice within the year they have been guilty of certain offences against the penal code. Criminal proceedings are not to be reported while still *sub judice.* The order of responsibility for offences is the same as in France. Proceedings must be taken within six months. In certain cases printed matter may be seized without the order of a court. This may take place where (1) the publication does not bear the name of printer or editor, (2) military secrets are revealed in time of war, (3) justice would be defeated by the publication not being immediately seized. A judicial tribunal is to decide at once upon the legality of the seizure. The press law is not to affect regulations made in time of war or internal disturbance. A temporary law passed in 1878 gave the police large powers in the case of socialistic publications.

Greece.—The constitution of Epidaurus, 1st January, 1822, did not specially mention, though no doubt it implied, liberty of the press. Under Otho censorship was exercised up to 1844. By the constitution of 18th March, 1844, every one may publish his thoughts by means of the press, observing the laws of the state. The press is free, and censorship (λογοκρισία) is not permitted. Responsible editors, publishers, and printers of newspapers are not required to deposit money on the ground of surety. Publishers of newspapers must be Greek citizens, art. 10. The legislature may exclude reporters from its sittings in certain cases, art. 48. Press offences are to be tried by jury, except when they deal only with private life, art. 93.

Holland.—The press has been free since the existence of the present kingdom of the Netherlands, which dates from 1815. Liberty of the press is expressly secured by art. 8 of the constitution of 1848. By art. 286 of the penal code seditious books and newspapers may be seized. By art. 283 of the same code and by a royal decree of 25th January, 1814, the name of the printer must appear upon newspapers. Press offences are not tried by jury.

Italy.—The strict licensing of the press in Italy excited the derision of Milton. In the *Areopagitica* he gives examples of the licenses of that period which were usually im-printed at the beginning of a book. The laws of the different states varied in severity. Thus it was a matter of complaint against Venice by Paul V. that she allowed the publication of works censured at Rome. The power of the church is seen in the fate of Bruno and Galileo. By art. 27 of the political code of Sardinia, granted by Charles Albert on 4th March, 1848, and still in force, the press is free, but abuses of the liberty are restrained by law. Bibles, catechisms, and liturgical works must be licensed by the bishop. The present press law of Italy is contained in the law of 26th March, 1848, as altered by later enactments. Everything printed in typographical characters, or by lithography or any similar means, must indicate the place and the date of printing and the name of the printer. A copy of everything printed must be deposited with certain officials and at certain libraries. Before the publication of any newspaper or periodical, notice of the intended publication must be given at the office of the secretary of state for internal affairs. The notice must contain (1) a declaration of the legal qualification of the person intending to publish, whether as proprietor or editor, (2) the nature of the publication, and (3) the name and residence of the responsible editor. Every newspaper is bound to insert gratuitously a contradiction or explanation of any charge made against a person in its columns. For contravention of these and other regulations there is a statutory penalty not exceeding 1000 lire (£40 [$194.40]). The publication of a newspaper may be suspended until the payment of a fine. The publication of parliamentary debates is permitted. Press offences are tried by a jury of twelve. By a law of 11th May, 1877, it is forbidden to publish any indication of the way in which individual judges or jurors voted in their deliberations.

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[1] See Dalloz, *Jurisprudence Générale*, s. v. "Presse"; Id., *Tables Alphabétiques*, 1845-77, s. v. "Presse."

Mexico.—A board or "junta" of censors existed during the Spanish dominion. The fundamental law of Mexico is now the constitution of 1857, as amended by subsequent additions. By art. 6 the expression of ideas cannot be the object of any judicial or administrative inquiry, unless in case of attacks on morality, public order, etc. By art. 7 the liberty of writing and publishing writings on any subject is inviolable. Censorship is abolished, and press offences are to be tried by one jury which testifies the act and another which applies the law and defines the penalty.

Norway.—The liberty of the press is secured by art. 100 of the constitution of 1814. No one can be punished for any writing unless he, or some one by his instigation, offend against the state, law, religion, or decency, or make infamous accusations against any one. Criticism of the Government is expressly permitted.

Ottoman Empire.—By art. 12 of the constitution of 23d December, 1876, the press was recognized as free, subject to the limits imposed by law. Press laws had been previously enacted on 5th March, 1865, and 12th March, 1867.

Portugal.—It is stated by Braga and others that a free press existed up to the establishment of the Inquisition, and that Gil Vicente (died 1536) was the last writer who dared to express his thoughts freely. At a later period Bocage was imprisoned for writings displeasing to the authorities. Boards of censorship under the names of the "Real Mesa Censoria," or the "Mesa do Desembargo do Paço," assumed to license publications. Liberty of the press was, however, finally secured, and censorship limited, by art. 7 of the constitution granted by John VI. in 1821. By art. 8 a special tribunal was constituted in both Portugal and Brazil to protect the liberty of printing. The censorship was confined to that exercised by the bishops over theological or dogmatic works. The debates in the legislature and proceedings in the courts of justice are not generally reported.

Roumania.—By the constitution of 30th June, 1866, art. 5, Roumanians enjoy liberty of the press. By art. 24 the constitution guarantees to all the liberty of communicating and publishing ideas through the press, every one being liable for abuse in cases determined by the penal code. Press offences are to be tried by jury. Censorship is abolished, and is never to be re-established. No previous authorization is necessary for the publication of newspapers. No sureties are to be demanded from journalists, writers, editors, or printers. The press is not to be subjected to regulation of advertisements. No newspaper or publication is to be suspended or suppressed. Every author is responsible for his writings; in default of the author, the manager or editor is responsible. Every newspaper must have a responsible manager in the possession of civil and political rights.

Russia.—The position of the Russian press generally is regulated by a law of 6th April, 1865. The effect of that law is to exempt from preventive censorship (if published in St. Petersburg or Moscow) all newspapers, periodicals, and original works and translations not exceeding a certain number of pages, and (wherever published) all Government publications, matter printed by academies, universities, and scientific bodies, and maps, plans, and charts. Everything printed and published that does not fall within any of these categories must, before issue to the public, be submitted for the approval of Government censors stationed in different parts of the empire. The minister of the interior has power to dispense with the preventive censorship in the case of provincial newspapers and periodicals. In St. Petersburg and Moscow the periodical press is subject to corrective censorship for infringement of the numerous restrictive regulations contained in the code, and supplemented at times by secret instructions from the minister of the interior to editors and publishers. It should be observed that, apart from the code, the sustained display of a spirit hostile to the Government renders the publisher of a periodical liable to punishment. The penalties established by the law of 1865 for offences against the press regulations consist in the infliction of a series of warnings published in the *Official Gazette.* A first warning merely enjoins more care for the future; a second is followed by suspension for a certain period, sometimes by a prohibition to insert advertisements; a third by suppression, and perhaps prosecution of the offending conductor. By imperial ukase of 2d June, 1872, the jurisdiction of the judicial tribunals over press offences was practically transferred to the minister of the interior, except in the case of violation of private rights, as by libel. The law of 1865 was modified in 1874 by a regulation to the effect that all publications appearing at longer intervals than one week should be submitted to the central board of censors. This is applied to all periodicals that had been formerly published without preventive censorship. By a ukase issued in 1881 a committee of four members is entrusted with the decision of all matters relating to the press submitted to it by the minister of the interior. The strictest supervision is exercised over the foreign press, periodical and otherwise. None but a few privileged individuals, such as members of the royal family, foreign diplomatists, and editors of newspapers in the capital, may receive foreign publications free of censorship. The censorship consists in blackening out, and sometimes in the excision, of whole columns and sheets of publications that may be deemed pernicious. Only such periodicals as are placed on a list approved by the board of censors are allowed to be received through the post-office by non-privileged persons. Telegraphic messages to newspapers are subject to strict censorship. The Russian telegraphic press agency is entirely under official management.

Spain.—There was probably no country where restrictions on the liberty of the press were at one time more stringent than in Spain. From the first use of printing up to 1521 censorship was exercised by the crown; after that date the Inquisition began to assume the right, and continued to do so up to its suppression in 1808. In 1558 Philip II. denounced the penalty of death against even the possessor of a book upon the *Index Expurgatorius* of the Inquisition. Some of the greatest names in Spanish literature were sufferers; Castillejo, Mendoza, Mariana, and Quevedo incurred the displeasure of the Inquisition; Luis Ponce de Leon was imprisoned for his translation of the Song of Solomon. The last *Index* appeared in 1790.[1] In 1812 the constitution promulgated by the regency in the name of Ferdinand VII. provided by art. 371 that all Spaniards should have liberty to write, print, and publish their political ideas without any necessity for license, examination, or approbation previous to publication, subject to the restrictions imposed by law. Art. 13 of the constitution of 30th June, 1876, promulgated on the accession of Alphonso XII., practically re-enacts this provision.

Sweden.—The press law of 16th July, 1812, is one of the fundamental laws of Sweden. It is an expansion of art. 86 of the constitution of 6th June, 1809. Liberty of the press is declared to be the privilege of every Swede, subject to prosecution for libellous writing. Privileges of individuals as to publications are abolished. The title and place of publication of every newspaper or periodical must be registered, and every publication must bear the name of the printer and the place of printing. Press offences are tried by a jury of nine, chosen respectively by the prosecutor, the prisoner, and the court. The verdict of two-thirds of the jury is final.

Switzerland.—Liberty of the press is secured by art. 45 of the constitution of 1848, re-enacted by art. 55 of the constitution of 29th May, 1874. Each canton has its own laws for the repression of abuse of the liberty, subject to the approbation of the federal council. The confederation can impose penalties on libels directed against itself or its officers. (J. W†.)

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[1] See Ticknor, *Hist. of Span. Lit.*, vol. i. p. 422 *sq.*, vol. iii. p. 366.

PRESTER JOHN. The history of Prester John is that of a phantom, taking many forms. It no doubt originally was based on some nucleus of fact, or connected itself with some such nucleus, though what that nucleus was has been much controverted and is extremely difficult to determine. But the name and the figure which it suggested occupied so prominent a place in the mind of Europe for two or three centuries that a real history could hardly have a stronger claim to exposition here than this history of a will-o'-the-wisp.

Before Prester John, *eo nomine*, appears upon the scene we find the way prepared for his appearance by the presentation of a kindred fable, and one which certainly entwined itself with the legends about Prester John after his figure had lodged itself in the popular imagination of Europe. This is the story of the appearance at Rome (1122), in the pontificate of Calixtus II., of a certain Oriental ecclesiastic, whom one account styles "John, the patriarch of the Indians," and another "an archbishop of India." This ecclesiastic related the most wonderful stories of the shrine of St. Thomas in India, and of the posthumous and still recurring miracles which were wrought there periodically by the body of the apostle, including the distribution of the sacramental wafer by his hand, and many other marvellous things. We cannot regard the appearance at Rome of the personage who related these marvels in presence of the pope as a mere popular fiction; it rests on two authorities apparently independent (one of them a letter from Odo of Rheims, abbot of St. Remy from 1118 to 1151), for their discrepancies show that one was not copied from the other, though in the principal facts they agree.

Nearly a quarter of a century later Prester John appears upon the scene, in the outline, at least, of the character which long adhered to him, viz., that of a Christian conqueror and potentate of enormous power and splendor, who combined the characters of priest and king, and ruled over vast dominions in the far East. This idea was universal in Europe from about the middle of the 12th century to the end of the 13th or beginning of the 14th. The Asiatic story then gradually died away, but the name remained as firmly rooted as ever, and the royal presbyter was now assigned a locus in Ethiopia. Indeed, as we shall see, it is not an improbable hypothesis that from a very early date in the history of this phantom its title was assigned to the Abyssinian king, though for a time this identification was overshadowed by the prevalence of the Asiatic legend. At the bottom of the double allocation there was, no doubt, that association or confusion of Ethiopia with India which is as old as Virgil, and perhaps much older.

The first mention of Prester John occurs in the chronicle of Otho or Otto, bishop of Freisingen. This writer states that when at the papal court in 1145 he met with the bishop of Gabala (Jibal in Syria), who related how, "not many years before one John, king and priest (*rex et sacerdos*), who dwelt in the extreme Orient beyond Persia and Armenia and was, with his people, a Christian but a Nestorian, had made war against the brother kings of the Persians and Medes, who were called Samiards (or Sanjards), and captured Egbatana their capital. The battle with those princes endured three days, but at last *Presbyter John*—for so he was wont to be styled—routed the Persians with immense slaughter. After this victory the aforesaid John was advancing to fight in aid of the church at Jerusalem; but, when he arrived at the Tigris, and found no possible means of transport for his army, he turned northward, as he had heard that the river in that quarter was frozen over in winter-time. After halting on its banks for some years (*per aliquot annos*) in expectation of a frost he was obliged to return to his own land. This personage was said to be of the ancient race of the Magi mentioned in the gospel, to rule the same nations that they ruled, and to have such a plenitude of wealth and glory that he used none but a sceptre of solid emerald. It was as fired by the example of his ancestors (they said) that he was proposing to go to Jerusalem when thus obstructed." We cannot say how far the report of the bishop of Gabala, or other rumors of the events on which this was founded, made an impression on Europe at that time. But there can be no doubt about the impression that was made some twenty years later (*c.* 1165) by the wide circulation of a letter which purported to have been addressed by the potentate in question to the Greek emperor Manuel. This letter, professing to come from "Presbyter Joannes, by the power and virtue of God and of the Lord Jesus Christ, Lord of Lords," is filled with the most extravagant details of the greatness and splendor of the writer. He claims to be the greatest monarch under heaven, as well as a devout Christian and protector of Christians. And it was his desire to visit the Holy Sepulchre with a great host, and to subdue the enemies of the Cross. Seventy-two kings, reigning over as many kingdoms, were his tributaries. His empire extended over the three Indies, including that Further India where lay the body of St. Thomas, to the sun-rising, and back again down the slope to the ruins of Babylon and the tower of Babel. All the wild beasts and monstrous creatures commemorated in current legend were to be found in his dominions, as well as all the wild and eccentric races of men of whom strange stories were told, including those unclean nations whom Alexander Magnus walled up among the mountains of the north, and who were to come forth at the latter day,—and so were the Amazons and the Bragmans. His dominions contained the monstrous ants that dug gold and the fish that gave the purple; they produced all manner of precious stones and all the famous aromatics. Within them was found the Fountain of Youth; the pebbles which give light, restore sight, and render the possessor invisible; the Sea of Sand was there, stored with fish of wondrous savor; and the River of Stones was there also; besides a subterranean stream whose sands were of gems. His territory produced the worm called "salamander," which lived in fire, and which wrought itself an incombustible envelope from which were manufactured robes for the presbyter, which were washed in flaming fire. When the king went forth to war thirteen great crosses made of gold and jewels were carried in wagons before him as his standards, and each was followed by 10,000 knights and 100,000 footmen. There were no poor in his dominions, no thief or robber, no flatterer or miser, no dissensions, no lies, and no vices. His palace was built after the plan of that which St. Thomas erected for the Indian king Gondopharus. Of the splendor of this details are given. Before it was a marvellous mirror erected on a many-storied pedestal (described in detail); in this speculum he could discern everything that went on throughout his dominions, and detect conspiracies. He was waited on by seven kings at a time, by sixty dukes and 365 counts; twelve archbishops sat on his right hand, and twenty bishops on his left besides the patriarch of St. Thomas's, the protopope of the Sarmagantians (Samarkand?), and the archprotopope of Susa, where the royal residence was. There was another palace of still more wonderful character, built by the Presbyter's father in obedience to a heavenly command, in the city of Bribric. Should it be asked why, with all this power and splendor, he calls himself merely "presbyter," this is because of his humility, and because it was not fitting for one whose sewer was a primate and king, whose butler an archbishop and king, whose chamberlain a bishop and king, whose master of the horse an archimandrite and king, whose chief cook an abbot and king, to be called by such titles as these. But the extent of his power and dominion could only be told when the number of the stars of heaven and of the sands of the seashore could be told.

How great was the popularity and diffusion of this letter may be judged in some degree from the fact that Herr Zarncke in his elaborate treatise on Prester John gives a list of close on a hundred MSS. of it. Of these there are eight in the British Museum, ten at Vienna, thirteen in the great Paris library, fifteen at Munich. There are also several renderings in old German verse. Many circumstances of the time tended to render such a letter acceptable. Christendom would welcome gladly the intelligence of a counterpoise arising so unexpectedly to the Mohammedan power; whilst the statements of the letter itself combined a reference to and corroboration of all the romantic figments concerning Asia which already fed the curiosity of Europe, which figured in the world-maps, and filled that fabulous history of Alexander which for nearly a thousand years supplanted the real history of the Macedonian throughout Europe and western Asia.

The only other surviving document of the 12th century bearing on this subject is a letter of which MS. copies are preserved in the Cambridge and Paris libraries, and which is also embedded in the chronicles of several English annalists, including Benedict of Peterborough, Roger Hovedon, and Matthew Paris. It purports to have been indited from the Rialto at Venice by Pope Alexander III. on the 5th day before the calends of October (27th September), data which fix the year as 1177. The pope addresses himself as *Alexander episcopus, servus servorum dei, carissimo in Christo filio Johanni, illustro et magnifico indorum regi* [Hovedon's copy here inserts *sacerdoti sanctissimo*], *salutem et apostolicam benedictionem.* He recites how he had heard of the monarch's Christian profession, diligence in good works, and piety by manifold narrators and common report, but also more particularly from his (the pope's) beloved son Master Philip, his physician and confidant (*medicus et familiaris noster*), who had received information from honorable persons of the monarch's kingdom, with whom he had intercourse in those (Eastern) parts. Philip had also reported the king's anxiety for instruction in Catholic discipline and for reconciliation with the apostolic see in regard to all discrepancies. Philip had also heard from the king's people that he fervently desired to have a church in Rome and an altar at Jerusalem. The pope goes on to say that he found it too difficult, on account of the length and obstructions of the way, to send any one (of ecclesiastical position?) *a latere*, but he would dispatch the aforesaid Philip to communicate instruction to him. And on accepting Philip's communications the king should send back honorable persons bearing letters sealed with his seal, in which his wishes should be fully set forth. "The more nobly and magnanimously thou conductest thyself, and *the less thou vauntest of thy wealth and power* (quanto . . . minus de divitiis et potentia tua videris inflatus), the more readily shall we regard thy wishes both as to the concession of a church in the city and of altars in the church of SS. Peter and Paul, and in the church of the Lord's Sepulchre at Jerusalem, and as to other reasonable requests."

There is no express mention of the title "Prester John" in what seem the more genuine copies of this letter. But the address and the expression in the italicized passage just quoted (which evidently alludes to the vaunting epistle of 1165) hardly leave room for doubt that the pope supposed himself to be addressing the (imaginary) author of that letter. To whom the reports of Philip the physician in reality referred is a point that will be discussed below. We do not know how far the imaginations about Prester John retained their vitality in 1221, forty-four years after the letter of Pope Alexander, for we know of no mention of Prester John in the interval. But in that year again a rumor came out of the East that a great Christian conqueror was taking the hated Moslems in reverse and sweeping away their power. Prophecies current among the Christians in Syria of the destruction of Mohammed's sect after six centuries of duration added to the excitement attending these rumors. The name ascribed to the conqueror was David, and some called him the son or the grandson of Prester John of India. He whose conquests and slaughters now revived the legend was in fact no Christian or King David but the famous Jenghiz Khán. The delusion was dissipated slowly, and even after the great Tartar invasion and devastation of eastern Europe its effects still influenced the mind of Christendom and caused popes and kings to send missions to the Tartar hordes with a lingering feeling that their kháns, if not already Christians, were at least always on the verge of conversion.

Before proceeding farther we must go back on the bishop of Gabala's story and elucidate it as far as we can. The most accomplished of modern geographical antiquaries, M. d'Avezac, first showed to whom the story must apply. The only conqueror whose career suits in time and approximates in circumstances is the founder of Kará-Khitái, which existed as a great empire in Central Asia during the latter two-thirds of the 13th century. This personage was a prince of the Khitái or Khitaian dynasty of Liao, which had reigned over northern China and the regions beyond the Wall during a great part of the 10th and 11th centuries, and from which came the name Khitái (Cathay), by which China was once known in Europe and still is known in Russia. On the overthrow of the dynasty about 1125 this prince, who is called by the Chinese Yeliu Tashi, and who had gone through a complete Chinese education, escaped westward with a body of followers. Being well received by the Uighurs and other tribes west of the desert, subjects of his family, he gathered an army and commenced a course of conquest which eventually extended over eastern and western Turkestan. He took the title of Gur Khán or Kor Khán, said to mean "universal" or "supreme" khán, and fixed at Balasaghun, north of the T'ian Shan range, the capital of his empire, which became known as that of Kará-Khitái (Black Cathay). In 1141 the assistance of this Khitaian prince was invoked by the sháh of Kharezm against Sanjár, the Seljúk sovereign of Persia, who had expelled the sháh from his kingdom and killed his son. The Gur Khán came with a vast army of Turks, Khitaians, and others, and defeated Sanjár near Samarkand (September, 1141) in a great battle, which the historian Ibn al-Athir calls the greatest and most sanguinary defeat that Islam had ever undergone in those regions. Though the Gur Khán himself is not described as having extended his conquests into Persia, the sháh of Kharezm followed up the victory by invading Khorásan and plundering the cities and treasuries of Sanjár. In this event—the defeat of Sanjár, whose brother's son, Mas'úd, reigned over Western Persia—occurring just four years before the story of the Eastern conqueror was told at Rome to Bishop Otto, we seem to have the destruction of the *Samiardi fratres* or Sanjár brothers, which was the germ of the story of Prester John.

There is no evidence of any profession of Christianity on the part of the Gur Khán, though it is a fact that the daughter of the last of his race is recorded to have been a Christian. The hosts of the Gur Khán are called by Moslem historians *Al-Turk-al-Kuffár*, the kafir or infidel Turks; and we know that in later days the use of this term "kafir" often led to misapprehensions, as when Vasco da Gama's people were led to take for Christians the Banyan traders on the African coast, and to describe as Christian sovereigns so many princes of the farther East of whom they heard at Calicut. Of the rest of the accretions to the story little can be said except that they are of the kind sure to have grown up in some shape when once the Christianity of the conqueror was assumed. We have said that Prester John was a phantom; and we know out of what disproportionate elements phantoms are developed. How the name John arose is one of the obscure points. Oppert supposes the title "Gur

Khán" to have been confounded with Yukhanan or Johannes; and of course it is probable that even in the Levant the stories of "John the patriarch of the Indies," repeated in the early part of this article, may have already mingled with the rumors from the East.

The obvious failure in the history of the Gur Khán to meet all points in the story of the bishop of Gabala led Professor Bruun of Odessa to bring forward another candidate for identity with the original Prester John, in the person of the Georgian prince John Orbelian, the "sbasalar," or generalissimo under several kings of Georgia in that age. Space forbids our stating all the ingenious arguments and coincidences with which Professor Bruun supported his theory. Among other arguments he does show some instances, in documents of the 15th century, of the association of Prester John with the Caucasus. In one at least of these the title is applied to the king of Abassia, *i.e.*, of the Abhasians of Caucasus. Some confusion between Abash (Abyssinia) and Abhas seems to be possibly at the bottom of the imbroglio. An abstract of Professor Bruun's argument will be found in the second edition of *Marco Polo*, vol. ii. pp. 539–542. We may quote here the conclusion arrived at in winding up that abstract. "Professor Bruun's thesis seems to me more than fairly successful in *paving the way* for the introduction of a Caucasian Prester John; the barriers are removed, the carpets are spread, the trumpets sound royally,—but the conquering hero comes not. He does very nearly come. The almost royal power and splendor of the Orbelians at this time is on record. . . . (see St. Martin, *Mém. sur l'Arménie*, ii. 77) . . . Orpel Ivane, *i.e.*, John Orbelian, Grand Sbasalar, was for years the pride of Georgia, and the hammer of the Turks. . . . But still we hear of no actual conflict with the chief princes of the Seljukian house, and of no event in his history so important as to account for his being made to play the part of *Presbyter Johannes* in the story of the Bishop of Gabala." As regards any real foundation for the title of "Presbyter" we may observe that nothing worth mentioning has been alleged on behalf of any candidate.

When the Mongol conquests threw Asia open to Frank travellers in the middle of the 13th century their minds were full of Prester John; they sought in vain for an adequate representative, nor was it in the nature of things that they should not find *some* representative. In fact they found *several*. Apparently no real tradition existed among the Eastern Christians of such a personage; the myth had taken shape from the clouds of rumor as they rolled westward from Asia. But the persistent demand produced a supply; and the honor of identification with Prester John, after hovering over one head and another, settled for a long time upon that of the king of the Nestorian tribe of Kerait, famous in the histories of Jenghiz under the name of Ung or Awang Khán. We may quote an illustration from geographical analogy: "Pre-Columbian maps of the Atlantic showed an island of Brazil, an island of Antillia, founded —who knew on what?—whether on the real adventure of a vessel driven in sight of the Azores or Bermudas, or on mere fancy and fogbank. But when discovery really came to be undertaken, men looked for such lands and found them accordingly. And there they are in our geographies, Brazil and the Antilles."[1]

In Plano Carpini's (1248) single mention of Prester John as the king of the Christians of India the Greater, who defeats the Tartars by an elaborate stratagem, Oppert recognizes Jaláluddín of Kharezm and his brief success over the Mongols in Afghánistan. In the Armenian prince Sempad's account (1248), on the other hand, this Christian king of India *is aided* by the Tartars to defeat and harass the Saracens, and becomes the vassal of the Mongols. In the narrative of William Rubruquis (1253), though distinct reference is made to the conquering Gur Khán under the name of Coir Cham of Caracatay, the title of "King John" is assigned to Kushluk, king of the Naimans, who had married the daughter of the last lineal representative of the gur kháns.[2] And from the remarks which Rubruquis makes in connection with this King John, on the habit of the Nestorians to spin wonderful stories out of nothing, and of the great tales that went forth about King John, it is evident that the intelligent traveller supposed this king of the Naimans to be the original of the widely-spread legend. He mentions, however, a brother of this John called Unc who ruled over the Crit and Merkit (or Kerait and Mekrit, two of the great tribes of Mongolia), whose history he associates with that of Jenghiz Khán. Unc Khán reappears in Marco Polo, who tells much about him as "a great prince, the same that we call Prester John, him in fact about whose great dominion all the world talks." This Unc was in fact the prince of the Kerait, called by the Chinese Tuli, and by the Persian historians of the Mongols Toghral, on whom the Kin emperor of north China had conferred the title of "wang" or king, whence his coming to be known as Awang or Ung Khán. He was long the ally of Jenghiz, but a breach occurred between them, and they were mortal enemies till the death of Ung Khán in 1203. In the narrative of Marco Polo "Unc Can," *alias* Prester John, is the liege lord of the Tartars, to whom they paid tribute until Jenghiz arose. And this is substantially the story repeated by other European writers of the end of the 13th century, such as Ricold of Montecroce and the Sieur de Joinville, as well as by one Asiatic, the famous Christian writer, Gregory Abulfaraj. We can find no Oriental corroboration of the claims of Ung Khán to supremacy over the Mongols. But that his power and dignity were considerable appears from the term "Pádsháh," which is applied to him by the historian Rashíduddín.

We find Prester John in one more phase before he vanishes from Asiatic history, real or mythical. Marco Polo in the latter part of the 13th century, and Friar John of Montecorvino, afterwards archbishop of Cambaluc, in the beginning of the 14th, speak of the descendants of Prester John as holding territory under the great khán in a locality which can be identified with the plain of Kuku-Khotan, north of the great bend of the Yellow River and about 280 miles northwest of Peking. The prince reigning in the time of these two writers was named King George, and was the "6th in descent from Prester John," *i.e.*, no doubt from Awang Khán. Friar Odoric, about 1326, visited the country still ruled by the prince whom he calls Prester John; "but," he says, "as regards him, not one hundredth part is true that is told of him." With this mention Prester John ceases to have any pretension to historical existence in Asia (for we need not turn aside to Mandeville's fabulous revival of old stories or to the barefaced fictions of his contemporary, John of Hese, which bring in the old tales of the miraculous body of St. Thomas), and his connection with that quarter of the world gradually died out of the memory of Europe.[3]

When next we begin to hear his name it is as an African, not as an Asiatic prince; and the personage so styled is in fact the Christian king of Abyssinia. The learned Ludolf has asserted that this application was an invention of the Portuguese and arose only in the 15th century. But this is a mistake; for in fact the application had begun much earlier, and probably long before the name had ceased to be attached by writers on Asia to the descendants of the king of the Kerait. It is true that Simon Sigoli, who visited Cairo in 1384, still speaks of "Presto Giovanni" as a monarch dwelling in India; but it is the India which is conterminous with the dominions of the soldan of Egypt, and whose lord is master of the Nile, to close or open its discharge upon Egypt.[4] Thirty years earlier (*c.* 1352) John Marignolli speaks of Ethiopia where the Negroes are, and which is called the land of Prester John.[5] Going back still farther, Friar Jordanus, who returned from the East before 1328, speaks of the emperor of the Ethiopians "quem vos vocatis *Prestre Johan*."

But, indeed, we shall have strong probability on our side if we go back much farther still, and say that, however vague may have been the ideas of Pope Alexander III. respecting the geographical position of the potentate whom he addressed from Venice in 1177, the only real person to whom the letter can have been sent was the king of Abyssinia. Let it be observed that the "honorable persons of the monarch's kingdom" whom the leech Philip had met with in the East must have been the representatives of some real power, and not of a phantom. It must have been a real king and not a rumor-begotten ignis fatuus who professed to desire reconciliation with the Catholic Church and the assignation of a church at Rome and of an altar at Jerusalem. Moreover, we know that the Ethiopic Church did long possess a chapel and altar in the Church of the Holy Sepulchre, and, though we have been unable to find travellers' testimony to this older than about 1497, it is quite possible that the appropriation may have originated much earlier.[1] We know from Marco Polo that about a century after the date of Pope Alexander's epistle a mission was sent by the king of Abyssinia to Jerusalem to make offerings on his part at the Church of the Sepulchre. It must be remembered that at the time of the pope's letter Jerusalem, which had been taken from the Moslem in 1099, was still in Christian possession. Abyssinia had been going through a long period of vicissitude and distraction. In the 10th century the royal line had been superseded by a dynasty of Falasha Jews, followed by other Christian families; but weakness and disorder continued till the restoration of the "House of Solomon" (c. 1268). Nothing is more likely than that the princes of the "Christian families" who had got possession of the throne of northern Abyssinia should have wished to strengthen themselves by a connection with European Christendom, and to establish relations with Jerusalem, then in Christian hands. We do not know whether the leech Philip ever reached his destination, or whether a reply ever came back to the Lateran.[2]

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[1] App. to *Marco Polo*, 2d ed., ii. 543.

[2] It has been pointed out by Mr. Alexander Wylie that Kushluk was son of a powerful king of the Naimans, whose name Ta-Yang-Khán is precisely "Great King John" as nearly as that could be expressed in Chinese.

[3] The stories of Khitái as a Christian empire, which led the Jesuits at the Court of Akbar to despatch Benedict Goes in search of it (1601), did, however, suggest to Jerome Xavier, their chief, that the country in question "was the Cathay of Marco Polo, and its Christian king the representative of the famous Prester John"—a jumble of inaccuracy.

[4] So Ariosto—

"Si dice che 'l Soldan Re dell' Egitto
A quel Re dà tributo e stà soggetto,
Perch'è in poter di lui dal cammin dritto
Levare il Nilo e dargli altro ricetto,
E per questo lasciàr subito afflitto
Di fame il Cairo e tutto quel distretto.
Senapo detto è dai suddetti suoi;
Gli diciam *Presto o Prete Ianni* noi."

[5] In a Spanish work of about the same date, by an anonymous Franciscan, we are told that the emperor called "Abdeselib, which means 'servant of the Cross,' is a protector of *Preste Juan*, who is the patriarch of Nubia and Ethiopia, and is lord of many great lands, and many cities of Christians, though they be black as pitch, and brand themselves with the sign of the cross in token of their baptism" (*Libro del conoscimento de todos reynos*, etc., printed at Madrid, 1877).

Baronius, who takes the view for which we have been arguing, supposes it possible that the church in Rome possessed in his own time by the Abyssinians (St. Stephen's in the Vatican) might have been granted on this occasion. But we may be sure that this was a modern concession during the attempts to master the Ethiopian Church early in the 16th century. Ludolf intimates that its occupancy had been taken from them in his own time after it had been held "for more than a century."

In the legendary history of the *Translation of the Three Blessed Kings* by John of Hildesheim (c. 1370), of which an account and extracts are given by Zarncke (Abhandl. ii., 154 *sq.*), we have an evident jumble in the writer's mind between the Asiatic and the African location of Prester John; among other matters it is stated that Prester John and the Nubians dug a chapel out of the rock under Calvary in honor of the three kings: "et vocatur illa capella in partibus illis capella Nubiyanorum ad reges in præsentem diem, sed Sarracini . . . ob invidiam obstruxerunt (p. 158)."

There is no need to proceed further. From the 14th century onwards Prester John had found his seat in Abyssinia. It is there that Fra Mauro's great map (1459) presents a fine city with the rubric, "Qui il Preste Janni fa residentia principal." When, nearer the end of the century (1481–95), King John II. of Portugal was prosecuting inquiries regarding access to India his first object was to open communication with "Prester John of the Indies," who was understood to be a Christian potentate in Africa, and regarding whom information was sought "through Abyssinian monks who visited these Spanish regions, and also through certain friars who went from this country to Jerusalem." And when Vasco da Gama went on his memorable voyage from Mozambique northwards he began to hear of "Preste Johani" as reigning in the interior,—or rather, probably, by the light of his preconceptions of the existence of that personage in east Africa he thus interpreted what was told him. More than twenty years later, when the first book on Abyssinia was composed—that of Alvarez —the title, constantly and as a matter of course designating the king of Abyssinia, is "Prester John," or simply "the Preste." The name occurs on almost every page of the narrative beginning with page 1, though in the translation printed for the Hakluyt Society that which the editor calls "general index" gives no indication of the fact.

The name of "Prester John" suggested alike to scholars and sciolists, first in its Oriental and then in its Ethiopian connection, many fanciful and strained etymologies, from Persian, Hebrew, Ethiopic, and what not, and on the assumption that neither "Presbyter" nor "John" was any proper element of the name. But for these dreams this passing notice must suffice.

On the whole subject in its older aspects, see Ludolf's *Historia Æthiopica* and its *Commentary, passim.* The excellent remarks of M. d'Avezac, comprising a conspectus of almost the whole essence of the subject, are in the *Recueil de voyages et de Mémoires*, published by the Société de Géographie, vol. iv., Paris, 1839, pp. 547–564. Two German works of importance which have been used in this article are the interesting and suggestive *Der Presbyter Johannes in Sage und Geschichte*, by Dr. Gustav Oppert (2d. ed., Berlin, 1870), and, most important of all in its learned, careful, and critical collection and discussion of all the passages bearing on the subject, *Der Priester Johannes*, by Friedrich Zarncke of Leipsic (1876–79), still unfortunately unfinished, and without the summing up which is required to complete the subject. The present writer has given considerable attention to the subject, and discussed it partially in *Cathay and the Way Thither*, p. 173 *sq.*, and in *Marco Polo*, 2d. ed., i. 229–233, ii. 539–543. (H. Y.)

PRESTON, a market-town and municipal and parliamentary borough of Lancashire, is situated on the north bank of the Ribble, on the Lancaster Canal, and at the junction of several railway lines, 28 miles northeast of Liverpool and 31 northwest of Manchester. It consists chiefly of one long street, running from east to west along a steep ridge above the Ribble, which is crossed by six bridges, three of which are railway bridges. The parish church of St. John, rebuilt in 1855 in the Decorated style, occupies the site of a very ancient structure. A large number of ecclesiastical parishes have been formed within recent years, but none of the churches possess special architectural features. The Catholic church of St. Walpurgis or St. Walpurge is an elaborate structure in the Early Decorated style, erected in 1854, and since then extensively altered. There are several good public buildings, including the town-hall (1867 in the Early Gothic style, from designs by Sir Gilbert Scott), the prison (1789), the corn exchange and market-house (1824), the courthouse (1829), the borough magistrates' court (1858), the covered market (1870), the county offices (1882), the public baths, and the barracks. The most important public institution is the free public library and museum, established in 1879. The building was erected, from designs by Mr. J. Hibbert, at a cost of £75,000 [$364,500] by the trustees of Mr. E. R. Harris, whose name it bears, a further sum of £30,000 [$145,800] being appropriated by them to furnish and endow the library and museum, which are to be maintained in efficiency forever by the corporation. This body gave the site in the principal market-place at a cost of £30,000 [$145,800]. Here is placed Dr. Shepherd's library, founded in 1761, of nearly 9000 volmes, as well as a collection of pictures, etc., valued at £40,000 [$194,400], bequeathed by Mr. R. Newsham. The Harris Institute, endowed by the above-named trustees with £40,000 [$194,400], is established in a building of classical style erected in 1849, wherein are held science and art classes, and where is placed a thoroughly equipped chemical laboratory. For the grammar-school, founded in 1550, a building in the Tudor style was erected in 1841 by private shareholders, but in 1860 they sold it to the corporation, who now have the management of the school. The blue-coat school, founded in 1701, was in 1817 amalgamated with the national schools. Preston is well supplied with public recreation grounds, including Avenham Park, the Miller Park with a statue of the 14th earl of Derby, and the Moor Park. Winckley Square, near the centre of the town, has a monument to Sir Robert Peel.

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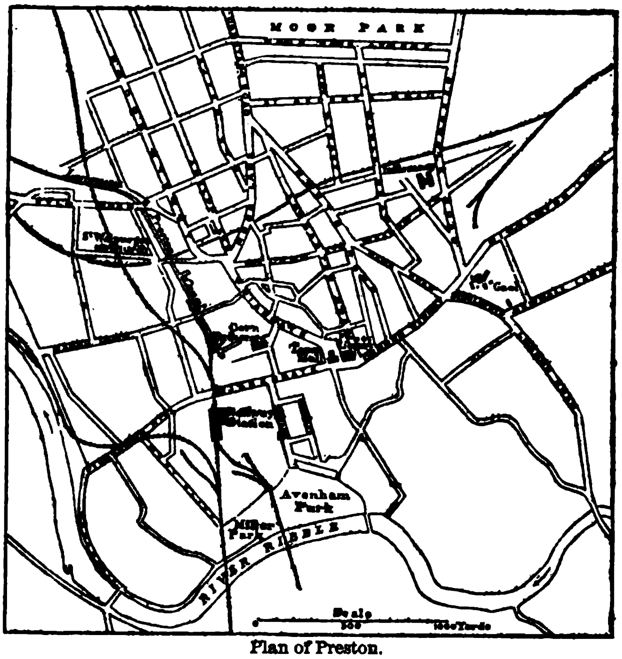
[1] Indeed, we can carry the date back half a century further by the evidence of a letter translated in Ludolf (*Comment.*, p. 303). This is addressed from Shoa by the king Zara Jacob in the eighth year of his reign (1442) to the Abyssinian monks, dwellers at Jerusalem. The king desires them to light certain lamps in the Church of the Sepulchre, including "three in our chapel." In the *Pilgerfahrt des Ritters Arnold von Harff* (1496–99), Cologne, 1860, p. 175, we find it stated that the Abyssinians had their chapel, etc., to the left of the Holy Sepulchre, between two pillars of the temple, whilst the Armenian chapel was over theirs, reached by a stone staircase alongside of the Indians (or Abyssinians). This exactly corresponds with the plan and references given in Sandys's *Travels* (1615, p. 162), which shows the different chapels. The first on the south, *i.e.*, the left looking from the body of the church, is "No. 35.—The chappell of the Abisines, over which the chappell of the Armenians." A reference to Jerusalem, which we procured through the kindness of Mr. Walter Besant, shows that the Abyssinians no longer have a chapel or privileges in the Church of the Sepulchre. Between the Armenians and the Copts they have been deprived of these, and even of the keys of their convent. The resentment of King Theodore at the loss of these privileges was one of the indirect causes which led to the war between him and England in 1867–68.

[2] Matthew Paris gives a letter from Philip, prior of the Dominicans in Palestine, which reached the pope in 1237, and which speaks of a prelate from whom he had received several letters, "qui præst omnibus quos Nestoriana hæresis ab ecclesia separavit (cujus prælatio per Indiam Majorem, et per regnum sacerdotis Johannis, et per regna magis proxima Orienti dilatatur)." We have little doubt that Abyssinia was the "regnum" here indicated, though it was a mistake to identify the Abyssinian Church with the Nestorians.

Formerly "proud" Preston was a place of "fashion and society"; but the introduction of the linen manufacture at the end of the 18th century completely altered its character. The inventions of Sir Richard Arkwright, who was a native of the town, found in Preston early acceptance; and owing to its convenient communications by river, canal, and railway, aided by native enterprise, it has become one of the principal seats of the cotton manufacture in Lancashire.



Plan of Preston.

There are also iron and brass foundries, engineering works, cotton-machinery works, and steam boiler works, and a considerable and increasing coasting trade with Ireland and England. In 1826 Preston became a creek of Lancaster; in 1839 it was included in the new port of Fleetwood; and in 1843 it was constituted an independent port. The number of vessels that entered the port in 1883 was 129 of 9365 tons, the number that cleared 137 of 9854 tons. By the deepening of the Ribble vessels of considerable tonnage can now unload at the new quay. But much more extensive operations in connection with the improvement of the port have (1885) been projected. At an estimate cost of £800,000 [$3,888,000], the Ribble is to be deepened for a distance of about 12 miles to the point where it falls into the Irish Sea, and a new wet dock is to be constructed, with an area of 40 acres, in the centre of the Ribble valley, between the existing river-course and the intended diversion of the channel. The dock will be 13,240 feet long and 600 feet wide. Four large warehouses are to be erected along the entire length of its east side. In addition to the main dock a timber dock of 25 acres is to be constructed, and also two large graving-docks, enabling vessels up to 1000 tons burden to be constructed.

The population of the parliamentary borough in 1811 was 17,115, in 1841 50,073, in 1871 85,427, and in 1881 93,720; that of the municipal borough, the area of which was extended in 1880 to 3721 acres, amounted in 1881 to 96,537 (males 44,264, females, 52,273). Preston returns two members to the House of Commons.

At Walton-le-Dale, close to Preston, where the Roman road crosses the Ribble, there are remains of a Roman post. Saxon ware, as well as Roman remains and coins, have been found in the neighborhood. The mound at Penwortham, to the southwest of the town, was probably a mote-hill of the Saxons. Preston owes its rise to the decay of Ribchester, which it gradually superseded as the port of the Ribble. In the reign of Athelstane the whole district of Amounderness was granted to the cathedral-church of York. The capital of the hundred, on account of this ecclesiastical connection, came to be known as "Priest's town," afterwards changed to "Preston." It possessed two monastic foundations, (1) a convent of Gray Friars founded in 1221 by Edmund, earl of Lancaster, son of Henry II., a little to the west of the Friargate, and occupied after the dissolution first as a private residence, then until 1790 as the house of correction, and subsequently as cottages, and now superseded by an iron-foundry; and (2) an ancient hospital dedicated to St Mary Magdalen, now occupied by the Roman Catholic church of St. Walpurgis. The town is celebrated for its merchant guild celebrations, of which the earliest on record is that of 1329. On account of the devastations to which the district was subjected by the Danes the church of York abandoned its possessions, and Tostig, brother of Harold, became lord paramount. At the Conquest it was granted, along with other possessions, to Roger de Poictou, and on his defection was forfeited to the crown. It possessed at an early period the charter of "a guild merchant, with hanse" and other customs belonging to such guild. Another charter was granted by Henry II., conferring on the inhabitants similar privileges and liberties to those enjoyed by the inhabitants of Newcastle-on-Tyne. Its privileges were confirmed and extended by King John, and in the 23d of Edward I. it obtained the right to send members to Parliament. In 1323 Robert Bruce partly destroyed it by fire. In 1617 it was visited by James I. on his return from Scotland. On the outbreak of the Civil War it declared for King Charles, but on the 12th February, 1643, it was taken by the Parliamentary forces under Sir John Seaton. Near the town, on the 17th of August, 1648, the Scots under Hamilton sustained an overwhelming defeat from Oliver Cromwell. On the 9th of November, 1715, Preston was occupied by the troops of the Pretender, and by their surrender on the 13th of the same month the death blow was given to his cause. On the 27th of November, 1745, it was entered by Charles, the young Pretender, on his Quixotic march towards London. By the Municipal Act of 1835 the borough is divided into six wards, comprising the ancient borough of Preston and the township of Fishwick, and is governed by a mayor, twelve aldermen, and thirty-six councillors.

Whittle, *Historical Account of Preston*, 1821–37; Dobson, *History of the Parliamentary Representation of Preston*, 1856, 2d ed. 1868; Id., *Preston in the Olden Time*, 1856; Id., *History of Preston Guild*, 1862; Hardwick, *History of Preston*, 1857; Hewitson, *History of Preston*, 1883.

PRESTWICH, a town of Lancashire, is situated on a branch of the Lancashire and Yorkshire Railway, 4 miles northwest of Manchester and 5 south of Bury. It possesses cotton manufactures, but consists chiefly of handsome mansions and villas inhabited by Manchester merchants. The church of St. Bartholomew occupies an eminence overlooking the Irwell. In the neighborhood is the county lunatic asylum. The population of the Urban sanitary district (area 1917 acres) in 1871 was 6820, and in 1881 it was 8627.

PRESUMPTION. See EVIDENCE, vol. viii. p. 650, *sq.*

PREVESA, the chief town of a sandjak in the Turkish vilayet of Janina, commanding the entrance to the Gulf of Arta. Its harbor is small, but it is a port of call for the steamers of the Austrian Lloyd and and has a considerable trade in the export of oil, wool, valonia, etc. Prevesa, which represents the ancient NICOPOLIS (*q. v.*) has a population of about 7000.

PRÉVOST, PIERRE (1751–1839) son of a Protestant clergyman in Geneva, was born in that city on 3d March, 1751, and was educated for a clerical career. But he forsook it for law, and this too he quickly deserted to devote himself to education and to travelling. He became intimate with J. J. Rousseau, and, a little latter, with Dugald Stewart, having previously distinguished himself as a translator of and commentator on Euripides. Frederick II. of Prussia secured him in 1780 as professor of philosophy, and made him member of the Academy of Sciences in Berlin. He there became acquainted with Lagrange, and was thus led to turn his attention to science. After some years spent on political economy (as in Adam Smith's *Wealth of Nations*) and on the principles of the fine arts (in connection with which he wrote, for the *Berlin Memoirs*, a remarkable dissertation on poetry) he returned to Geneva and commenced his works on magnetism and on heat. Interrupted occasionally in his studies by political duties, in which he was often called to the front, he remained professor of philosophy at Geneva till he was called in 1810 to the chair of physics. He died at Geneva on 8th April, 1839. Prévost published much on philology, philosophy, and political economy; but he will be remembered mainly on two accounts—(1) his having published, with additions of his own, the posthumous memoirs of the ingenious Le Sage [see ATOM. vol. iii. p. 41 and ATTRACTION]; and (2) his having first enunciated the theory of exchanges (see RADIATION), on which has been based one of the grandest experimental methods of modern times. He was distinguished as much for his moderation, precision and truthfulness as for his extraordinary versatility.

PRÉVOST D'EXILLES, ANTOINE FRANÇOIS (1697–1763), more commonly called the abbé Prévost, one of the most important French novelists of the 18th century, was born at Hesdin in Artois on 1st April, 1697. His father was of good family, and held legal employments of some importance. Prévost was educated by the Jesuits, first at Hesdin and then at Paris. At the age of sixteen he left the Collége d'Harcourt and enlisted. This, was, however, at the close of the War of the Spanish Succession, and he soon returned to the Jesuits, and was almost persuaded to enter the order. According to some accounts he actually did so, but a truant disposition once more came on him and he again joined the army, apparently obtaining some commission. It is, however, not easy to make his statement that he passed five or six years thus tally with the positive assertion that in 1719 he once more sought the cloister, this time joining the famous learned community of the Benedictines of St. Maur. He took the vows finally in 1720, and it would appear that for some seven years he devoted himself without repining to study at various houses of the order, preaching, teaching, and writing some part of the *Gallia Christiana*. In 1727, however, or thereabouts, (for the details of Prévost's life, though unusually interesting, are most vaguely and insufficiently recorded) he once more broke bounds and fled to Holland. It is said that the immediate occasion was nothing more than a wish he had formed to be transferred to Cluny, and which made him commit some technical misdemeanor. However, this may be, he was for six years an exile in Holland and England, and one story even asserts that he contracted a regular or rather irregular marriage during this period. He certainly published the first of his remarkable novels, the *Mémoires d'un Homme de Qualité*, in 1728, and continued them for some years. Besides this he produced much miscellaneous work—*Clêveland*, another novel; *Manon Lescaut*, his masterpiece (which is a kind of appendix to his first book); and a periodical publication, partly in the style of the *Spectator* and partly in that of a literary review, called *Le Pour et le Contre*. All these were begun and most of them were finished before 1735, when he was back in France and produced his last novel of importance, the *Doyen de Killérine*, in which, as in *Clêveland*, he made much use of his English sojourn. He returned to France openly and with the royal permission, being allowed to wear the dress of the secular priesthood. Among his patrons the cardinal de Bissy and the prince de Conti are named; the latter made him his chaplain. He lived for nearly thirty years longer, composing, though not for bread, an extraordinary number of books, some of them original, some compilations. Amongst them were an *Histoire Générale des Voyages*, historical compilations on William the Conqueror, and Margaret of Anjou, letters, moral essays, semi-scientific works, translations (including *Pamela* and *Clarissa*), and some original pieces. Of all these the novel called *Histoire d'une Grecque Moderne* (1741) has alone attracted some attention in modern times. Prévost was a facile writer and a fair critic, but except for his first three novels, and especially for *Manon Lescaut*, he would hardly be remembered save as a man of a curiously eventful and very imperfectly recorded life. His death itself has a kind of legendary character, and some of the circumstances are, it may be hoped, fictitious. He lived in a small cottage, (for, despite his immense literary work on subjects which for the most part occupy only writers for money, he seems to have written purely for love) at Chantilly, and it was his custom to walk much in the woods there. What is agreed is that he was struck with apoplexy during one of these walks, on 23d November, 1763, and was found senseless. The legend adds the hideous particular that he was not dead, and that a clumsy village surgeon, heedlessly beginning what he supposed to be a *post-mortem* examination, at once recalled his patient to life and killed him. Even without this detail there is sufficient romantic interest (without other stories, some of them demonstrably fictitious, such as that he was accidentally the cause of his father's death) about this life of a man who is at the same time uniformly represented as an indefatigable student and one of a quiet and easy-going temperament.

Prévost's three chief romances, the *Mémoires*, *Clêveland*, and the *Doyen de Killérine*, are not unremarkable, because they hold a kind of middle place between the incident-romance of Le Sage and Defoe and the sentiment-romance of Marivaux and Richardson; but they all have the defect of intolerable length and of an indefinite fluency. *Manon Lescaut*, his one masterpiece, and one of the greatest novels of the century, is in both these respects so different that it might seem impossible that the same man should have written it. It is very short, it is entirely free from improbable incident, it is penetrated by the truest and most cunningly managed feeling, and almost every one of its characters is a triumph of that analytic portraiture which is the secret of the modern novel. The chevalier des Grieux, the hero, is probably the most perfect example of the carrying out of the sentiment, "All for love and the world well lost," that exists in fiction (it is curious that Prévost translated Dryden's play of the name), at least where the circumstances are those of ordinary and probable life. Tiberge, his friend, is hardly inferior in the difficult part of mentor and reasonable man. Lescaut, the heroine's brother, has vigorous touches as a bully and Bohemian; but the triumph of the book is Manon herself. Animated by a real affection for her lover, and false to him only because her incurable love of splendor, comfort, and luxury prevents her from welcoming privation with him or for him, though in effect she prefers him to all others, perfectly natural and even amiable in her degradation, and yet showing the moral of that degradation more vividly than a hundred characters drawn with a less complacent pencil could have done, Manon is one of the most remarkable heroines in all fiction. She had no literary ancestress; she seems to have sprung entirely from the imagination, or perhaps the sympathetic observation, of the wandering scholar who drew her. Only the *Princesse de Clèves* can challenge comparison with her before or near to her own date, and in *Manon Lescaut* the plot is much more complete and interesting, the sentiments less artificial, and the whole story nearer to actual life than in Madame de la Fayette's masterpiece. It is not easy to name a novel on the same scale which is more directly and naturally affecting at a first reading, and which on subsequent study approves itself more thoroughly as a work of art, than *Manon Lescaut*.

There is no complete edition of Prévost's works. *Œuvres Choisies* were published in 1783, and again in 1806. Of *Manon Lescaut* the editions are very numerous.

PRÉVOST-PARADOL, LUCIEN ANATOLE (1829–1870), a writer whose career, except in its unhappy end, was typical of the importance of journalism in France, was born at Paris on the 8th of August, 1829. His mother was an actress; little is said of his father.

He was educated at the Collége Bourbon, showed great brilliancy and precocity, and entered the Ecole Normale. In 1855 he was appointed professor of French literature at Aix. He held the post, however, barely a year, resigning it to take up the pen of a leader-writer on the *Journal des Débats*. He also wrote in the *Courrier du Dimanche*, and for a very short time in the *Presse*. Even before his appointment at Aix he had produced a book, *Revue de l'Histoire Universelle* (1854), and he continued to publish at short intervals, his chief work being a collection of essays on politics and literature, which appeared between 1859 and 1866, and some *Essais sur les Moralistes Français* (1864). He was, however, rather a journalist than a writer of books, and was one of the chief opponents of the empire on the side of moderate liberalism. He underwent the usual and popular difficulties of a journalist under that régime, and was once imprisoned. In 1865, at the extraordinarily early age of thirty-five, he was elected an Academician. He was twice a candidate for election to the Chamber, but failed each time. Three years later he visited England, and was publicly entertained at Edinburgh, an entertainment which was the occasion of some rather undignified and very foolish contrasts drawn in the English press between the position of journalists in the two countries. The accession of Émile Ollivier to power was fatal to Prévost-Paradol. There is no reason for doubting that, in common with some of the best men in France, he believed in the possibility of a liberal empire, and he accepted the appointment of envoy to the United States. This was the signal for the most unmeasured attacks on him from the republican party. He had scarcely installed himself in his post before the outbreak of war between France and Prussia occurred. Either an exaggerated feeling of patriotism, or the disappointment of his hopes in the combined wisdom of M. Ollivier and the emperor, or (as his enemies said) remorse at having betrayed his party for nothing, or more probably the action of startling news on an excitable temperament and a mind weakened and irritated by the personal invectives to which he had been subject, threw his intellect out of gear. He committed suicide at New York[1] on the 26th July, 1870. Prévost-Paradol was not in any sense a strong man, and, except for his tragic end, his name is not very likely to live either in literature or politics. His style was light and facile, but at the same time flimsy, and his thoughts were rarely profound. But he had for a time "l'esprit de tout le monde" in France, and the personal system of journalism forced him into unnatural prominence and productiveness.

PRIAM. See Troy.

PRIAPUS, the Greek god of teeming flock and fruitful field. He was unknown to the earliest Greek poets Homer and Hesiod, but in later times his worship prevailed on the fertile coasts of Asia Minor. Lampsacus on the Hellespont, nestling in its vineyards, claimed to be his birthplace. According to the people of Lampsacus he was the son of Dionysus and Aphrodite. Having the misfortune, as a child, to be plain-looking, Priapus was abandoned by his heartless parents, but a gentle shepherd who chanced to pass that way found and reared the helpless babe like his own son. As the youthful god grew to manhood he repaid his benefactor by making the flocks and herds to bring forth and multiply. So the simple shepherds worshipped him and brought him offerings of the fatlings of their flocks,—lambs and goats and heifers, and even, it is said, donkeys. As the god and guardian of gardens, vineyards, and orchards he received sacrifices of fruits and vegetables, and images of him were set up in gardens to frighten birds and thieves. Bees too were his especial care, and he had the power to disarm the evil eye. Fishermen prayed to him for an abundant harvest of the sea, and sailors in their sore distress called on him and he saved them. On many a wave-beaten bluff his image stood and his altar smoked decked with flowers the earliest of the year, when winter storms were over and summer seas allured the mariner to launch his bark again. In the rites of Dionysus homage was paid to the rural god with mirth and laughter. From Greece he passed to Italy, and continued in his new home to discharge his old functions of garden-god and scarecrow.

PRIBRAM or **Przibram**, a prosperous mining town of Bohemia, is situated about 32 miles S. W. of Prague. The lead-mines in the vicinity have been worked for several centuries and are especially important on account of the large quantity of silver extracted from the ore. In average years this amounts to 70,000 ℔, representing a money value of nearly £300,000 [$1,458,000]. The mines belong to the Government and employ about 5000 persons. One of the shafts, 3350 feet deep, is among the deepest in the world. Besides mining, the inhabitants occupy themselves in making glass beads, soap, candles, beer, and liqueurs. The most interesting buildings are the old deanery and church, and the archiepiscopal palace, now converted into a mining academy. At the top of the Heiliger Berg, a hill rising above the town, is a church with a wonder-working image of the Virgin, which attracts numerous pilgrims. The population of Pribram in 1880 was 11,171, or, including the adjacent Birkenberg, where the largest mines are situated, 14,881.

PRICE, Richard (1723–1791), philosopher, son of a Dissenting minister, was born on 23d February, 1723, at Tynton, in the parish of Llangeinor, Glamorganshire. His education was conducted partly by private tutors, partly at private schools. His father was a bigoted Calvinist and seems to have been a person of morose temper, facts which may account, on the principle of reaction, for the liberal opinions and the benevolent disposition of the son. Young Price appears at an early age to have studied the works of Clarke and Butler, and to have conceived a special admiration for the theological and philosophical works of the latter writer. In his eighteenth year he removed to a Dissenting academy in London, and having completed his education became chaplain and companion to a Mr. Streatfield at Stoke-Newington. While still occupying this position he officiated in various Dissenting congregations, such as those in the Old Jewry, Edmonton, and Newington Green. By the death of Mr. Streatfield, and of an uncle in 1756 his circumstances were considerably improved, and in the following year, the year in which he first published his best-known work, a *Review of the Principal Questions in Morals*, he married a Miss Sarah Blundell, originally of Belgrave in Leicestershire. Price now resided at Newington Green, where his time appears to have been mainly occupied in the performance of his ministerial duties, though he made occasional excursions into the regions of mathematics and philosophy. In 1767 he published a volume of sermons, including one on the future state, which attracted the attention and gained him the acquaintance of Lord Shelburne, an event which had much influence in raising his reputation and determining the character of his subsequent pursuits. Soon after this date he added to his duties at Newington Green those of morning preacher to a congregation at Hackney, where his audience appears to have been more numerous and appreciative than any which he had heretofore succeeded in keeping together.

But it was not so much in the capacity of a religious teacher as a writer on financial and political questions that Price was destined to become known to his countrymen at large. In 1769 he wrote some observations addressed in a letter to Dr. Franklin on the expectation of lives, the increase of mankind, and the population of London, which were published in the *Philosophical Transactions* of that year; and, again, in May, 1770, he communicated to the Royal Society some observations on the proper method of calculating the values of contingent reversions. The publication of these papers is said to have exercised a most beneficial influence in drawing attention to the inadequate calculations on which many insurance and benefit societies had recently been formed. In the year 1769 Price received the degree of D.D. from the university of Glasgow. In 1771 he published his *Appeal to the Public on the Subject of the National Debt*, of which subsequent editions appeared in 1772 and 1774. This pamphlet excited considerable controversy at the time of its publication, and is supposed to have influenced Pitt in re-establishing the sinking fund for the extinction of the national debt, which had been created by Walpole in 1716 and abolished in 1733. That Price's main object, the extinction of the national debt, was a laudable and desirable one would now probably be universally acknowledged. The particular means, however, which he proposed for the purpose of effecting this object are described by Lord Overstone[1] as "a sort of hocus-pocus machinery," supposed to work "without loss to any one," and consequently purely delusive. As Lord Overstone says, all the sinking funds that have been set on foot have been supported either by loans or by the produce of taxes, and have never paid off a single shilling of debt by their own agency. In 1829 Pitt's sinking fund was abolished by Act of parliament.

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[1] [At Washington.—Am. Ed.]

A subject of a much more popular kind was next to employ Dr. Price's pen. Being an ardent lover of civil and religious liberty, he had from the first been strongly opposed to the war with the American colonies, and in 1776 he published a pamphlet entitled *Observations on Civil Liberty and the Justice and Policy of the War with America.* Several thousand copies of this work were sold within a few days; a cheap edition was soon issued; the pamphlet was extolled by one set of politicians and abused by another; amongst its critics were Dr. Markham, archbishop of York, John Wesley, and Edmund Burke; and its author rapidly became one of the best-known men in England. In recognition of his services in the cause of liberty by the publication of this pamphlet Dr. Price was presented with the freedom of the city of London, and it is said that the encouragement derived from this book had no inconsiderable share in determining the Americans to declare their independence. A second pamphlet on the war with America, the debts of Great Britain, and kindred topics followed in the spring of 1777, and whenever the Government thought proper to proclaim a fast-day Dr. Price took the opportunity of declaring his sentiments on the folly and mischief of the war. His name thus became identified, for good repute and for evil repute, with the cause of American independence. He was the intimate friend of Franklin; he corresponded with Turgot; and in the winter of 1778 he was actually invited by Congress to transfer himself to America and assist in the financial administration of the insurgent States. This offer he refused from unwillingness to quit his own country and his family connections, concluding his letter, however, with the prophetic words that he looked "to the United States as now the hope, and likely soon to become the refuge of mankind."

One of Price's most intimate friends was the celebrated Dr. Priestley, but this circumstance did not prevent them from taking the most opposite views on the great questions of morals and metaphysics. In 1778 appeared a published correspondence between these two liberal theologians on the subjects of materialism and necessity, wherein Price maintains, in opposition to Priestly, the free agency of man and the unity and immateriality of the human soul. Both Price and Priestley were in theological opinion what would now vaguely be called "Unitarians," though they occupied respectively the extreme right and the extreme left position of that school. Indeed Price's opinions would seem to have been rather Arian than Socinian.

After the publication of his pamphlet on the American war Dr. Price became an important personage. He now preached to crowded congregations, and, when Lord Shelburne acceded to power, not only was he offered the post of private secretary to the premier, but it is said that one of the paragraphs in the king's speech was suggested by him and even inserted in his very words.

In 1786 Mrs. Price died, and as there were no children by the marriage, and his own health was failing, the remainder of Price's life appears to have been somewhat clouded by solitude and dejection. It was illuminated, however, by one bright gleam, the eager satisfaction with which he witnessed the passing events of the French Revolution. "I could almost say, Lord, now lettest thou thy servant depart in peace, for mine eyes have seen thy salvation. . . . After sharing in the benefits of one Revolution, I have been spared to be a witness to two other revolutions, both glorious."[2] The darker side of the picture he happily did not live to see. On the 19th of April, 1791, he died, worn out with suffering and disease. His funeral was conducted at Bunhill Fields by Dr. Kippis, and his funeral sermon was preached on the following Sunday by Dr. Priestley, names, which like his own, are specially honorable in the roll of English Nonconformist divines.

On the 4th of November, 1789, Price had preached at the meeting-house in the Old Jewry, before the Society for commemorating the Revolution in Great Britain, his celebrated sermon on the Love of our Country. This sermon, together with a speech subsequently made by him at a public dinner at the London Tavern, rendered him peculiarly obnoxious to Burke, and brought down upon him some of the fiercest denunciations of that brilliant but impassioned writer in his *Reflections on the Revolution in France.*

Price's reputation rests mainly upon the position which he occupies in the history of moral philosophy. His ethical theories are contained in the treatise already mentioned, a *Review of the Principal Questions in Morals*, the third edition of which, expressing "the author's latest and maturest thoughts," was published in 1787. This work is professedly directed against the doctrines of Hutcheson, but the treatment as a whole is constructive rather than polemical. Price's views approximate more closely to those of Cudworth than to those of any other English moralist; but they are mainly interesting in the history of morals on account of their resemblance to the theories subsequently propounded by Kant. The main positions of Price's treatise are three, which may be stated as follows: (1) actions are *in themselves* right or wrong; (2) right and wrong are simple ideas incapable of analysis; (3) these ideas are perceived immediately by the intuitive power of the reason or understanding, terms which he employs indifferently.

To the first of these positions it is not, at first sight, easy to attach any precise meaning, nor does even a careful perusal of the work altogether remove the ambiguity. The most natural interpretation, perhaps, of the expression that "an action is right in itself" is that it is right without any relation to the nature of the agent, the end aimed at, or the circumstances under which it is performed. But, apart from the fact that the objections to such a theory would be too obvious to be overlooked, the following passage is sufficient to show that Price cannot have entertained it: "All actions being necessarily right, indifferent or wrong: what determines which of these an action should be accounted is the *truth of the case*, or the relations and circumstances of the agent and the objects. In certain relations there is a certain conduct right. There are certain manners of behavior which we unavoidably approve, as soon as these relations are known. Change the relations, and a different manner of behavior becomes right. Nothing is clearer than that what is due or undue, proper or improper to be done, must vary according to the different natures and circumstances of beings. If a particular treatment of one nature is right, it is impossible that the same treatment of a different nature, or of all natures, should be right" (ch. vi.). What, then, does he mean by the phrase that "an action is right or wrong *in itself*"? Excluding the meaning which we have set aside, he may wish to express either that actions are right or wrong irrespectively of their consequences, or that the same action would appear right or wrong not to man only but to all intelligent beings, or, as seems to be the case, he may sometimes wish to express one of these meanings and sometimes the other.

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[1] Lord Overstone reprinted in 1857, for private circulation, Price's and other rare tracts on the national debt and the sinking fund.

[2] Sermon on the Love of our Country.

The second and third positions, that right and wrong are simple ideas incapable of analysis, and that they are perceived by an intuitive act of the reason, are succinctly stated in the following passage: "'Tis a very necessary previous observation that our ideas of right and wrong are simple ideas, and must therefore be ascribed to some power of immediate perception in the human mind. He that doubts this, need only try to give definitions of them, which shall amount to more than synonymous expressions" (ch. i. sect. 1). In this and similar passages the question in dispute between the two rival schools of moralists is brought to a definite issue. Does the term "right" admit of any explanation, definition or analysis, or is it simply inexplicable? The majority of moralists have adopted the former alternative, and have endeavored to explain the idea of right in subordination to that of good. Any course of action which has, on the whole, a tendency to promote the happiness or to alleviate the misery of mankind they denominate as right; and any course of action which has a contrary tendency they denominate as wrong. Price, on the other hand, maintains that when we say an action is right we can give no further account of it, that we state an ultimate fact which neither requires nor can receive any further explanation. The connection of the third with the first and second positions is obvious. Right and wrong, being simple ideas, and being, moreover, qualities of actions, considered in themselves, are regarded by Price as being perceived immediately by the reason just in the same way that color is perceived by the eye or sound by the ear. That they are perceived immediately follows from the fact that they are simple ideas, incapable of analysis; that they are perceived by the reason or understanding, and not by a sense, is maintained in an elaborate course of argument against Hutcheson. When the reason or understanding has once apprehended the idea of right, it ought to impose that idea as a law upon the will; and thus it becomes, equally with the affections, a spring of action.

The place of the emotional part of our nature in this system is not very clear. The predominant view, however, appears to be that, while it is the source of all vicious action, it may, when enlightened by reason, aid in the determination of virtuous conduct. The school of Hutcheson, on the other hand, maintains that the emotions are, in the last analysis, the original source of all conduct, be it virtuous or vicious.

As already stated, the English moralist with whom Price has most affinity is Cudworth. The main point of difference is that, while Cudworth regards the ideas of right and wrong as νοήματα or modifications of the intellect itself, existing first in germ and afterwards developed by circumstances, Price seems rather to regard them as acquired from the contemplation of actions, though acquired necessarily, immediately and intuitively.

Those who are familiar with the writings of Kant (which are posterior to those of Price) will recognize many points of resemblance both in the fundamental ideas and in the modes of expression. Amongst these points are the exaltation of reason; the depreciation of the affections; the unwillingness of both authors to regard the "partial and accidental structure of humanity," the "mere make and constitution of man," as the basis of morality—in other words, to recognize ethical distinctions as relative to human nature; the ultimate and irresolvable character of the idea of rectitude; the notion that the reason imposes this idea as a law upon the will, becoming thus our independent spring of action; the insistence upon the reality of liberty or "the power of acting and determining"; the importance attached to reason as a distinct source of ideas; and, it may be added, the discrimination (so celebrated in the philosophy of Kant) of the moral (or practical) and the speculative understanding (or reason).[1]

Price's ethical theories are almost the antithesis of those of Paley, whose *Moral and Political Philosophy* appeared in 1785. Speaking of this work in his third edition Price says, "Never have I met with a theory of morals which has appeared to me more exceptionable."

Most of Price's more important works have been already mentioned. To these may be added an *Essay on the Population of England* (2d ed., 1780); two *Fast-day Sermons*, published respectively in 1779 and 1781; and *Observations on the importance of the American Revolution and the means of rendering it a benefit to the World*, 1784. A complete list of his works is given as an appendix to Dr. Priestly's *Funeral Sermon*. Notices of Price's ethical system occur in Mackintosh's *Progress of Ethical Philosophy*, Jouffroy's *Introduction to Ethics*, Whewell's *History of Moral Philosophy in England*, Bain's *Mental and Moral Sciences*, the article on ETHICS (vol. viii. p. 531), and a monograph on Shaftesbury and Hutcheson by the writer of this article in Sampson Low & Co's series of *English Philosophers*. The authority for his life is a memoir by his nephew, William Morgan. (T. F.)

PRICHARD, JAMES COWLES (1786–1848), the founder of ethnology or anthropology in England, was born on 11th February, 1786, at Ross in Herefordshire. His parents were of the Society of Friends, and his career in after life partly turned on his not receiving the then narrow course of school education, but a wider home training in modern languages and general literature. Living at Bristol, he occupied himself much in examining the natives of different countries who were to be met with amongst the shipping of the port, and he would occasionally bring a foreigner to his father's house. Thus in early life he laid a foundation for his later researches, and he was mainly led to adopt medicine as a profession from the facilities which its study offered for the investigation of man. He took his degree at Edinburgh, afterwards reading for a year at Trinity College, Cambridge, whence, joining the Church of England, he migrated to St. John's College, Oxford, afterwards entering as a gentleman commoner at Trinity College, Oxford, but seeking no degree in either university. In 1810 he settled at Bristol as a physician, and in 1813 published his *Researches into the Physical History of Man*, in 2 vols., afterwards extended to 5 vols. The central principle of the book is the primitive unity of the human species, acted upon by causes which have since divided it into permanent varieties or races. Dr. Prichard states that he was led into this inquiry by the diversity of races being alleged as a disproof of the Mosaic records; in argument, however, he endeavored not to rely on theology, but to proceed "by the ordinary method of observation and experience." The work is dedicated to Blumenbach, whose five races of man are adopted. But where Prichard excelled Blumenbach and all his other predecessors was in his grasp of the principle that people should be studied by combining all available characters, and he accordingly discusses them at large with regard at once to bodily form, language, and state of civilization. One investigation begun in this work requires special mention, the bringing into view of the fact, neglected or contradicted by philologists, that the Celtic nations are allied by language with the Slavonian, German, and Pelasgian (Greek and Latin), thus forming a fourth European branch of the Asiatic stock (which would now be called Indo-European or Aryan). Prichard, whose own Celtic descent is shown by his name, was a fitting promulgator of this leading principle of Celtic research. His special treatise containing Celtic compared with Sanskrit words appeared in 1831 under the title *Eastern Origin of the Celtic Nations*. It is remarkable that the essay by Adolph Pictet, *De l'Affinité des Langues Celtiques avec le Sanscrit*, which was crowned by the French Academy and made its author's reputation, should have been published in 1837 in evident ignorance of the earlier and in some respects stricter investigations of Prichard. His work has been re-edited since by Dr. R. G. Latham (London, 1857), with large additions of Celtic material. Prichard's *Analysis of Egyptian Mythology* (London, 1819) had some popularity at the time, and was translated into German with a preface by A. W. v. Schlegel; its comparison of the Egyptian religion with Brahmanism is now obsolete, and its author was unwise in bringing out a new edition in 1838, after Champollion's *Grammar* and *Dictionary* had opened the actual Egyptian inscriptions to scholars. Dr. Prichard's last important book was a revision and condensation of his researches into a *Natural History of Man* (London, 1843), which has gone through several editions, and remains a standard work of the anthropologist's library. Towards the end of his life, in recognition of his services, he was made a commissioner of lunacy, and in consequence removed from Bristol to London, where he died in 1848.

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[1] Price does not, like Kant, distinguish between the words "reason" and "understanding."

A memoir by his friend, Dr. Hodgkin, will be found in the *Journal of the Ethnological Society*, of which he was one of the early presidents.

PRIDE, THOMAS (d. 1658), Parliamentary officer, was of humble origin, and is stated to have been brought up by the parish of St. Bride's, London. Subsequently he was a drayman and a brewer. At the beginning of the Civil War he served as ensign under the earl of Essex, and gradually obtained promotion to the rank of colonel. He distinguished himself at the battle of Preston, 17th August, 1648, and in Cromwell's Scottish campaign he held command of a brigade. He was noted for his resolute character and extreme anti-Royalist sentiments. After the Commons had voted that the king's concessions at Newport were a basis for a settlement, he was chosen by the army chiefs to effect their purpose of "purging" the Commons. Taking his stand at the entrance of the House of Commons with a written list in his hand, he caused the arrest of the Royalist members who were pointed out to him, and placed them in custody. After about a hundred members had been dealt with by this ordinance, subsequently known as "Pride's Purge," the mutilated House of Commons proceeded to bring the king to trial. Pride was one of the judges of the king and signed his death-warrant. Under Cromwell he received the honor of knighthood, and was also chosen a member of the new House of Lords. He died at Nonsuch on 23d October, 1658, and after the Restoration his body was dug up and suspended on the gallows at Tyburn along with that of Cromwell.

Noble, *Lives of the Regicides*; Bate, *Lives of the Prime Actors and Principal Contrivers of the Murder of Charles I.*; Carlyle, *Cromwell*.

PRIDEAUX, HUMPHREY (1648–1724), dean of Norwich, was the third son of Edward Prideaux of Place in Padstow, Cornwall, by his wife Bridget, daughter of John Moyle of Bake in the same county. Both families were of good repute in the west of England, and that of Prideaux was especially influential, as is shown by the elaborate pedigrees in Sir John Maclean's *Deanery of Trigg Minor* (ii. 194–242). He was born at Place on 3d May, 1648, and received the rudiments of his education at the grammar-schools of Liskeard and Bodmin. In 1665 he was placed at Westminster under Dr. Busby, and after staying there for three years was admitted a student at Christ Church, Oxford, taking his degrees in the following order, B.A. in 1672, M.A. 1675, B.D. 1682, and D.D. 1686. It was the rule of that house that its best scholars should, after they had taken their first degree be employed in editing some classical writer, and Prideaux was accordingly deputed to superintend a new edition of Lucius Florus and to prepare for the press, from a Greek MS. in the Bodleian, a work by Johannes Malalas. The first of these works is now exceedingly scarce, if indeed a copy be in existence, and the second was, on his advice, left in manuscript. The famous Arundel marbles had just been given to the university, and Prideaux was instructed to undertake the task of describing the gift, his transcript of the inscriptions, with a commentary and additions from the Selden marbles, appearing in 1676. In 1679 he was appointed to the rectory of St. Clement's, Oxford, and in the same year became Hebrew lecturer at Christ Church, whereupon he published two Hebrew tracts of Maimonides with a Latin translation and annotations. Prideaux continued tutor at Christ Church until February, 1686, holding for the last three years the rectory of Bladon with Woodstock; but in 1686 he exchanged for the benefice of Saham in Norfolk, and took up his residence in that county, with which he had for some time been connected through his appointment in August, 1681, to a prebendal stall in Norwich cathedral. The sympathies of Prideaux inclined to Low Churchism in religion and to Whiggism in politics, and during the years which immediately preceded and succeeded the Revolution of 1688 he took an active part in the controversies of the day, publishing in quick succession the following pamphlets—*The Validity of the Orders of the Church of England* (1688), *Letter to a Friend on the Present Convocation* (1690), *The Case of Clandestine Marriages stated* (1691). Prideaux was promoted to the archdeaconry of Suffolk at the close of 1688 and to the deanery of Norwich in June, 1702, and it was the wish of some of the members of the episcopal bench that he should have been appointed to the bishopric of Norwich, but their desires were not gratified. In 1694 he was obliged, through ill-health, to resign the rectory of Saham, and after having held the vicarage of Trowse for fourteen years (1696–1710) he found himself incapacitated, by repeated attacks of stone, from further parochial duty. He died at Norwich on 1st November, 1724, and was buried in the cathedral on 4th November. His wife, Bridget, only daughter and sole heir of Anthony Bokenham of Helmingham, Suffolk, died at Norwich in November, 1700; they were married on 16th February, 1686.

Many of the dean's writings were of great value and their popularity continued unimpaired down to the present century. His *Life of Mahomet*, originally published in 1697, had passed through eight editions by 1723, and his *Directions to Churchwardens*, first issued in 1701, reached a twelfth edition in 1871. But the favor with which these volumes were received, great as it was, contrasts but badly with the extraordinary success of his account of *The Old and New Testament connected in the History of the Jews*, a work of great research and learning. This has been many times reissued since the appearance of the first part in 1716 and has been translated into the French, German and Italian languages. Le Clerc subjected it to a critical examination. A series of remarks upon it is contained in Walter Moyle's works, and continuations were compiled by Samuel Shuckford and Michael Russell. Prideaux published several small tracts, and many volumes of manuscript collections are in the possession of his descendant at Place. These, with particulars of the dean's letters in print and in manuscript and with bibliographical details of his numerous publications, are described in the *Bibilotheca Cornubiensis*, ii. 527–533 and iii. 1319. A volume of his letters to John Ellis, some time under-secretary of state, was edited by Mr. E. M. Thompson for the Camden Society in 1875 and contained a vivid picture of Oxford life after the Restoration, but it will always be regretted that some passages in his correspondence should betray feelings unworthy of the writer. An anonymous life of Dean Prideaux appeared in 1748 but it was mainly compiled from a larger memoir by his son.

PRIESSNITZ, VINCENZ. See HYDROPATHY, vol. xii. p. 575 *sq.*

PRIEST (Ger. *Priester*, Fr. *prêtre*) is a contracted form of "presbyter" (πρεσβύτερος, "elder;" see PRESBYTER), a name of office in the early Christian church, already mentioned in the New Testament. But in the English Bible the presbyters of the New Testament are called "elders," not "priests;" the latter name is reserved for ministers of pre-Christian religions, the Semitic כֹּהֲנִים (*kōhănīm*, sing. *kōhēn*) and כְּמָרִים (*kemārīm*), or the Greek ἱερεῖς. The reason of this will appear more clearly in the sequel; it is enough to observe at present that, before our English word was formed the original idea of a presbyter had been overlaid with others derived from pre-Christian priesthoods, so that it is from these and not from the etymological force of the word that we must start in considering historically what a priest is. The theologians of the Greek and Latin churches expressly found the conception of a Christian priesthood on the hierarchy of the Jewish temple, while the names by which the sacerdotal character is expressed—ἱερεύς, *sacerdos*—originally designated the ministers of sacred things in Greek and Roman heathenism, and then came to be used as translations into Greek and Latin of the Hebrew *kōhēn*. *Kōhēn*, ἱερεύς, *sacerdos*, are in fact fair translations of one another; they all denote a minister whose stated business was to perform, on behalf of the community, certain public ritual acts, particularly sacrifices, directed godwards. Such ministers or priests existed in all the great religions of ancient civilization and indeed a priesthood in the sense now defined is generally found, in all parts of the world, among races which have a tribal or national religion of definite character, and not merely an unorganized mass of superstitious ideas, fears and hopes issuing in practices of sorcery. The term "priest" is sometimes taken to include "sorcerer," just as religion is often taken to include the belief in mysterious or superhuman powers which can be constrained by spells, but this is an abuse of language. Religion begins when the relation of the divine powers to man is conceived—on the analogy of the relations of formed human society—as having a certain stable personal character on which the worshippers can calculate and act. The gods of the ancient religions might do arbitrary acts, but their conduct towards man was not habitually arbitrary. In so far as they could be reckoned on, they had a religion; in so far as they were still arbitrary, or themselves subject to the influence of unknown forces, room was left for the persistence of sorcery and similar superstitions, which history proves to have always renewed their strength in times when religious faith failed, when men ceased to be fully persuaded that the favor and help of the gods were sure if certain known conditions were fulfilled. In the best times of the antique religions no such doubts were felt, the real interest of the gods in their worshippers was certain, for all good things came from their hands and the actions on the part of individuals or of the state by which their favor was maintained, lost or regained were matter of undisputed tradition. The main points of this tradition were known to every one concerned, and difficult cases were resolved by experts—such as the Greek ἐξηγηταί—or referred, through some form of oracle, to the gods themselves. The relations of the gods to men, as thus traditionally defined, were not so much to individuals as to families, tribes or states, and it was the business of the community to see that they were maintained on a sound footing. This was partly done by watching over the conduct of individuals, for every one had certain religious duties; and conversely, certain acts of a private as well as of a public character were hateful to the gods, and, unless expiated, might bring calamity to the whole community. But it was also necessary to honor the gods by direct acts of homage, by images and temples, by feasts and sacrifices. To attend to these things was an essential part of the right government of the state, the right ordering of tribal and family life, and they could not be wholly left to the spontaneity of individuals, but necessarily fell to be performed on behalf of the community by its natural head or by specially appointed officials. In either case the service done to the gods on behalf of many may properly be called "priestly service," though in the former case the priesthood, being only one of the many functions of domestic or civil authority, was not necessarily recognized by a special name. Both kinds of priesthood are found in the old civilization of southern Europe; thus Homer knows special priests who preside over ritual acts in the temples to which they are attached, but his kings also do sacrifice on behalf of their people. The king, in fact, both in Greece and in Rome, was the acting head of the state religion, and when the regal power came to an end his sacred functions were not transferred to the ordinary priests, but either they were distributed among high officers of state, as archons and prytanes, or the title of "king" was still preserved as that of a religious functionary, as in the case of the *rex sacrorum* at Rome and the *archon basileus* at Athens. In the domestic circle the union of priesthood and natural headship was never disturbed; the Roman paterfamilias sacrificed for the whole family. On the other hand, *gentes* and *phratriæ*, which had no natural head, had special priests chosen from their members; for every circle of ancient society, from the family up to the state, was a religious as well as a civil unity, and had its own gods and sacred rites. The lines of religious and civil society were identical, and so long as they remained so no antagonism could arise between the spiritual and the temporal power. In point of fact, in Greece and Rome the priest never attained to any considerable independent importance; we cannot speak of priestly power and hardly even of a distinct priestly class. In Greece the priest, so far as he is an independent functionary and not one of the magistrates, is simply the elected or hereditary minister of a temple charged with "those things which are ordained to be done towards the gods" (see Aristotle, *Pol.*, vi. 8), and remunerated from the revenues of the temple or by the gifts of worshippers and sacrificial dues. The position was often lucrative and always honorable and the priests were under the special protection of the gods they served. But their purely ritual functions gave them no means of establishing a considerable influence on the minds of men, and the technical knowledge which they possessed as to the way in which the gods could be acceptably approached was neither so intricate nor so mysterious as to give the class a special importance. The funds of the temples were not in their control, but were treated as public moneys. Above all, where, as at Athens, the decision of questions of sacred law fell not to the priests but to the college of ἐξηγηταί, one great source of priestly power was wholly lacking. There remains, indeed, one other sacred function of great importance in the ancient world in which the Greek priests had a share. As man approached the gods in sacrifice and prayers, so too the gods declared themselves to men by divers signs and tokens, which it was possible to read by the art of DIVINATION (*q.v.*). In many nations divination and priesthood have always gone hand in hand; at Rome, for example, the augurs and the *X Vviri sacrorum*, who interpreted the Sibylline books, were priestly colleges. In Greece, on the other hand, divination was not generally a priestly function, but it did belong to the priests of the Oracles (see ORACLE). The great oracles, however, were of Panhellenic celebrity and did not serve each a particular state, and so in this direction also the risk of an independent priestly power within the state was avoided.[1]

In Rome, again, where the functions of the priesthood were politically much more weighty, where the technicalities of religion were more complicated, where priests interpreted the will of the gods, and where the pontiffs had a most important jurisdiction in sacred things, the state was much too strong to suffer these powers to escape from its own immediate control; the old monarchy of the king in sacred things descended to the inheritors of his temporal power; the highest civil and religious functions met in the same persons (comp. Cic. *De Dom.*, i. 1); and every priest was subject to the state exactly as the magistrates were, referring all weighty matters to state decision and then executing what the one supreme power decreed. And it is instructive to observe that when the plebeians extorted their full share of political power they also demanded and obtained admission to every priestly college of political importance, to those, namely, of the pontiffs, the augurs, and *X Vviri sacrorum*. The Romans, it need hardly be said, did not have hereditary priests.[2]

The same close connection between state and religion meets us, under the forms of Oriental despotism, in the great civilizations of Egypt and Babylonia. Here all civil and religious power has its source in the king, and he is therefore himself the centre and head of the priesthood. Nowhere is religion more thoroughly a part of statecraft than in ancient Egypt; the official religion of the united monarchy is plainly an artificial structure built up by priestly fable and speculation out of the old religions of the several nomes and dedicated to the service of the monarchy. The priesthood accordingly has large functions, including, besides the service of the temples, astrology and divination, and the development and preservation of a sort of official theology and ritual theory, by which the conflicting elements of local religion and mythology were reconciled. It has a strict bureaucratic organization, like any other branch of the administration; the higher priests are great officers of state, with civil and even military power; under Smendes (XXIst Dynasty) the priests of Amon at Thebes actually ascended the throne. An absolute monarchy, in which the king is revered as himself a divine person and in which the ministers of religion are the organs of a comprehensive and mysterious statecraft, obviously offers to sacerdotalism a far greater career than was possible among the free peoples of Greece and Rome; and the priests held in their hands the whole wisdom of the Egyptians, and so kept all parts of culture in such strict subservience, alike to the gods and to the monarchy, as to make the empire of the Nile the ideal type of absolutism based on divine right. In this respect, however, the Babylonian system, of which we have less ample details, probably fell little short of the Egyptian. Here also we find, as in Egypt, a state religion built on a priestly fusion of older cults, and therefore also a mythological theology which is not folk-lore but priest-lore. The older elements of religion are worked into a theoretic system of astral powers, and this in turn gives rise to a priestly study of astrology containing elements of real science. This complicated and many-sided lore gave to the priesthoods of Chaldæa and the Nile the character of a earned class, which is quite wanting in Greece and Rome, and it also produced a sacred and sacerdotal iterature quite different in range and importance from such Western analogues as the Sibylline books or the *ibri augurales*.

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[1] For the Greek priests, see, besides Schömann and other works on Greek antiquities, Newton. *Essays on Art and Archæology*, p. 136 *sq.* (from epigraphic material).

[2] On the Roman priests, see in general Marquardt, *Römische Staatsverwaltung*, vol. iii., and for the pontiffs in particular PONTIFEX. *supra*, p. 470.

Against the genuine intellectual achievements of the Chaldæan and Egyptian priests must be set the incorporation of magic and sorcery in the circle of priestly ciences. The ordinary functions of religion are directed to conciliate or persuade the gods, but magic pretends to constrain the supernatural powers, and belongs, as we have seen, to superstition rather than o religion. But in Egypt and Babylonia the state eligion was an artificial mosaic of old beliefs, in which he crassest superstitions had their place, and thus magical arts received a state recognition and were part f the business of the state priests in a way unknown n the West. Occult arts, in fact, are part of the mahinery of government. Now when we go still farther ast to the Aryans of India, we again find the idea prominent that certain formulas have the power of onstraining the gods, but in a form somewhat differnt from that of mere sorcery, and less primitive. All ncient peoples sought victory from the gods, and they sought it by sacrifice and prayer; but nowhere is the ower of sacrifice more strongly felt than among the ncient Aryans; it was Agni, the sacrificial flame, as ncient legend has it, that led the conquerors of India from victory to victory. But there were also bloody struggles among the Aryans themselves, between men who invoked the same deity, and here the issue was ot whether Indra was stronger than the gods of the on-Aryans, but which of the rival sacrifices he would ccept. Now the priests accompanied sacrifice with songs of invocation, and so it became essential to have the most powerful song, which the god could not resist. The knowledge of these songs and of all that accompanied their use was handed down in priestly families, whose aid became indispensable to every sovereign, and at last out of these families there grew up the great and privileged caste of Brahmans. For further details as to the development of the priestly caste and wisdom in India the reader must refer to BRAHMANISM; here it is enough to observe that among a religious people a priesthood which forms a close and still more an hereditary corporation, and the assistance of which is indispensable in all religious acts, must rise to practical supremacy in society except under the strongest form of despotism, where the sovereign is head of the church as well as of the state.

Among the Zoroastrian Iranians, as among the Indian Aryans, the aid of a priest to recite the sacrificial liturgy was necessary at every offering (Herod., i. 132), and the Iranian priests (âthravans, later *Magi*) claimed, like the Brahmans, to be the highest order of society; but a variety of conditions were lacking to give them the full place of their Indian brethren. Zoroastrianism is not a nature religion, but the result of a reform which never, under the old empire, thoroughly penetrated the masses; and the priesthood, as it was not based on family tradition, did not form a strict hereditary caste. Under the Sásánians, however, Zoroastrianism was a state religion in the strictest sense, and the priests attained very great power, their assistance being absolutely necessary not only in the public ritual of the fire-temple but for the constant guidance of every individual in the minute details of ceremonial observance, which make up the chief body of the religious system of the sacred books, and every breach of which involved penance. It is thus easily understood that the clergy formed a compact hierarchy not inferior in influence to the clergy of the Christian Middle Ages, had great power in the state, and were often irksome even to the great king. But the best established hierarchy is not so powerful as a caste, and the monarchs had one strong hold on the clergy by retaining the patronage of great ecclesiastical places, and another in the fact that the Semitic provinces on the Tigris, where the capital lay, were mainly inhabited by men of other faith.[1]

In this rapid glance at some of the chief priesthoods of antiquity we have hitherto passed over the pure Semites, whose priesthoods call for closer examination because of the profound influence which one of them—that of the Jews—has exercised on Christianity, and so on the whole history of the modern world. But before we proceed to this it may be well to note one or two things that come out by comparison of the systems already before us. Priestly acts—that is, acts done by one and accepted by the gods on behalf of many—are common to all antique religions, and cannot be lacking where the primary subject of religion is not the individual but the natural community. But the origin of a separate priestly class, distinct from the natural heads of the community, cannot be explained by any such broad general principle; in some cases, as in Greece, it is little more than a matter of convenience that part of the religious duties of the state should be confided to special ministers charged with the care of particular temples, while in others the intervention of a special priesthood is indispensable to the validity of every religious act, so that the priest ultimately becomes a mediator and the vehicle of all divine grace. This position, we see, can be reached by various paths: the priest may become indispensable through the growth of ritual observances and precautions too complicated for a layman to master, or he may lay claim to special nearness to the gods on the ground, it may be, of his race, or it may be of habitual practices of purity and asceticism which cannot be combined with the duties of ordinary life, as, for example, celibacy was required of priestesses of Vesta at Rome. But the highest developments of priestly influence are hardly separable from something of magical superstition; the *opus operatum* of the priest has the power of a sorcerer's spell. The strength of the priesthood in Chaldea and in Egypt stands plainly in the closest connection with the survival of a magical element in the state religion, and Rome, in like manner, is more priestly than Greece because it is more superstitious. In most cases, however, where an ancient civilization shows us a strong priestly system we are unable to make out in any detail the steps by which that system was elaborated; the clearest case perhaps is the priesthood of the Jews, which is not less interesting from its origin and growth than from the influence exerted by the system long after the priests were dispersed and their sanctuary laid in ruins.

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[1] Compare especially Nöldeke's *Tabari*, p. 450 *sq.*

Among the nomadic Semites, to whom the Hebrews belonged before they settled in Canaan, there has never been any developed priesthood. The acts of religion partake of the general simplicity of desert life; apart from the private worship of household gods and the oblations and salutations offered at the graves of departed kinsmen, the ritual observances of the ancient Arabs were visits to the tribal sanctuary to salute the god with a gift of milk, first-fruits or the like, the sacrifice of firstlings and vows (see NAZARITE and PASSOVER), and an occasional pilgrimage to discharge a vow at the annual feast and fair of one of the more distant holy places (see MECCA). These acts required no priestly aid; each man slew his own victim and divided the sacrifice in his own circle; the share of the god was the blood which was smeared upon or poured out beside a stone (*nosb ghabghab*) set up as an altar or perhaps as a symbol of the deity. It does not appear that any portion af the sacrifice was burned on the altar, or that any part of the victim was the due of the sanctuary. We find therefore no trace of a sacrificial priesthood, but each temple had one or more doorkeepers (*sādin hājib*), whose office was usually hereditary in a certain family and who had the charge of the temple and its treasures. The sacrifices and offerings were acknowledgments of divine bounty and means used to insure its continuance; the Arab was the "slave" of his god and paid him tribute, as slaves used to do to their masters, or subjects to their lords; and the free Bedouin, trained in the solitude of the desert to habits of absolute self-reliance, knew no master except his god, and acknowledged no other will before which his own should bend. Hence the other side of Arab religion was to look for divine direction in every grave or difficult concern of life; what could not be settled in the free council of the tribesmen, or by the unenforced award of an umpire, was referred to the command of the god, and the oracle was the only authority by which dissensions could be healed, lawsuits determined, and judgment authoritatively spoken. The voice of the god might be uttered in omens which the skilled could read, or conveyed in the inspired rhymes of soothsayers, but frequently it was sought in the oracle of the sanctuary, where the sacred lot was administered for a fee by the *sādin*. The sanctuary thus became a seat of judgment, and here too compacts were sealed by oaths and sacrificial ceremonies. These institutions, though known to us only from sources belonging to an age when the old faith was falling to pieces, are certainly very ancient. Their whole stamp is primitive, and they correspond in the closest way with what we know of the earliest religion of the Israelites, the only other Semitic people whose history can be traced back to a time when they had not fully emerged from nomad life. And, in fact, the fundamental type of the Arabic sanctuary can be traced through all the Semitic lands, and so appears to be older than the Semitic dispersion; even the technical terms are mainly the same, so that we may justly assume that the more developed ritual and priesthoods of the settled Semites sprang from a state of things not very remote from what we find among the heathen Arabs. Now among the Arabs, as we have seen, ritual service is the affair of the individual, or of a mass of individuals gathered in a great feast, but still doing worship each for himself and his own private circle; the only public aspect of religion is found in connection with divination and the oracle to which the affairs of the community are submitted. In Greece and Rome the public sacrifices were the chief function of religion, and in them the priesthood represented the ancient kings. But in the desert there is no king and no sovereignty save that of the divine oracle, and therefore it is from the soothsayers or ministers of the oracle that a public ministry of religion can most naturally spring. With the beginning of a settled state the sanctuaries must rise in importance and all the functions of revelation will gather round them. A sacrificial priesthood will arise as the worship becomes more complex (especially as sacrifice in antiquity is a common preliminary to the consultation of an oracle), but the public ritual will still remain closely associated with oracle or divination, and the priest will still be, above all things, a revealer. That this was what actually happened may be inferred from the fact that the Canaanite and Phœnician name for a priest (*kōhēn*) is identical with the Arabic *kāhin*, a "soothsayer." Soothsaying was no modern importation in Arabia; its characteristic form—a monotonous croon of short rhyming clauses—is the same as was practiced by the Hebrew "wizards who peeped and muttered" in the days of Isaiah, and that this form was native in Arabia is clear from its having a technical name (*saj'*), which in Hebrew survives only in derivative words with modified sense.[1] The *kāhin*, therefore, is not a degraded priest but such a soothsayer as is found in most primitive societies, and the Canaanite priests grew out of these early revealers. In point of fact some form of revelation or oracle appears to have existed in every great shrine of Canaan and Syria,[2] and the importance of this element in the cultus may be measured from the fact that at Hierapolis it was the charge of the chief priest, just as in the Levitical legislation. But the use of "kāhin" for "priest" in the Canaanite area points to more than this: it is connected with the orgiastic character of Canaanite religion. The soothsayer differs from the priest of an oracle by giving his revelation under excitement and often in a frenzy allied to madness. In natural soothsaying this frenzy is the necessary physical accompaniment of an afflatus which, though it seems supernatural to a rude people, is really akin to poetic inspiration. But it is soon learned that a similar physical state can be produced artificially, and at the Canaanite sanctuaries this was done on a large scale. We see from 1 Kings xviii., 2 Kings x., that the great Baal temples had two classes of ministers, *kōhănīm* and *nĕbīīm*, "priests" and "prophets," and as the former bear a name which primarily denotes a soothsayer, so the latter are also a kind of priests who do sacrificial service with a wild ritual of their own. How deeply the orgiastic character was stamped on the priesthoods of north Semitic nature-worship is clear from Greek and Roman accounts, such as that of Appuleius (*Metam.*, bk. viii.). Sensuality and religious excitement of the wildest kind went hand in hand, and a whole army of degraded ministers of a religion of the passions was gathered round every famous shrine.

The Hebrews, who made the language of Canaan their own, took also the Canaanite name for a priest. But the earliest forms of Hebrew priesthood are not Canaanite in character; the priest, as he appears in the older records of the time of the Judges, Eli at Shiloh, Jonathan in the private temple of Micah and at Dan, is much liker the *sâdin* than the *kâhin*.[1] The whole structure of Hebrew society at the time of the conquest was almost precisely that of a federation of Arab tribes, and the religious ordinances are scarcely distinguishable from those of Arabia, save only that the great deliverance of the Exodus and the period when Moses, sitting in judgment at the sanctuary of Kadesh, had for a whole generation impressed the sovereignty of Jehovah on all the tribes, had created an idea of unity between the scattered settlements in Canaan such as the Arabs before Mohammed never had. But neither in civil nor in religious life was this ideal unity expressed in fixed institutions; the old individualism of the Semitic nomad still held its ground. Thus the firstlings, first-fruits, and vows are still the free gift of the individual which no human authority exacts, and which every householder presents and consumes with his circle in a sacrificial feast without priestly aid. As in Arabia, the ordinary sanctuary is still a sacred stone (מַצֵּבָה = *nosb*) set up under the open heaven, and here the blood of the victim is poured out as an offering to God (see especially 1 Sam. xiv. 34, and compare 2 Sam. xxiii. 16, 17). The priest has no place in this ritual; he is not the minister of an altar,[2] but the guardian of a temple, such as was already found here and there in the land for the custody of sacred images and palladia or other consecrated things (the ark at Shiloh, 1 Sam. iii. 3; images in Micah's temple, Judges xvii. 5; Goliah's sword lying behind the "ephod" or plated image at Nob, 1 Sam. xxi. 9; no doubt also money, as in the Canaanite temple at Shechem, Judges ix. 4). Such treasures required a guardian; but, above all, wherever there was a temple there was an oracle, a kind of sacred lot, just as in Arabia (1 Sam. xiv. 41, Sept.), which could only be drawn where there was an "ephod" and a priest (1 Sam. xiv. 18 Sept. and xxiii. 6 *sq.*) The Hebrews had already possessed a tent-temple and oracle of this kind in the wilderness (Exod. xxxiii. 7 *sq.*), of which Moses was the priest and Joshua the æditus, and ever since that time the judgment of God through the priest at the sanctuary had a greater weight than the word of a seer, and was the ultimate solution of every controversy and claim (1 Sam. ii. 25; Exod. xxi. 6, xxii. 8, 9, where for "judge," "judges," read "God"). The temple at Shiloh, where the ark was preserved, was the lineal descendant of the Mosaic sanctuary—for it was not the place but the palladium and its oracle that were the essential thing—and its priests claimed kin with Moses himself. In the divided state of the nation, indeed, this sanctuary was hardly visited from beyond Mount Ephraim; and every man or tribe that cared to provide the necessary apparatus (ephod, teraphim, etc.) and hire a priest might have a temple and oracle of his own at which to consult Jehovah (Judges xvii., xviii.); but there was hardly another sanctuary of equal dignity. The priest of Shiloh is a much greater person than Micah's priest Jonathan; at the great feasts he sits enthroned by the doorway, preserving decorum among the worshippers; he has certain legal dues, and if he is disposed to exact more no one ventures to resist (1 Sam. ii. 12 *sq.*, where the text needs a slight correction). The priestly position of the family survived the fall of Shiloh and the captivity of the ark, and it was members of this house who consulted Jehovah for the early kings until Solomon deposed Abiathar. Indeed, though priesthood was not yet tied to one family, so that Micah's son, or Eleazar of Kirjath-jearim (1 Sam. vii. 1), or David's sons (2 Sam. viii. 18) could all be priests, a Levite—that is, a man of Moses' tribe—was already preferred for the office elsewhere than at Shiloh (Judges xvii. 13), and such a priest naturally handed down his place to his posterity (Judges xviii. 30).

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[1] Mĕshuggā', 2 Kings ix. 11, Jer. xxix. 26,—a term of contempt applied to prophets.

[2] For examples, see PALMYRA and PHILISTINES; see further, Lucian, *De Dea Syria*, 36, for Hierapolis; Zosimus, i. 58, for Aphaca; Pliny, *H. N.*, xxxvii. 58 (compared with Lucian, *ut supra*, and Movers, *Phoenizier*, i. 655), for the temple of Melkart at Tyre.

Ultimately, indeed, as sanctuaries were multiplied and the priests all over the land came to form one well-marked class, "Levite" and legitimate priest became equivalent expressions, as has been explained in detail in the article LEVITES. But between the priesthood of Eli at Shiloh or Jonathan at Dan and the priesthood of the Levites as described in Deut. xxxiii. 8 *sq.* there lies a period of the inner history of which we know almost nothing. It is plain that the various priestly colleges regarded themselves as one order, that they had common traditions of law and ritual which were traced back to Moses, and common interests which had not been vindicated without a struggle (Deut., *ut sup.*). The kingship had not deprived them of their functions as fountains of divine judgment (comp. Deut. xvii. 8 *sq.*); on the contrary, the decisions of the sanctuary had grown up into a body of sacred law, which the priests administered according to a traditional precedent. According to Semitic ideas the declaration of law is quite a distinct function from the enforcing of it, and the royal executive came into no collision with the purely declaratory functions of the priests. The latter, on the contrary, must have grown in importance with the unification and progress of the nation, and in all probability the consolidation of the priesthood into one class went hand in hand with a consolidation of legal tradition. And this work must have been well done, for, though the general corruption of society at the beginning of the Assyrian period was nowhere more conspicuous than at the sanctuaries and among the priesthood, the invective of Hos. iv. equally with the eulogium of Deut. xxxiii. proves that the position which the later priests abused had been won by ancestors who earned the respect of the nation as worthy representatives of a divine Torah.

The ritual functions of the priesthood still appear in Deut. xxxiii. as secondary to that of declaring the sentence of God, but they were no longer insignificant. With the prosperity of the nation, and especially through the absorption of the Canaanites and of their holy places, ritual had become much more elaborate, and in royal sanctuaries at least there were regular public offerings maintained by the king and presented by the priests (comp. 2 Kings xvi. 15). Private sacrifices, too, could hardly be offered without some priestly aid now that ritual was more complex; the provision of Deut. xviii. as to the priestly dues is certainly ancient, and shows that besides the tribute of first-fruits and the like the priests had a fee in kind for each sacrifice, as we find to have been the case among the Phœnicians according to the sacrificial tablet of Marseilles. Their judicial functions also brought profit to the priests, fines being exacted for certain offences and paid to them (2 Kings xii. 16; Hos. iv. 8; Amos ii. 8). The greater priestly offices were therefore in every respect very important places, and the priests of the royal sanctuaries were among the grandees of the realm (2 Sam. viii. 18; 2 Kings x. 11, xii. 2); minor offices in the sanctuaries were in the patronage of the great priests and were often miserable enough,[1] the petty priest depending largely on what "customers" he could find (2 Kings xii. 7 [8]; Deut. xviii. 8). That at least the greater offices were hereditary—as in the case of the sons of Zadok, who succeeded to the royal priesthood in Jerusalem after the fall of Abiathar—was almost a matter of course as society was then constituted, but there is not the slightest trace of an hereditary hierarchy officiating by divine right, such as existed after the exile. The sons of Zadok, the priests of the royal chapel, were the king's servants as absolutely as any other great officers of state; they owed their place to the fiat of King Solomon, and the royal will was supreme in all matters of cultus (2 Kings xii., xvi. 10 *sq.*); indeed the monarchs of Judah, like those of other nations, did sacrifice in person when they chose down to the time of the captivity (1 Kings ix. 25; 2 Kings xvi. 12 *sq.*; Jer. xxx. 21). And as the sons of Zadok had no divine right as against the kings, so too they had no claim to be more legitimate than the priests of the local sanctuaries, who also were reckoned to the tribe which in the 7th century B.C. was recognized as having been divinely set apart as Jehovah's ministers in the days of Moses (Deut. x. 8, xviii. 1 *sq.*).

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[1] This appears even in the words used as synonyms for "priest," משרת, שמר הסף, which exactly correspond to *sâdin* and *ḥâjib*. That the name of כהן was borrowed from the Canaanites appears certain, for that out of the multiplicity of words for soothsayers and the like common to Hebrew and Arabic (either formed from a common root or expressing exactly the same idea,—יִדְּעֹנִי, 'arrâf; חֹבֵר, ḥabir; רֹאֶה, חֹזֶה, ḥâzi; קֹסֵם, comp. istiksâm) the two nations should have chosen the same one independently to mean a priest is, in view of the great difference in character between old Hebrew and Canaanite priesthoods, inconceivable. Besides כהן Hebrew has the word כמר (pl. כמרים), which, however, is hardly applied to priests of the national religion. This, in fact, is the old Aramaic word for a priest (with suffixed article, *kumrâ*). Its origin is obscure, but, as it belongs to a race in which the mass of the people were probably not circumcised (Herod., ii. 104, compared with Joseph., *Ant.*, viii. 10, 3, and *C. Ap.*, i. 22) while the priests were (Dio Cassius, lxxix. 11; *Ep. Barnabæ*, ix. 6; comp. Chwolson, *Ssabier*, ii. 114), it may be conjectured that kumrâ means the circumcised (Ar. *kamara*, "*glans penis*").

[2] It is not clear from 1 Sam. ii. 15 whether even at Shiloh the priest had anything to do with sacrifice, whether those who burned the fat were the worshippers themselves or some subordinate ministers of the temple. Certainly it was not "the priest" who did so, for he in this narrative is always in the singular. Hophni and Phinehas are not called priests, though they bore the ark, and so were priests in the sense of Josh. iii.

The steps which prepared the way for the post-exile hierarchy, the destruction of the northern sanctuaries and priesthoods by the Assyrians, the polemic of the spiritual prophets against the corruptions of popular worship, which issued in the reformation of Josiah, the suppression of the provincial shrines of Judah and the transference of their ministers to Jerusalem, the successful resistance of the sons of Zadok to the proposal to share the sanctuary on equal terms with these new-comers, and the theoretical justification of the degradation of the latter to the position of mere servants in the temple supplied by Ezekiel soon after the captivity, have already been explained in the article LEVITES and in PENTATEUCH (vol. xviii. p. 520), and only one or two points call for additional remark here.

It is instructive to observe how differently the prophets of the 8th century speak of the judicial or "teaching" functions of the priests and of the ritual of the great sanctuaries. For the latter they have nothing but condemnation, but the former they acknowledge as part of the divine order of the state, while they complain that the priests have prostituted their office for lucre. In point of fact the one rested on old Hebrew tradition, the other had taken shape mainly under Canaanite influence, and in most of its features was little more than the crassest nature-worship. In this respect there was no distinction between the temple of Zion and other shrines, or rather it was just in the greatest sanctuary with the most stately ritual that foreign influences had most play, as we see alike in the original institutions of Solomon and in the innovations of Ahaz (2 Kings xvi. 10 *sq.*, xxiii. 11 *sq.*). The Canaanite influence on the later organization of the temple is clearly seen in the association of temple prophets with the temple priests under the control of the chief priest, which is often referred to by Jeremiah; even the viler ministers of sensual worship, the male and female prostitutes of the Phœnician temples, had found a place on Mount Zion and were only removed by Josiah's reformation.[2] So, too, the more complex sacrificial ritual which was now in force is manifestly not independent of the Phœnician ritual as we know it from the Marseilles tablet. All this necessarily tended to make the ritual ministry of the priests more important than it had been in old times; but it was in the dark days of Assyrian tyranny, in the reign of Manasseh, when the sense of divine wrath lay heavy on the people, when the old ways of seeking Jehovah's favor had failed and new and more powerful means of atonement were eagerly sought for (Micah vi. 6 *sq.*; 2 Kings xxi.; and comp. MOLOCH), that sacrificial functions reached their full importance. In the time of Josiah altar service and not the function of "teaching" has become the essential thing in priesthood (Deut. x. 8, xviii. 7); the latter, indeed, is not forgotten (Jer. ii. 8, xviii. 18), but by the time of Ezekiel it also has mainly to do with ritual, with the distinction between holy and profane, clean and unclean, with the statutory observances at festivals and the like (Ezek. xliv. 23 *sq.*). What the priestly Torah was at the time of the exile can be seen from the collection of laws in Lev. xvii.–xxvi., which includes many moral precepts, but regards them equally with ritual precepts from the point of view of the maintenance of national holiness. The sacrificial ritual of the Priestly Code (see PENTATEUCH) is governed by the same principle. The holiness of Israel centres in the sanctuary, and round the sanctuary stand the priests, who alone can approach the most holy things without profanatian, and who are the guardians of Israel's sanctity, partly by protecting the one meeting-place of God and man from profane contact, and partly as the mediators of the continual atoning rites by which breaches of holiness are expiated.

The bases of priestly power under this system are the unity of the altar, its inaccessibility to laymen and to the inferior ministers of the sanctuary, and the specific atoning function of the blood of priestly sacrifices. All these things were unknown in old Israel: the altars were many, they were open to laymen, and the atoning function of the priest was judicial, not sacrificial. So fundamental a change as lies between Hosea and the Priestly Code was only possible in the general dissolution of the old life of Israel produced by the Assyrians and by the prophets; and indeed, as is explained under PENTATEUCH, the new order did not take shape as a system till the exile had made a *tabula rasa* of all old institutions; but it was undoubtedly the legitimate and consistent outcome of the latest development of the temple worship at Jerusalem before the exile. It was meant also to give expression to the demands of the prophets for spiritual service and national holiness, but this it did not accomplish so successfully; the ideas of the prophets could not be realised under any ritual system, but only in a new dispensation (Jer. xxxi. 31 *sq.*), when priestly Torah and priestly atonement should be no longer required. Nevertheless, the concentration of all ritual at a single point, and the practical exclusion of laymen from active participation in it—for the old sacrificial feast had now shrunk into entire insignificance in comparison with the stated priestly holocausts and atoning rites[3]—lent powerful assistance to the growth of a new and higher type of personal religion, the religion which found its social expression not in material acts of oblation but in the language of the Psalms. In the best times of the old kingdom the priests had shared the place of the prophets as the religious leaders of the nation; under the second temple they represented the unprogressive traditional side of religion, and the leaders of thought were the psalmists and the scribes, who spoke much more directly to the piety of the nation.

But, on the other hand, the material influence of the priests was greater than it had ever been before; the temple was the only visible centre of national life in the ages of servitude to foreign power, and the priests were the only great national functionaries, who drew to themselves all the sacred dues as a matter of right and even appropriated the tithes paid of old to the king. The great priests had always belonged to the ruling class, but the Zadokites were now the only hereditary aristocracy, and the high priest, who now stands forth above his brethren with a prominence unknown to the times of the first temple, is the one legitimate head of the theocratic state, as well as its sole representative in the highest acts of religion (comp. PENTATEUCH, vol. xviii. p. 520). When the high priest stood at the altar in all his princely state, when he poured out the libation amidst the blare of trumpets, and the singers lifted up their voice and all the people fell prostrate in prayer till he descended and raised his hands in blessing, the slaves of the Greek or the Persian forgot for a moment their bondage and knew that the day of their redemption was near (Ecclus. l.). The high priest at such a moment seemed to embody all the glory of the nation, as the kings had done of old, and when the time came to strike a successful blow for freedom it was a priestly house that led the nation to the victory which united in one person the functions of high priest and prince. From the foundation of the Hasmonean state to the time of Herod the history of the high-priesthood merges in the political history of the nation; from Herod onward the priestly aristocracy of the Sadducees lost its chief hold over the nation and expired in vain controversy with the Pharisees. (See ISRAEL).

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[1] See 1 Sam. ii. 36, a passage written after the hereditary dignity of the sons of Zadok at Jerusalem was well established.

[2] 2 Kings xxiii. 7; comp. Deut. xxiii. 18, where "dogs"—the later Galli; comp. *Corp. Insc. Sem.*, i. 93 *sq.*

[3] Compare the impression which the ritual produced on the Greeks, Bernays's *Theophrastus*, pp. 85, 111 *sq.*

The influence of the Hebrew priesthood on the thought and organization of Christendom was the influence not of a living institution, for it hardly began till after the fall of the temple, but of the theory embodied in the later parts of the Pentateuch. Two points in this theory were laid hold of—the doctrine of priestly mediation and the system of priestly hierarchy. The first forms the text of the principal argument in the Epistle to the Hebrews, in which the author easily demonstrates the inadequacy of the mediation and atoning rites of the Old Testament, and builds upon this demonstration the doctrine of the effectual high-priesthood of Christ, who, in His sacrifice of Himself, truly "led His people to God," not leaving them outside as He entered the heavenly sanctuary, but taking them with Him into spiritual nearness to the throne of grace. This argument leaves no room for a special priesthood in the Christian church, and in fact nothing of the kind is found in the oldest organization of the new communities of faith. The idea that presbyters and bishops are priests and the successors of the Old Testament priesthood first appears in full force in the writings of Cyprian, and here it is not the notion of priestly mediation but that of priestly power which is insisted on. Church office is a copy of the old hierarchy. Now among the Jews, as we have seen, the hierarchy proper has for its necessary condition the destruction of the state and the bondage of Israel to a foreign prince, so that spiritual power is the only basis left for a national aristocracy. The same conditions have produced similar spiritual aristocracies again and again in the East in more modern times, and even in antiquity more than one Oriental priesthood took a line of development similar to that which we have traced in Judæa. Thus the hereditary priests of Ḳozaḥ (Κοζέ) were the chief dignitaries in Idumæa at the time of the Jewish conquest of the country (Jos., *Ant.*, xv. 7, 9), and the high priest of Hierapolis wore the princely purple and crown like the high priest of the Jews (*De Dea Syria*, 42). The kingly insignia of the high priest of the sun at Emesa are described by Herodian (v. 3, 3), in connection with the history of Elagabalus, whose elevation to the Roman purple was mainly due to the extraordinary local influence of his sacerdotal place. Other examples of priestly princes are given by Strabo in speaking of Pessinus (p. 567) and Olbe (p. 672).[1] As no such hierarchy existed in the West, it is plain that if the idea of Christian priesthood was influenced by living institutions as well as by the Old Testament that influence must be sought in the East (comp. Lightfoot, *Philippians*, p. 261). The further development of the notion of Christian priesthood was connected with the view that the Eucharist is a propitiatory sacrifice which only a consecrated priest can perform. The history of this development is still very obscure, especially as regards its connection with heathen ideas, but something will fall to be said on it under the heading of SACRIFICE. It is sufficient to remark here that the presentation of the sacrifice of the mass came to be viewed as the essential priestly office, so that the Christian presbyter really was a *sacerdos* in the antique sense. Protestants, in rejecting the sacrifice of the mass, deny also that there is a Christian priesthood "like the Levitical," and have either dropped the name of "priest" or use it in a quite emasculated sense.

There is probably no nature religion among races above mere savagery which has not had a priesthood; but an examination of other examples would scarcely bring out any important feature that has not been already illustrated. Among higher religions orthodox Islam has never had real priests, doing religious acts on behalf of others, though it has, like Protestant churches, leaders of public devotion (imâms) and an important class of privileged religious teachers ('ulemâ). But a distinction of grades of holiness gained by ascetic life has never been entirely foreign to the Eastern mind, and in the popular faith of Mohammedan peoples something very like priesthood has crept in by this channel. For where holiness is associated with ascetic practices the masses can never attain to a perfect life, and naturally tend to lean on the professors of special sanctity as the mediators of their religious welfare. The best example, however, of a full-blown priestly system with a monastic hierarchy grafted in this way on a religion originally not priestly is found in Tibetan Buddhism (see LAMAISM), and similar causes undoubtedly had their share in the development of sacerdotalism in the Christian church. The idea of priestly asceticism expressed in the celibacy of the clergy belongs also to certain types of heathen and especially Semitic priesthood, to those above all in which the priestly service is held to have a magical or theurgic quality. (W. R. S.)

PRIESTLEY, JOSEPH (1733–1804), was born on 13th March, 1733, at Fieldhead near Birstal, in the West Riding of Yorkshire. His father, Jonas Priestley, was a woollen-cloth dresser and apparently of very moderate means. His mother was the only child of Joseph Swift, a farmer at Shafton near Wakefield. The paternal grandfather, also named Joseph, was a churchman whose high moral character became a sacred tradition in his family. The young Joseph's parents were Nonconformists. They had six children in eight years, and on the birth of the last, in the hard winter of 1739, the mother died. During those years Joseph lived a good deal with his maternal grandfather at Shafton. But he relates that his mother "was careful to teach him the Assembly's Catechism," and that, with a view of impressing on his mind "a clear idea of the distinction of property," she on one occasion made him carry back a *pin* which he had picked up at the house of an uncle. Three years after the loss of his mother, his father's sister, Mrs. Keighley, a lady in good circumstances, having no children of her own, took the boy to live with her.

At the age of twelve he was sent to a neighboring endowed school, where, under the tuition of a clergyman, Mr. Hague, he made rapid progress in classics, while on holidays, by way of recreation, he learned Hebrew from Mr. Kirkley, a Dissenting minister. On the removal of the clergyman Mr. Kirkley opened a school of his own, and Priestley became entirely his pupil. From the age of sixteen to nearly twenty his health was unsatisfactory, and he attended neither school nor college, but still continued his studies in private with occasional assistance. It was thought that his constitution would be better adapted to an active than to a sedentary life, and with a view to commerce he learned French, Italian, and German without assistance. But the aunt, Mrs. Keighley, had set her heart on making a minister of him, and young Priestley's own aspirations took the same form. When, therefore, his health improved, the offer of a mercantile situation in Lisbon was surrendered, and Priestley in his twentieth year (1752) was sent to Daventry, where there existed a Nonconformist academy, originally founded by Dr. Doddridge at Northampton, and removed after his incapacitation by illness or on his death in 1751.

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[1] See also Mommsen, *Hist. of Rome*, Eng. trans., iv. 150.

There is no mention of any hesitation on the part of Priestley or his friends as to whether he should enter the established church or not. But there was certainly nothing in his theological creed at this period to have prevented his taking orders. The hindrance, therefore, must have been his adherence to the Nonconformist tradition on questions of ecclesiastical polity and ritual. There were, however, in his early associations some elements which not only help to explain his after career but throw a curious light on the fluid condition of Nonconformist denominations in those days as compared with their sectarian fixedness now. He was brought up in the principles of Calvinism. But he tells us his aunt's house "was the resort of all the Dissenting ministers in the neighborhood without distinction; and those who were most obnoxious on account of their heresy were almost as welcome to her, if she thought them honest and good men—which she was not unwilling to do—as any others." Notwithstanding the comparative freedom of the conversations to which he listened, young Priestley at seventeen was strictly orthodox, and anxiously endeavored to realize the experiences he supposed to be necessary to conversion. His chief trouble was that he could not repent of Adam's transgression, a difficulty he never surmounted. The pressure of this impossibility forced his candid mind to the conclusion that there must be a mistake somewhere, and he began to doubt whether he was really so much entangled in Adam's guilt as he had been taught. Accordingly he was refused admission into the communion of the Independent church which his aunt attended. His adhesion to Calvinism was now considerably relaxed. But this did not interfere with his entrance at Daventry. Dr. Doddridge had not confined his educational aims to students for the ministry, and he not only refused to impose theological tests but he incurred reproach by resolutely refusing to press his own orthodox creed on the heterodox pupils occasionally received. Priestley's intellectual preparation previous to his entrance is noteworthy. Besides being a fair classic, he had improved his Hebrew by giving lessons in that language. He had acquired three modern languages. He had "learned Chaldee and Syriac, and just begun to read Arabic"; nor was he disproportionately backward in mathematics. He had also mastered Gravesande's *Elements of Natural Philosophy*, and various text-books of the time in logic and metaphysics. It cannot surprise us that he "was excused all the studies of the first year and a great part of those of the second." At Daventry he stayed three years taking a prominent part in the singularly free discussions that seem to have formed a considerable part of the academical exercises. "In this situation," he says, "I saw reason to embrace what is generally called the heterodox side of almost every question." His chief tutors were Dr. Ashworth of conservative and the Rev. Samuel Clark of decidedly liberal tendencies. Priestley's speculations at this time were philosophical rather than scientific. Under the influence of Hartley's *Observations on Man* and Collins's *Philosophical Enquiry* he exchanged his early Calvinism for a system of "necessarianism,"—that is, he learned to hold that the invariable connection of cause and effect is as inviolable in the moral as in the material world. During these early years he began his enormous industry as a writer, and in particular laid down the lines of his *Institutes of Natural and Revealed Religion*.

From Daventry he went in 1755, at twenty-two years of age, to take charge of a small congregation at Needham Market in Suffolk. This church was halting between Presbyterianism and Independency, being subsidized by both. Priestley insisted on dropping the Independent connection. As a consequence he had to content himself with a salary of £30, and succeeded in living on less. His studies had not in the least chilled his devotion to the sacred work, which indeed to the end of his life he counted his highest honor. He was diligent in preaching and teaching, but his intellectual freedom, together with a physical difficulty in speech, prevented his attaining popularity. To cure the defect in speech he paid twenty guineas, given him by his aunt, to a London specialist or quack. But this difficulty turned out to be as irremediable as his intellectual unconformability; and the only permanent advantage derived from his visit to the metropolis was an introduction to various scholars of the day, such as Dr. Price, also Dr. Benson and Dr. Kippis, friends of Lardner. Later on he made the acquaintance of the last also through some manuscript notes on the doctrine of atonement, which attracted the great scholar's attention.

In 1758 Priestley removed to Nantwich, obtaining a more congenial congregation; and there he established a school, which increased his income but lessened his literary activity. Always bringing his best intelligence to bear on everything he undertook, he varied his elementary lessons with instruction in natural philosophy, illustrated by experiments, for which he could now afford the needful instruments. "These," he says, "I taught my scholars in the highest class to keep in order, and to make use of; and by entertaining their parents and friends with experiments, in which the scholars were generally the operators, and sometimes the lecturers too, I considerably extended the reputation of my school." Up to this time his studies had been entirely literary and theologico-philosophical. It is noteworthy that his efforts to liberalize education turned his attention to science. He was probably one of the very first teachers to appreciate the importance of physical science to early culture.

In 1761 he was appointed classical tutor in a Nonconformist academy, then recently established at Warrington on the same liberal principles as the institution at Daventry. In this position he passed six of his happiest years, pursuing his scientific studies, especially in chemistry and electricity, enjoying congenial intercourse with Dr. Turner of Liverpool, also with Wedgwood's partner Mr. Bentley, Dr. Enfield, and various Manchester men whose sons or grandsons helped to form the "Manchester school." In 1762 he married the daughter of Mr. Isaac Wilkinson, an ironmaster of Wrexham. At Warrington Priestley received the complimentary degree of LL.D. from Edinburgh, apparently in recognition of his *Chart of History*. On a visit to London he made the acquaintance of Dr. Franklin, and his researches in electricity procured his election to the Royal Society in 1766.

In the following year (1767) Dr. Priestley removed to Leeds to take charge of Mill Hill chapel; and in the same year was published his *History of Electricity*, a work suggested by Dr. Franklin, and contributing greatly to the author's fame. Now, however, he turned once more to speculative theology, and surrendered the Arianism he had hitherto loosely held, adopting instead definite Socinian views. In addition to preaching and teaching diligently in his congregation he carried on his chemical researches with results considered at the time startling. Chemistry was hardly in its infancy; it was unborn. "The vast science," says Mr. Huxley, "which now passes under that name had no existence." Living next door to a brewery Dr. Priestley amused himself with experiments on the "fixed air" (carbonic acid) produced there, and succeeded in forcing it into water. Thus commenced his researches on "different kinds of air" remarkable rather for the impulse they gave to controversy and experiment than for any mature scientific results. He had a keen instinct for surmise, but no adequate method of research and verification. On this point Roscoe and Schorlemmer observe in their treatise on *Chemistry* (vol. i. p. 18) that "Priestley's notion of original research, which seems quite foreign to our present ideas, may be excused, perhaps justified by the state of science in his day. He believed that all discoveries are made by chance, and he compares the investigation of nature to a hound, wildly running after, and here and there chancing on game (or, as James Watt called it, 'his random haphazarding'), whilst we would rather be disposed to compare the man of science to the sportsman, who having, after persistent effort, laid out a distinct plan of operations, makes reasonably sure of his quarry." At this time also he wrote various political tracts and papers, always in favor of popular rights, and in particular hostile to the attitude of the Government towards the American colonies.

In 1771 he was nearly appointed to accompany Captain Cook to the South Seas. But the Government of the day was shocked at the idea of giving official position to a Socinian minister, and Priestley was disappointed. Shortly afterwards he accepted the somewhat anomalous situation of "literary companion" and librarian to Lord Shelburne. With this nobleman he travelled in Holland and Germany, returning by Paris, where he spent a month in 1774. The position gave him ample leisure for his scientific and literary pursuits. But on the completion of his most noteworthy philosophical treatise, *Disquisitions on Matter and Spirit*, the connection was dissolved. It has been surmised that the patron feared to share the unpopularity of his client's views. Those views Priestley himself considered to be "materialistic." It is a question of words. Seeing that he denied impenetrability to matter, it is difficult to say why the substance he left might not as well be called spirit as anything else.

In 1780 he removed to Birmingham, where he enjoyed the friendship of James Watt and his partner Boulton, also of Dr. Darwin, grandfather of the illustrious man in whom the honors of the name culminated. Here Dr. Priestley again took charge of a congregation, and resumed his theological efforts in a controversy with the bishop of Waterford, and in a laborious *History of the Corruptions of Christianity*. But bad times were at hand. The French Revolution excited passionate controversy, and Priestley was naturally on the side of the revolutionists. In 1791 the anniversary of the capture of the Bastille was observed in Birmingham by a dinner at which he was not present, and with which he had nothing to do. But the mob wished to testify by some signal deed their abhorrence of the un-English notions propounded at the dinner, and therefore burned down Priestley's chapel and house. Before the deed was done they waded knee deep in torn manuscripts, and amused themselves with futile efforts to make an electric machine avenge its owner's impiety by firing the papers with a spark. The blow was a terrible one. Priestley and his family had escaped violence by timely flight, but every material possession he valued was destroyed and the labors of years annihilated. But neither despair nor bitterness possessed him. He left Birmingham, and for three years preached in Hackney, then a suburban village, and in 1794 he went out to the young States whose cause he had advocated to spend the last ten years of his life in the land of the future. He resided at Northumberland in Pennsylvania, eager as ever for controversy and research. His materialism, so-called, never dimmed his hope of immortality. His religion to the end was characterized by a childlike simplicity of spirit. On his deathbed he would have his grandchildren to kneel by his side for their daily prayers, and listened with pleasure to the hymns they lisped. On the 6th of February, 1804, he clearly and audibly dictated a few alterations he wished to make in some of his publications. "That is right," he said, "I have now done"; and within an hour he quietly expired.

The interest of Dr. Priestley's life lies not so much in any splendid achievements, either literary or scientific, but rather in the character of the man. His career also affords a typical illustration of the mutual relation and interaction of several great factors of human progress at a very critical period. As a Nonconformist minister, born into a Calvinistic circle, educated in an Independent academy, developing into a Socinian divine, yet maintaining always the most friendly relations with clergymen, priests, and orthodox ministers, he gives us a curious insight into the condition of English religion just before its sectarian divisions had hardened into their modern form. As a pioneer in the investigation of gases and the discoverer of oxygen he helped—but, it must be admitted, as often by his mistakes as by his successes—to erect chemistry into a science. As a professed materialist whose doctrines seemed at the same time to merge matter in force he, amongst others, prepared the way for the modern agnosticism, which declines to look behind phenomena. As a politician he anticipated nineteenth-century radicalism. In general, as an exceptionally single-eyed and fearless searcher after truth he bore the brunt of persecution by vulgar ignorance, and in his disappointments illustrated how little can be practically accomplished by isolated enlightenment apart from popular education.

The works of Dr. Priestley, as collected and edited by John Towill Rutt, fill twenty-five octavo volumes, one of which, however, consists of memoirs and correspondence. The date of this collected edition is 1832. It contains upwards of 130 separate works, varying in size from brief pamphlets to treatises in four volumes, and his labors range over almost all possible subjects of human knowledge or speculation. Mathematics, chemistry, physiology, grammar, logic, mental and moral philosphy, history, theology, interpretation of prophecy, politics, and sociology, all alike furnished themes for Priestley's untiring pen, and if he did not write on any of them with striking originality he treated all with freedom and intelligence. In 1761 he issued his first published works, a treatise on the *Scripture Doctrine of Remission* and *The Rudiments of English Grammar*. From that date till 1767 he was content with publishing something every alternate year. But from 1767 to 1804 he allowed only two years to go by unmarked by one or more publications, many of them remarkable as monuments of conscientious and laborious industry. His first scientific work, *The History and Present State of Electricity, with Original Experiments*, was published in 1767. The rapid advance of science has left to this and similar works of his little more than an antiquarian interest. But the treatise illustrates his prophetic spirit, inasmuch as it shows how far he was in advance of his contemporaries in appreciation of the prospects of physical research. In 1774 he issued his first volume of *Experiments and Observations on Different Branches of Air, etc.* In this volume he announced his discovery of "dephlogisticated air," now known as oxygen. The then prevalent theory of *phlogiston*, or the combustible principle in matter, betrayed him into great confusion, evident enough in the very name he gave to his new "branch of air." Nevertheless it is said of him in Roscoe and Schorlemmer's *Chemistry* (vol. i. p. 16) that "no one obtained more important results or threw more light upon the chemical existence of a number of different gases than Joseph Priestley." These *Experiments and Observations* were continued through five volumes, of which the last appeared in 1780. Perhaps the limit of Priestley's power of growth is illustrated by the persistency with which he clung to *phlogiston* notwithstanding the discoveries of Black, Lavoisier, and Cavendish. In 1800 he issued a treatise called *The Doctrine of Phlogiston established, and that of the Composition of Water refuted*. In a letter of that year to the Rev. T. Lindsay he says, "I have well considered all that my opponents have advanced, and feel perfectly confident of the ground I stand upon. In this definite treatise I insert all that is contained in my former publications on the subject, with many new experiments. Though nearly alone, I am under no apprehension of defeat." Dr. Priestley clearly failed to appreciate the progress of the science he had done so much to promote. But the attempt made by Lavoisier to claim for himself a concurrent discovery of oxygen at the same time as Priestley's was certainly unjustifiable. This achievement, together with the first preparation of nitric oxide, nitrous oxide, hydrochloric acid, and other important gases, constitutes the true ground of his fame as a scientific pioneer (see Roscoe and Schorlemmer, *l.c.*).

Priestley's chief theological works were the *Institutes of Natural and Revealed Religion*, *A History of the Corruptions of Christianity*, and *A General History of the Christian Church to the Fall of the Western Empire*. Bishop Horsley's criticisms on the second of these works produced letters in reply, "with additional evidence that the primitive church was Unitarian." His principal metaphysical writings were *Disquisitions relating to Matter and Spirit* and various essays and letters on necessarianism. A complete list of his works will be found in vol. i. part ii. of Rutt's collected edition.

(J. A. P., JR.)

PRIM, Juan, Marquis de los Castillejos, Count de Reus (1814–1870), Spanish soldier and statesman, was the son of Lieutenant-Colonel Pablo Prim, and was born at Reus in Catalonia on 12th[1] December, 1814. He entered the free corps known as the volunteers of Isabella II. in 1834 and greatly distinguished himself throughout the Carlist War, in the course of which he rose to the rank of lieutenant-colonel and had two orders of knighthood conferred upon him. After the pacification of 1839 he entered political life, and as a progressist opposed to the dictatorship of Espartero he was sent into exile. However, in 1843 he was elected deputy for Tarragona and issued a pronunciamento against Espartero at Reus; and after defeating Espartero at Bruch he entered Madrid in triumph with Serrano. The regent Maria Christina recognized his services, promoted him to the rank of major-general, and made him count of Reus. Prim now looked forward to peace under a settled constitutional monarchy, but Narvaez, the prime minister, failed to understand what constitutional freedom meant, and Prim, on showing signs of opposition, was sentenced to six years' imprisonment in the Philippine Islands. The sentence was not carried out, and Prim remained an exile in England and France until the amnesty of 1847. He then returned to Spain, but kept aloof from politics, and was first employed as captain-general of Porto Rico and afterwards as military representative of Spain with the sultan during the Crimean War. In 1854 he returned to Spain on being elected to the cortes, and gave his support to O'Donnell, who promoted him to be lieutenant-general in 1856. In the war with Morocco, at the head of his division, he did such good service at Los Castillejos or Marabout, Cabo Negro, Guad al Gelu, and Campamento in 1860 that he was made marquis de los Castillejos and a grandee of Spain. He next commanded the Spanish expeditionary army in Mexico, when he acted in exact accordance with the treaty of London and refused to consent to the ambitious schemes of Napoleon III. On his return to Spain he joined the opposition, heading pronunciamentos in Catalonia against Narvaez and O'Donnell. All his attempts failed until the death of Narvaez in April, 1868, after which Queen Isabella fell more and more under the influence of the Jesuits, and became increasingly tyrannical, until at last even Serrano was exiled, and more than 10,000 persons, including every journalist of position, were in prison. In September, 1868, Serrano and Prim returned, and Admiral Topete, commanding the fleet, raised the standard of revolt at Cadiz. For the public events of the subsequent ten months the reader is referred to the article SPAIN. In July, 1869, Serrano was elected regent, and Prim became president of the council and was made a marshal. On 16th November, 1870, Amadeo, duke of Aosta, was elected king of Spain, but Prim was not destined to receive the new monarch, for on leaving the chamber of the cortes on 28th December he was shot by unknown assassins and died two days later. The cortes at once declared that he had deserved well of his native land, and took his children as wards of the country; three days afterwards King Amadeo I. swore in the presence of the corpse to observe the new Spanish constitution.

Two biographies of Prim down to 1860 were published in that year by Gimenez y Guited and Gonzales Llanos; see also L. Blairet, *Le Général Prim et la situation actuelle de l'Espagne*, Paris, 1867, and Guillaumot, *Juan Prim et l'Espagne*, Paris, 1870.

PRIMATE (*primas*, i.e., *primus*), a title more than once bestowed in the *Codex Theodosianus* on various civil functionaries, came about the beginning of the 4th century to be used also, especially in Africa, as a designation of the "primæ sedis episcopus." In the canon law the word "primate" is regarded as essentially the Western equivalent of the Eastern "patriarch." See ARCHBISHOP and PATRIARCH.

PRIMOGENITURE. The term "primogeniture" is used to signify the preference in inheritance which is given by law, custom, or usage to the eldest son and his issue, or in exceptional cases to the line of the eldest daughter. The practice prevailed under the feudal codes throughout all the Western countries. It is now almost entirely confined to the United Kingdom, having been abolished (except in the succession to the crown) by the various civil codes which have superseded feudalism on the Continent, and having been universally rejected in the United States of America as being contrary to the spirit of their institutions. The system has of late years been persistently attacked in Great Britain, chiefly on the ground of hardship in cases of intestacy where the property is small; but the rule was found to operate so successfully in former times towards keeping large properties together that it seems likely to be still maintained by law; and even if abolished as a rule of law it would most probably be maintained in full vigor as a habit or rule of practice.

In dealing with the whole subject it will be convenient to state in the first place the nature of the rules of primogeniture as they now exist in England, with some notice of the exceptional usages which illustrate the meaning and origin of the system, and in the second place to give an account of those archaic customs in which we may find the actual origin of primogeniture before it was altered and extended by the policy of the feudal sovereigns, and by traditional usages which governed their succession to the throne. The English law provides that in ordinary cases of inheritance to land the rule of primogeniture shall prevail among the male children of the person from whom descent is to be traced, but not among the females; and this principle is applied throughout all the degrees of relationship. There are exceptions to this rule in the gavelkind lands of Kent, where all the males take equally in each degree, in the burgage tenements of certain ancient boroughs, where the descent is to the youngest son under the custom called "borough-English," and in the copyhold lands of a great number of manors, where customs analogous to those of gavelkind and borough-English have existed from time immemorial. In another class of exceptions the rule of primogeniture is applied to the inheritance of females, who usually take equal shares in each degree. The necessity for a sole succession has, for example, introduced succession by primogeniture among females in the case of the inheritance of the crown, and a similar necessity led to the maxim of the feudal law that certain dignities and offices, castles required for the defence of the realm, and other inheritances under "the law of the sword" should not be divided, but should go to the eldest of the co-heiresses (Bracton, *De Legibus*, ii. c. 76; Co. Litt., 165a). In the case of dignities the rule of sole succession is adopted without reference to the right of primogeniture, the dignity lying in abeyance until the line of a particular co-heiress is selected by the sovereign as "the fountain of honor." Another exceptional usage gives a preference to the line of the eldest daughter in the inheritance of customary holdings in the Isle of Man, in various lordships in Cumberland, Westmoreland, and Durham, as well as in isolated manors in Surrey and Sussex, and in other parts of the southern and midland counties. At Tynemouth in Northumberland it was the custom that the eldest daughter surviving her parents should inherit her father's estate for her life, and in some of the southern manors already mentioned the rule of primogeniture among females is not confined to daughters but is extended to the eldest sister or aunt, or even to female relations in more remote degrees. There are many other special customs by which the ordinary rules of descent are varied according to manorial usage, as that the youngest son shall inherit if the father dies seised, but otherwise the eldest, or that fee-simple shall go to the youngest and entailed land to the eldest, or that the special custom shall only affect lands of a certain value (as is said to be the usage in several manors near London), or that male and female issue should share together (as formerly was the practice at Wareham and Exeter and in certain other ancient boroughs, as well as in some of the copyholds belonging to the see of Worcester), or that the eldest or the youngest should be preferred among the daughters in the claim to a renewal of a customary estate for lives, with other analogous variations.

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[1] [E. Baret gives 6th December as date of birth, as do other authorities. Biographie Générale.—AM. ED.]

It will be seen that the English law of inheritance creates a double preference, subject to the exceptions already mentioned, in favor of the male over the female and of the first-born among the males. This necessitates the rule of representation by which the issue of children are regarded as standing in the places of their parents. This is called "representative primogeniture." The rule appears to have been firmly established in England during the reign of Henry III., though its application was favored as early as the 12th century throughout the numerous contests between brothers claiming by proximity of blood and their nephews claiming by representation, as in the case of King John and his nephew Prince Arthur (Glanville, vii. c. 3; Bracton, *De Legibus*, ii. c. 30). We must now describe some of those ancient usages in which the origin of primogeniture is to be sought.

In addition to the rule of eldership as applied to inheritances of land there are traces of a multitude of customs which applied a similar rule to certain classes of "principals" or heirlooms, such as the best bed or piece of furniture, or horse and cart, and the like, which descended to the eldest son; and by a similar rule of the common law the ancient jewels of the crown are heirlooms which descend to the successor according to the rule of primogeniture. In the district of Archenfield near the Welsh border the house and lands were divided between the sons on their father's death, but certain "principals" passed to the eldest as heirlooms, such as the best table and bed, "all of which the men of Archenfield retained as derived to them from great antiquity, even before the Norman Conquest" (Quo Warranto Roll, 20 Edw. I., "Irchinfield"). A similar usage existed in some of the lands in Sussex belonging to Battle Abbey; and by the custom of the hundred of Stretford in Herefordshire the eldest son was entitled to keep the best article of every kind of chattel, as the best of the chests and cups, or the best table and chair (Co. Litt., 18b). This right resembles in many respects the privilege of the youngest co-heir to take the hearthplace or *covert del astre*, which formerly prevailed in the gavelkind lands of Kent according to the Kentish custumal, and privileges of the same kind which were customary in the district round Amiens and in many parts of Flanders under the tenures called "maineté," "quévaise," and "madalstad" (Bouthors, "Coutûmes Locales du Bailliage d'Amiens," *Cout. Gén.*, i. 699, ii. 901). This exceptional law does not seem to have prevailed in Scotland or Ireland; but in the Shetland Islands it appears to have been the custom, as also in several of the Continental instances, that the youngest child of either sex should have the house when the property came to division. Similar benefits were reserved to the youngest son by the Welsh laws, which provided that when brothers divided a patrimony containing a habitation "the youngest should have the principal messuage and all the buildings and eight acres of land, and the hatchet, the boiler, and the ploughshare," and a preference of the same kind prevailed in some parts of Devon and Cornwall and in very extensive lordships in Brittany. Traces of the same or analogous usages may be found in many parts of Germany, Switzerland, Russia, Hungary, and other countries.[1]

The custom of giving a preferential birthright to the eldest son or child did not prevail so extensively in ancient times, though it was known in some parts of Germany as well as in France, where it is called "le préciput." The eldest son or eldest child got the house and a piece of furniture and a plot of land "as far as a chicken could fly," as being traditionally exempt from the general partition. In the *Ordinances* of St. Louis we find a rule that a gentleman having daughters only should divide the rest of his property equally among them, "mais l'aînée outre sa portion aura la maison paternelle et le vol du chapon."

Instances of this kind are found among the rural customs of England and Normandy, which serve to indicate the source of one part at least of the English system of primogeniture. The rights of the eldest, however, have been collected from many quarters. Sir Henry Maine has traced the modern form of this system to the growth of the power of the chieftain and its development in feudal times. The mediæval jurists are responsible for many exaggerations of the principle of sole succession to rights of dominion. But it is at any rate important to observe that there were Teutonic customs giving a benefit of eldership before the feudal system was invented, which appear to have much less connection with the power of the patriarch or chieftain than with the sentiment that gave the father's house to the eldest son under the Athenian law or secured to him a larger set of rights under the *Laws of Manu* (Demosth., *Pro Phorm.*, 34; Coulanges, *Cité Antique*, c. 6). It should also be remembered that at least one tribe of Germans was accustomed in the days of Tacitus to allow the father's war-horse to descend as an heirloom or "principal" to the eldest son (*Germ.*, cc. 18, 20, 32), and that the strict rule of primogeniture appears to have existed in Scandinavia from the most ancient times. To the English instances already mentioned may be added a passage from Bede's life of St. Benedict which shows that some substantial birthright was reserved in his time for the eldest son, when a patrimony had to be divided according to the Northumbrian laws, "Quomodo terreni parentes, quem primum fuderint, eum principium liberorum suorum cognoscere et cæteris præferendum ducere solent" (Bede, *Vit. Bened.*, s. 11). This may refer to some system of double portions, like the Jewish rule as to "birthright" (Deut. xxi. 15, 16), or it may denote a preference in partition which secured the dwelling-house or principal chattels to "the first-fruits of the family." A passage from Glanville, which is applicable to England and Scotland in the 12th century, shows that in the case of a rustic holding the custom of the district determined whether it should be divided among all the sons or reserved for the eldest or youngest. "If he were a free sokeman, the inheritance in that case will be divided among all the sons according to their number in equal shares, if the holding was partible by ancient custom, the chief messuage being, however, reserved for the first-born son in honor of his seniority, but on the terms of his making compensation to his brothers from the rest of his property. But if it was not anciently partible, then by the custom of some places the first-born son will take the whole inheritance, but by other customs the youngest son is the heir" (Glanville, vii. c. 3). In the time of Bracton, a century later, the presumption that primogeniture was an exceptional rule had been reversed, and special proof was required in freehold lands of a custom to exclude the eldest. He still speaks, however, of customs in favor of the eldest or youngest son in the case of the "villein-socage" holdings, which afterwards developed into copyholds. "When a free sokeman dies leaving several heirs to share, if the inheritance is partible from ancient times, they shall all have their equal shares; and if there is only one messuage that shall remain entire for the eldest, but so that the others shall have up to its value out of the common stock. But if the inheritance has not been divided from ancient times then it shall remain to the eldest. But if it be villein-socage then the custom of the place is to be observed, for it is the usage in some parts for the youngest to be preferred to the eldest, or the contrary" (*De Leg.*, ii. c. 76). The ancient rule of inheritance among socage tenants in Scotland was the same as that described by Glanville.

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[1] *Reports on Tenure of Land*, 1869; Grimm, *Deutsche Alterthüm.*, 475; Wenckebach, *Jus Theelacticum Redivivum*, 1759; Kövy, *Summ. Juris Hungarici*, 351; Mesökövesel. *Les Bachkirs*, etc., iii. 81.

These customs of "rural primogeniture" can be traced, as we have seen, in some parts of the Continent, but their existence is rarely to be distinguished where the influence of the Roman law prevailed in the barbarian kingdoms, as in Italy, Spain, and Provence. In Normandy and Picardy, however, these usages long remained in an exceptionally vigorous form,—a fact which may be due to the Scandinavian origin of the Normans, or perhaps, as Richebourg suggested in his note on the *Coutûme de Caux*, the custom may have lasted down as a tradition from Gaulish times. The laws of the Channel Islands still preserve a special benefit for the eldest son; but the *Coutûmier Général* affords several examples of a more ample birthright which can hardly be attributed to any feudal influence. By the custom of Normandy "the eldest son in right of his eldership might take and choose as a *préciput* such fief or *terre noble* as he pleased; and if there were but one *manoir roturier* on the land the eldest before the division might declare that he retained it with court and garden, making recompense to his younger brothers" (*Coutûme de Normandie*, 337, 356). "L'aisné faisant partage . . . peut retenir par précipu le lieu chevels . . . anciennement appelé hébergement, soit en ville ou en champs, de quelque estendue qu'il soit" ("Usage de Bayeux," *Cout. Gén.*, iv. 77, 78, 94). The usage of the district of Caux, on the frontier of Picardy, was even more favorable to the eldest son: "Demeurant le manoir et pourpris en son integrité au profit de l'aisné sans qu'il en puisse être disposé à son préjudice, ny qu'il soit tenu en faire récompense ausdits puisnés" ("Suec. Bailliage de Caux," *ibid.*, 74).

This last instance appears to give us a clue to the origin of the strict English primogeniture as applied to the rustic holdings, sometimes called *fiefs de roturier* or "ploughman's fee," which in most parts of the Continent, as in almost every district in England before the Norman Conquest, descended to all the sons in equal shares, with some customary privilege or birthright in favor of the eldest or youngest son. The strict rule of the custom of Caux was deliberately applied by the Norman kings of England not only to military fiefs but also (wherever it was possible) to agricultural tenancies. This was effected partly by reversing the presumption of partibility, as shown by the passage from Bracton cited above, and partly by direct enactments of the king or of his greater tenants, who assumed or received the prerogative of abolishing inconvenient modes of inheritance. The urban customs of the "French" portions of Hereford and Nottingham appear to have been altered in this way. (See MUNICIPALITY.) Simon de Montfort, by his charter in 1255, granted to the burgesses of Leicester that the eldest son should be his father's heir instead of the youngest; and an analogous right was exercised under the name of "disgavelling" by the archbishop of Canterbury in Kent. About the reign of Edward II. the idea first began to prevail that such alterations of descent could not be carried out without the consent of parliament, and it was eventually held that even the king had no such prerogative (Robinson, *Gavelkind*, i. c. 5). The earlier view is very clearly statied in a charter by which Edward I. disgavelled certain lands of John de Cobham (Charter Rolls, 4 Edw I., No. 17). The most important clauses of this document were in effect as follows:

> "It pertains to our prerogative to abolish such laws and customs as diminish instead of increasing the strength of the kingdom, or at least to change them by our special favor in the case of our deserving and faithful followers; and since it has often happened by the Kentish custom that lands, which when undivided in certain hands are quite sufficient for the service of the state and the maintenance of many, are afterwards divided and broken up among coheirs into so many parts and particles that no one portion suffices even for its owner's maintenance, we therefore grant to J. de Cobham that all the gavelkind lands and tenements which he now holds in fee simple shall descend to his eldest son or other heir at common law in the same way as his estates held by serjeanty or knight-service."

A similar change of tenure was effected by Acts of parliament for many estates in Kent in 11 Hen. VII., 15 Henry VIII., 31 Hen. VIII., 2 and 3 Edw. VI., 1 Eliz., 8 Eliz., and 21 James I., and primogeniture was introduced in the same way into the soke of Oswaldbeck in Nottinghamshire in 32 Hen. VIII. and into the city of Exeter by the Act of 23 Eliz. c. 12. The customary descent of copyhold lands (where primogeniture had not been established in ancient times by the ordinances of the lords or by an application of the current presumption) has been changed in a great number of cases by other private Acts of parliament or has been destroyed by enfranchisement. The Welsh custom of partition was altered in some respects, especially by forbidding the inheritance of bastards, by the Statute of Wales passed in the 12th year of Edward I.; the custom as modified was confirmed when the principality was united in 27 Hen. VIII. to the kingdom of England, but it was soon afterwards enacted by the Act 34 and 35 Hen. VIII. c. 26 that freehold lands in Wales should thenceforth be "holden as English tenure to all intents according to the common laws of this realm of England, and not be partible amongst heirs-male after the custom of gavelkind as heretofore in divers parts of Wales was used and accustomed." The change in the Irish customs was carried out in a different way. There is evidence that before the adoption of the English law several systems of customary inheritance were known in Ireland. Besides the law of tanistry, which will be described afterwards, there are indications in the Brehon tracts not only of arrangements in favor of the youngest branch, such as have been already mentioned, but also of a preference in some cases for the eldest son, "the cattle and land being equally divided, but the house and offices going in addition to his own share to the eldest son" (Hearn, *Aryan Household*, 80, 82; O'Curry, *Lectures*, clxxix.). Besides these cases we have the record of that system of "Irish gavelkind" which was described by Spenser and Davis, and which has been shown by Sir H. S. Maine to be closely connected with very early Aryan institutions still surviving in practice among the Hindus.

> "The lands in that kingdom possessed by the mere Irish were divided into several territories or countries, and the inhabitants of every Irish 'country' were divided into several septs or lineages, in every one of which there was a chief called *Canfinny* or '*caput cognationis*,' and all the inferior tenancies in these territories were partible among the males in gavelkind; but the estate which these inferior tenants had was not an estate of inheritance, but a temporary or transitory possession, for these lands were not partible among the next heirs of him that died, but among all the males of this sept or clan in this manner: the *Canfinny* (who

> was generally the oldest man in the sept) made all these partitions according to his discretion. This *Canfinny*, after the death of every one who had a competent portion of land, assembled all the sept and having put all their possessions into hotchpot made a new partition of the whole; in which partition . . . . he allotted to every one of the sept according to his age a better or larger part" (Robinson, *Gavelkind*, i. c. 2; Davis's *Reports*, 37, "Case of Tanistry").

This is obviously the description of a joint family similar to those which have been found in the Scottish Highlands, in France, in the Slavonic countries, and in India, and, as it would seem, the various modes and periods of redistributing such joint possessions are merely matters of detail and convenience. It would be of greater importance to our subject to know whether any special property was reserved for one of the dead man's sons, as in the case of the Frisian "theel-lands." It was resolved in the great case of tanistry in the third year of James I. that this Irish "custom of gavelkind" was void in law as being unreasonable and as being "a mere personal custom" not binding the descent of the inheritance, "and therefore all the lands in these Irish territories were adjudged to be descendible according to the course of the common law, notwithstanding the Irish usage." By one of the penal statutes against Roman Catholics in Ireland (2 Anne c. 6), the usage of partibility was to some extent revived, it being enacted that the lands of Roman Catholics should be divided among all the sons "as in gavelkind," unless the heir should be a Protestant; but this harsh law was fortunately repealed by the Irish Act of 18 Geo. III. c. 49.

The remote origin of all these ancient forms of primogeniture may probably be traced to a system of family religion that prevailed among the tribes from which the Aryan nations have descended. We are told in the *Laws of Manu* that the eldest son had his very being for the purpose of accomplishing the rites of the family religion, of offering the funeral cake, and of providing the repasts for the spirits of the dead ancestors. "The right of pronouncing the prayers belongs to him who came into the world the first. A man must regard his elder brother as equal to his father. By the eldest at the moment of his birth the father discharges his debt to his own progenitors; the eldest son ought therefore before partition to manage the whole of the patrimony" (*Laws of Manu*, ix. 105, 126; Coulanges, *La Cité Antique*, c. 6, "La Droit d'Aînesse"). This view seems to account for the widespread usage that the eldest son should keep the house, or hearthplace, or the parents' furniture as part of his share of the inheritance. It is said that among the Hindus the right to inherit a dead man's property is exactly coextensive with the duty of performing his obsequies, and we are told that in ancient Rome an inheritance could not be distributed under a will "without a strict apportionment of the expenses of these ceremonies among the different co-heirs" (Maine, *Anc. Law*, 191). Some support is also given to this theory by the custom which is said to have prevailed in Norway by which particular lands were set apart for funeral expenses, and if a man had no kinsman to give him proper burial he might leave his property as "brande-erbe" or "burning-land" as an endowment for burial, and the friend who accepted the duty was allowed to keep the property as "odal land" or privileged family inheritance (Robertson, *Early Kings*, ii. 323). Numerous other illustrations might be given from the analogous customs in which the youngest son is preferred. There seems to be no reason why the eldest should be preferred by one nation and the youngest by another; but something may perhaps be due to the accident that the one set of tribes was civilized enough to have fixed family habitations, and the other may have lived in a nomad fashion, so that the youngest would be most likely to remain in the parents' tent and to be ready to perform the duties of the hearthplace. Sir Henry Maine draws a distinction between the archaic customs of the tribe and that strict form of primogeniture which he has traced to the power of the chieftain. Taking primogeniture in the sense of an exclusive succession of the eldest son to property, he finds no sign of its existence before the destruction of the Roman empire by the barbarians. "Even when the Teutonic races spread over western Europe they did not bring with them primogeniture as their ordinary rule of succession." He considers the "birthright" given to the eldest in the instances which have been mentioned to be in the nature of a reward or a security for impartial distribution (*Early Hist. Inst.*, 197, 198). Primogeniture, as we know it in our law, had rather a political than a civil origin, and comes from the authority of the feudal lord and probably from that of the tribal chief; but here and there on the Continent there are traces of it as a civil institution, and in such cases the succession of the eldest son does not exclude provision for the younger sons by what are called appanages. The evidence of ancient law and usage would, however, seem to show that it was usually the youngest son who remained at home with his father to serve him through life and succeed to his remaining property at his death" (*Early Law and Custom*, p. 260).

As regards the political origin of a great part of the English system of primogeniture a distinction should be made between royal and feudal successions. The devolution of the crown in European countries has usually been regulated by some kind of primogeniture, based partly on the rules which have governed private successions, partly on the indivisible character of the empire as it survived into modern times, and partly again on that "law of the sword" or rule of public policy which forbids the disintegration of the state. It is possible also that the Irish system of tanistry contained some of the elements of this method of royal succession. The custom was described by Spenser in his *View of the State of Ireland* shortly before the abolition of the Brehon law in the reign of James I. as follows: "It is a custom among all the Irish that, presently after the death of any of their chief lords or captains, they do presently assemble themselves . . . to choose another in his stead, where they do nominate and elect for the most part not the eldest son nor any of the children of the lord deceased, but the next to him of blood that is eldest and worthiest, as commonly the next brother, if he have any, or the next cousin and so forth, as any is elder in that kindred or sept, and then next to him they choose the next of the blood to be tanaist, who shall succeed him in the said captaincy if he live thereunto." This system may be described as the election of an elder to be head of the sept (like the analogous election of a patriarchal "house-father" in a joint family), with an additional choice of an elder in reversion, to avoid disputes as to succession in times of war. A similar rule may have obtained among the Teutonic tribes (Maine, *Early Hist. Inst.*, 202); as the smaller chiefs sank into the position of nobles and were succeeded by their eldest sons (for reasons connected with the priestly character of the king) in the possession of their offices and demesnes, a rule of the same kind might grow up with regard to the king or ruling chieftain, by which the eldest son would get not only his private demesne but also that "portion of land attached to the seignory or chiefry which went without partition to the tanaist." In this way a principle of inheritance might be formed "which first of all extended from the demesne to all the estates of the holder of the seignory, however acquired, and ultimately determined the law of succession for the privileged classes throughout feudalized Europe" (*ibid.*, 204, 208). This part of the subject is confessedly very obscure; and it must not be forgotten that there were other and stranger modes of succession to chieftainships in Ireland and Scotland, which appear to have been unconnected with any such rules of primogeniture (Girald. Cambr., *Top. Hibern.*, iii. 25; Ware, *Ant. Hib.*, ii. 64; Ailred's *Chron.*, ed. Twysden, 348; Robertson, *Early Kings*, i. 36). Bede has left us a description of the rule among the Picts. "It was the custom in Pictland," as the saying went, that the kingdom should come from women rather than from men. (Compare the similar customs among the ancient Spartans, Lycians, and Iberians in M'Lennan's *Studies*, 101, 145.) The dignity never went from father to son, but when the king died the crown went to his next brother, or in default to his sister's son, or in any event to the nearest male relation claiming through a female and on the female side. The list of kings contains no instance of a son bearing his father's name, or of the same name belonging to both father and mother; and the only fathers of kings of whom any account has survived are certainly known to have been foreigners, the one being a prince of Strathclyde and the other a grandson of the king of Northumbria. One and the same rule of primogeniture has been applied in England to royal and to private estates, with the exception as to the succession of the eldest daughter which has already been mentioned. The system varied greatly in the Continental countries according to the circumstances of each case. In France the crown was regarded as a partible inheritance under the first two dynasties. At the beginning of the 11th century primogeniture had become the rule as to fiefs, offices, and dignities, and partly no doubt from analogy and partly for reasons of public policy the crown was brought within the same rule under the house of Capet (Montesquieu, *Esprit des Lois*, xxxi. 32; Kenny, *Law of Primogeniture in England*, 10). But in this case there was a singular modification, known as the "Salic Law" or "Salic rule" (as if it had been derived from the customs of the Salian Franks), by which the succession was eventually limited to males claiming through males. The origin of this law has been found in the fact that "the kings sprung from Hugh Capet succeeded one another, son to father, or brother to brother, for more than 300 years" previously to the disputes which arose in the 14th century as to the succession of an heir claiming through a female (Maine, *Early Law and Custom*, 154). The rule was adopted because it corresponded to the facts which had existed; it was extended because it suited the circumstances of those states in which the sovereign had a large authority; in constitutional countries the rule has been considered to be against public policy, partly perhaps because the reign of a female sovereign is regarded as favorable to popular liberties.

The history of primogeniture as applied to feudal succession is simpler than that of the inheritance of the crown. When a fief was regarded not strictly as an estate in land but rather as being in the nature of an office, there was at first no room for the notion of its descent to an heir. Held first at will and afterwards for short fixed periods, the fiefs or benefices came gradually to be regarded as inheritances. When this idea was first established the fief was usually treated as being partible among all the sons, and it was not until 1138 that Frederick Barbarossa, for reasons of public policy, forbade the greater tenancies to be subdivided. The *Assises de Jérusalem* had laid down the same rule in 1099, though the king was then allowed to select any one of the children for succession. "In Brittany, primogeniture was not introduced till 1185, even for nobles and knights. . . . Down to the French Revolution a German baron had to make a family settlement and to get the consent of his younger sons, if he wished his land to descend to the eldest son alone" (Kenny, 11). In France the eldest son began to gain pre-eminence in the division of fiefs about the beginning of the 11th century, and the usage spread with more or less vigor through all the Western countries. "Usu ad omnia feuda serpsit, ut vel ex asse majori cedant, vel major præcipuum aliquod in iis habeat" (Zoesius, cited in Co. Litt., 191a). In countries where the Roman law prevailed the privileges of the eldest son were secured by a legal fiction, the jurists deciding that every noble was a "miles" or soldier on service entitled to exceptional benefits. In Spain the inheritance was considered to be divisible into fifteen shares, of which seven in all (being one-fifth of the whole and one-third of the residue, known as the customary "fifth and third") were within the parent's disposal as a *majoratas*; and this was usually entailed upon the eldest son. Similar privileges by way of *majorat* have been given to particular landowners in France at various times since the abolition of primogeniture in the great Revolution. The feudal primogeniture of England was firmly established in the reigns of the first two Norman kings, with a temporary provision for the case of estates lying both in England and Normandy, in which the Norman estate was allotted to the eldest son and the English estates to the second. Its origin, as we have seen, is to be found partly in old modes of customary inheritance surviving both in England and in Normandy, but mainly in the deliberate policy of the sovereigns, who wished to keep the military estates together, and took advantage of the strictness of the "custom of Caux" to carry out the objects of the "law of the sword." (C. I. E.)

PRIMROSE.[1] The genus *Primula* contains numerous species distributed throughout the cooler parts of Europe and Asia, and found also on the mountains of Abyssinia and Java. They are all herbaceous perennials, possessing a permanent stock, from which are emitted tufts of leaves and flower-stems which die down in winter; the new growths formed in autumn remain in a bud-like condition ready to develop themselves in spring. They form the typical genus of *Primulaceæ*, the floral conformation of which is very interesting on several accounts independently of the beauty of the flowers. Thus the five stamens springing from the tube of the corolla, instead of being placed alternately with or between its lobes, are opposite or "superposed" to them, an arrangement accounted for by some on the supposition that an outer row of stamens (which, if present, would render the flower symmetrical) is suppressed. In support of this view the case of *Samolus*, an allied genus in which there are five petaloid stamens as well as five fertile ones, may be cited. By others the anomaly is explained on the hypothesis that the corolla is suppressed, what appears to be such being merely an outgrowth from the stamens. But this view is not borne out by observation of the development of the flower. Within the base of the corolla tube is the one-celled superior ovary, rising up into the centre of which is a dome-shaped placenta, quite detached from the walls of the ovary and studded with ovules. The origin and explanation of this free central placenta have formed the subject of a copious literature, the point at issue being whether the placenta is a direct prolongation from the axis of the plant or an outgrowth from the walls of the carpels.[2] The variation in the length of the stamens and of the style in the flowers of this genus has attracted much attention since Darwin pointed out the true significance of these varied arrangements. Briefly it may be said that some of the flowers have short stamens and a long style, while others have long stamens, or stamens inserted so high up that the anthers protrude beyond the corolla tube, and a short style. Gardeners and florists had for centuries been familiar with these variations, calling the flowers from which the anthers protruded "thrum-eyed" and those in which the stigma appeared in the mouth of the tube "pin-eyed." Darwin showed by experiment and research that the most perfect degree of fertility, as shown by the greatest number of seeds and the healthiest seedlings, was attained when the pollen from a short-stamened flower was transferred to the stigma of a short-styled flower, or when the pollen from the long stamens was applied to the long style. As in any given flower the stamens are short (or low down in the flower-tube) and the style long, or conversely, it follows that to ensure a high degreee of fertility cross fertilization must occur, and this is effected by the transfer of the pollen from one flower to another by insects. Incomplete fertility arises when the stigma is impregnated by the pollen from the same flower. The size of the pollen-grains and the texture of the stigma are different in the two forms of flower. The discovery of the physiological significance of these variations in structure, which had long been noticed, was made by Darwin, and formed the first of a series of similar observations and experiments recorded from time to time in the *Journal of the Linnean Society* and elsewhere by himself and subsequent observers. Among British species may be mentioned the Common Primrose (*P. vulgaris*); the Cowslip (*P. veris*), which is the original source of the *Polyanthus* of the gardens; the true Oxlip (*P. elatior*), a rare plant only found in the eastern counties; and the Common Oxlip, by some considered to be a form of the Common Primrose, but provided with a stem supporting the flowers. Darwin's experiments go to prove that the first-named three are species, while the last-named is a hybrid between the cowslip and the primrose. In addition to these species two others occur in Britain, namely, *P. farinosa*, found in Wales, the north of England, and southern Scotland, and *P. scotica*, which occurs in Orkney and Caithness. These two species are found also in high Arctic latitudes, and *P. farinosa*, or a very closely allied form, exists in Fuego.

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[1] Lat. *primula*; Ital. and Span. *primavera*; Fr. *primevère*, or in some provinces *primerole*. Strangely enough the word was applied, according to Dr. Prior, in the Middle Ages to the daisy (*Bellis perennis*), the present usage being of comparatively recent origin.

[2] For a full discussion of this and other points in the morphology of the flower, the reader may refer to Dr. Masters's paper in the *Proceedings of the Linnean Society*, 2d ser., vol. i. (1877) p. 285, or to Eichler's *Blüthen-Diagramme*.

The *Auricula* of the gardens was formerly considered to be a form of *P. Auricula*, a yellow-flowered species, a native of the Swiss mountains, but it has been recently shown by Kerner that in all probability the origin of the *Auricula* was *P. pubescens*, supposed to be a natural hybrid between *P. Auricula* and *P. hirsuta*. The *Polyanthus* has already been mentioned as a variety of the cowslip, but it may further be added that some very remarkable forms which have been cultivated for centuries owe their peculiarities to the assumption by the ordinarily green calyx of a petaloid condition; when this is complete we have the condition called "hose in hose" by the gardeners. This may, however, arise from actual duplication of the corolla within the calyx. The Chinese Primrose, now so much cultivated in gardens, is derived from *P. prænitens*. The Japanese Primrose is nearly or quite hardy, and is the stateliest of the genus; its flowers of varied colors are placed tier above tier, like the branches of a fir tree. *P. cortusoides* is another Japanese species of which many forms are now cultivated. *P. sinensis*, with mealy leaves and yellow flowers, is the Abyssinian Primrose of gardens. The Himalayas are rich in species of primrose, often very difficult of determination or limitation, certain forms being peculiar to particular valleys. Of these *P. denticulata*, *Stuartii*, *sikkimmensis*, *nivalis*, may be mentioned as frequently cultivated, as well as the lovely rose-colored species *P. rosea*.

PRINCE. "Prince" and "princess" are names or descriptions implying either political authority or social rank in the persons to whom they relate or are accorded. We have in "prince" the English and French form of the Latin *princeps*, which with more or less modification has been adopted into nearly every language of modern Europe, and of which the original and common use was to indicate priority or pre-eminence of any sort. In an honorary sense it was, to to begin with, applied by the Romans to the first or most distinguished members of the senate and the equestrian order respectively, and their appellations of *princeps senatus* and *princeps juventutis* were afterwards appropriated to the emperors themselves and to their adopted heirs and successors in the empire. Hence the attribute *princeps* became definitely associated with the notions of sovereignty and dominion, and its derivatives have been always and everywhere employed as titles of dignity and expressions of awe or respect.

In English the word "prince" may be used in certain connections in the original wide sense of the Latin word. More definitely it is applicable to supreme rulers of both sexes and almost all kinds. Thus the emperor of Russia, the queen of England, and the king of the Belgians are equally princes or monarchs, and the consorts of emperors and kings are princesses. But the presidents of republics are neither princes nor monarchs. Prince, however, unlike monarch, applies to rulers who are subordinate as well as to rulers who are supreme, to such minor potentates as the electors of the old German empire or the feudal peers of France once were, and the reigning grand-dukes or dukes of Germany now are. Again, all the children and many of the descendants and other relations of monarchs and princes of every class and grade are themselves princes or princesses, although it often happens that they have also some special name or personal dignity by which they are ordinarily known. The eldest son of the emperor of Russia, for instance, is called the "cesarewich," as the eldest son and next brother of the king of France under the *ancien régime* were called the "dauphin" and "monsieur." In England for several centuries the younger sons of the sovereign have had dukedoms conferred on them, as in the cases of the dukes of Edinburgh, Connaught, and Albany, and from the reign of Edward IV. until the reign of Victoria the dukedom of York was always given to the second son and the dukedom of Gloucester to the third, unless it was already appropriated. The princes and princesses of Russia are "grand-dukes" and "grand-duchesses," of Austria "archdukes" and "archduchesses," and of Spain "infants" and "infantas." Some of the eldest sons of kings are "dukes," as the duke of Brabant in Belgium and the duke of Sparta in Greece. But, when they are not dukes, or princes with a territoral title, as the prince of Wales or the princes of Naples in Italy and Orange in Holland, they are described as "princes" with the additions of "imperial," "crown," "royal," or "hereditary," as the case may be, and the name of the dominions to which they are the heirs-apparent. The eldest sons of reigning grand-dukes or dukes, however, are called "hereditary grand-dukes" or "hereditary dukes," their younger brothers and their sisters being all the same princes and princesses. The Prussian fashion of calling the eldest daughter of the sovereign the "princess royal" was introduced into England by George II. It was not the custom, however, for the daughters of English monarchs to be entitled "princesses" at all until the reign of Charles I. The two daughters of Henry VIII. were the Lady Mary and the Lady Elizabeth until they ascended the throne, for, although there is a tradition that they were both made princess of Wales successively, there is no evidence whatever to support it. As late as the reign of Charles II. the granddaughters of Charles I., daughters of James, duke of York, the heir-presumptive to the crown, were called the Lady Mary and the Lady Anne until they became princesses by marriage, the one as the wife of William, prince of Orange, and the other as the wife of Prince George of Denmark. It is difficult to say when the younger sons of English sovereigns were originally called "princes." But the practice of so calling them probably began as early as the reign of Henry VII., although there was no opportunity of observing it again before the reign of James I., when it was certainly established.

In France before the Revolution the designation of "princes du sang," or "princes of the blood," was common from generation to generation to all the male descendants of the French kings, and they had precedence according to their proximity to the crown of all dignitaries and nobles. It was not, however, until the reign of Charles VII. or Louis XI. that they were called "princes," their earlier appellation having been "seigneurs du sang" or "seigneurs du lignage du roi." In France, too, the natural children of the king were, when formally acknowledged, termed "princes légitimés," at any rate from the reign of Louis XIV., and although they were excluded from the line of succession to the throne they were ranked immediately after the princes du sang. The princely character of all the male descendants of the imperial, royal, and other reigning families of the Continent, when neither illegitimate nor the issue of a morganatic marriage, is perpetual and indelible. Moreover, the families which were formerly reigning within the boundaries of the old German or existing Austrian empires, despite that they have now ceased to reign, are in this respect still in the full possession of their earlier privileges. But in England, on the contrary, it was considered necessary only about a quarter of a century ago to make express provision by royal authority that the titles of "prince" and "princess" should be enjoyed by the children of the sons as well as by the sons and daughters of any sovereign of the United Kingdom. It may therefore be concluded that they had no previous claim to the attributes of prince and princess, and that they will not transmit them to their posterity.

Besides the more or less general uses of the words "prince" and "princess" which we have already noticed, there are the particular applications of them, first to a distinct class of rulers, and secondly to a particular order of nobility. Princes regarded as the political chiefs of states are inferior to emperors and kings, and not necessarily superior to reigning grand-dukes or dukes. Very few examples of them at present exist,—those of Waldeck and Pyrmont, Montenegro, Bulgaria, and Monaco alone occurring to us.[1] None of the great feudatories of the Middle Ages, whether in Germany, France, or Spain, were formally described as princes, and of the mediatized families still extant who once supplied members to the imperial diet, many of them from a remote period, not one had the designation of "prince" before the commencement of the 17th century, while not more than five or six had it before the commencement of the 18th century. The old Italian and Welsh princes and the more modern princes of Orange are in fact nearly the only reigning princes who are remembered in history. As a name of dignity, neither of dominion on the one hand nor of courtesy on the other, "prince" is common enough among the nobility of the Continent. But in England it is never conferred on anybody except the heir-apparent to the crown, and his principality is a peerage. Since the reign of Edward III. the eldest sons of the kings and queens of England have always been dukes of Cornwall by birth, and, with a few exceptions, princes of Wales by creation. Before that Edward I. had conferred the principality on his eldest son, afterwards Edward II., who was summoned to and sat in parliament as prince of Wales. But Edward the Black Prince was the original grantee of the principality as well as of the dukedom, under the special limitations which have continued in force to the present day. The entail of the former was "to him and his heirs the kings of England" and of the latter "to him and his heirs the first-begotten sons of the kings of England." Hence when a prince of Wales and duke of Cornwall succeeds to the throne the principality in all cases merges at once in the crown, and can have no separate existence again except under a fresh creation, while the dukedom, if he has a son, descends immediately to him, or remains in abeyance until he has a son if one is not already born. If, however, a prince of Wales and duke of Cornwall should die in the lifetime of the sovereign, leaving a son and heir, both dignities are extinguished, because his son, although he is his heir, is neither a king of England, nor the first-begotten son of a king of England. But if instead of a son he should leave a brother his heir, then—as was decided in the reign of James I. on the death of Henry, prince of Wales, whose heir was his brother Charles, duke of York—the dukedom of Cornwall would pass to him as the first-begotten son of the king of England then alive, the principality of Wales alone becoming merged in the crown. It has thus occasionally happened that the dukes of Cornwall have not been princes of Wales, as Henry VI. and Edward VI., and that the princes of Wales have not been dukes of Cornwall, as Richard II. and George III.[2] It was in direct imitation of these dignities that the principality of the Asturias and the dukedom of Rothesay were created by John I. of Castile and Robert III. of Scotland in favor of their eldest sons and the eldest sons of their successors. In the new kingdoms of Holland and Italy the principalities of Orange and Naples have been appropriated to the eldest sons of the sovereigns. Under the monarchy in France princes invariably yielded precedence to dukes, unless of course they were "princes du sang" or "princes légitimés," as the princes of Condé, of Conti, or of Lamballe. Several of the French dukes numbered principalities among their inferior titles, as the duke of La Rochefoucauld also prince of Marçillac, and the duke of Gramont also prince of Bidache, while several of the French princes were the heads merely of junior branches of ducal families, as the princes of Léon and of Soubise of the Rohan family, and the princes of Tingry and of Robecq of the Montmorency family. When Napoleon established the empire and reintroduced titles into France, princes were made the first and dukes the second order of the new nobility. But only a few princes were created—Talleyrand, prince of Bénévent; Bernadotte, prince of Ponte Corvo; Berthier, prince of Wagram; Davoust, prince of Eckmühl; Masséna, prince of Essling; and Ney, prince of Moskowa, nearly if not quite exhausting the list. In Germany and Austria the title of "prince" is represented by "Prinz" when it appertains to the members of imperial and royal families, as Kronprinz von Oesterreich or Prinz Wilhelm von Preussen, and by "Fürst" when it appertains to the members of mediatized or noble families, as Fürst von Salm-Salm or von Hohenlohe-Langenburg, and Fürst von Metternich-Winneburg or von Bismarck-Schönhausen. According to its identification with "Prinz" or "Fürst" it is a higher or lower dignity than "Herzog" (duke). In the old empire, however, the Churfürsten or electors were always next to the emperor and the king of the Romans. In Italy, as well as in Belgium and Holland, princes are inferior to dukes as members of a particular order of nobility. In Spain and Portugal we are not aware that the title of "prince" has ever been conferred on a subject outside of the royal family except in the well-known case of Godoy, Prince of the Peace. Among the Russian nobility there are neither dukes nor marquesses, the orders being princes, counts, and barons. It is to be observed, however, that in no part of the Continent does precedence depend exclusively as in the United Kingdom on the apparent rank of titular distinctions or the relative positions which they nominally occupy in formal classification. (F. DR.)

PRINCE EDWARD ISLAND, formerly called Isle St. Jean, a province of Canada, in British North America, lies between 45° 58′ and 47° 7′ N. lat. and 62° and 64° 27′ W. long., on the south side of the Gulf of St. Lawrence. It is separated from Nova Scotia on the south and from New Brunswick on the south and west by Northumberland Strait, which varies from 9 to 30 miles in width. Its greatest length is nearly 150 miles, its

See Plate IV., vol. xvii.

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[1] [Bulgaria is an hereditary principality under the sovereignty of the Sublime Porte, as is the island of Samos. Other princely sovereignties are Liechtenstein, Reuss-Greiz, Reuss-Schleiz, Schaumburg-Lippe, Schwartzburg-Rudolstadt, Schwartzburg-Sondershausen, Lippe Detmold. (See Almanack de Gotha, 1885, pp. 97, 98, 1054, 1056.)—AM. ED.]

[2] [Richard II. and George III., not being sons of reigning kings, were excluded from the title "Prince of Wales." Richard, brother of Henry III., and Henry VIII. were dukes of Cornwall, but not princes of Wales.—AM. ED.]

general breadth 34 miles, and the area 2133 square miles (1,365,120 acres).[1]

Physical Features.—Prince Edward Island resembles a crescent in its northern outline, the two horns being North and East Capes, and it is altogether irregular in form. Its suface is slightly rolling, the elevations of land, however, rising nowhere higher than 500 feet. The coast-line is indented with numerous bays and projecting headlands, the more prominent of the latter being North Cape on the northwest, West Cape on the west, East Cape on the east, Cape Bear on the southeast; others are Stewart, Bell, Prim, Gallas, Black, Amherst, and Fifteen on the south, Kildare, Aylesbury, Turner, Cablehead, and Campbell on the north, Durell and Bruce on the east, and Seal Point on the west. The principal bays are Richmond on the north, Egmont on the southwest, Hillsborough on the south, and Cardigan on the east. These inlets, piercing the land from opposite directions, form narrow isthmuses which divide the island into three distinct peninsulas. Other bays are St. Peter's, Greenville, Harrington, and Tignish on the north; Colville, Rollo, Fortune, and Boughton on the east; Orwell and Pownal on the south. Along the coasts are several small islands, viz., Grover, Fish, Barnbury, Lennox, Robinson's, Boughton, Panmure, Wood, Governor, St. Peter's, and Brae. The chief rivers are North, Elliott or West, Hillsborough or East, Ellis or Grand, Percival, Trout, Boughton, Murray, Dunk, and Morrell. The Grand river is the seat of a large and increasing oyster and codfish trade. The Dunk is a fine salmon and trout stream. The principal harbors are Charlottetown, Georgetown, Bedeque, Port Hill, Cascumpeque, Souris, Murray, Savage, Bedford, and Westmoreland. The island is well watered, and by the disintegration of the soft red sandstones a bright red loamy soil of great fertility is produced. To this the province owes its remarkable productiveness as an agricultural district, and the gently undulating surface, the rich fields, and pretty homesteads embowered in trees give variety and beauty to the landscape.

Geology.—The oldest geological formations in Prince Edward Island are represented by beds of brown, gray, and red sandstone and shale, with layers of coarse concretionary limestone and fossil plants. These are of newer Carboniferous (or in part of Lower Permian) age, and have been named by Sir William Dawson the Permo-carboniferous series. They appear in the peninsula between Orwell Bay and Pownal Bay, in Governor's Island, in Hillsborough Bay, and on the coast between West and North Capes, as well as in other localities on the south and west. But the prevalent rocks are bright red sandstones with calcareous cement, alternating with beds of red and mottled clay, and with occasional white bands and layers of concretionary limestones and conglomerate, which in mineral character resemble the Trias or New Red Sandstone of Nova Scotia. The formation may be divided into two sections: "the lower, representing," says Dawson, "the Bunter Sandstein of Europe, is characterized by the prevalence of hard concretionary calcareous sandstones and obscure fossil plants, while the upper (representing, perhaps, the Keuper of Europe) has softer and more regularly bedded sandstones and clays." Owing to the similarity of the Permo-carboniferous and Triassic beds, and the general covering of soil, it is not possible definitely to mark the limits of the two formations. Drift deposits, viz., boulder clay, stratified sand and gravel containing in some places sea-shells of species now living and occasional boulders (this deposit comparatively rare), and loose boulders, overlie the surface of the more solid rocks in the greater part of the island. Beds of peat, dunes of drifted sand, alluvial clays, and mussel mud (valuable as a fertilizer) occur in creeks and bays. The portions of country occupied by the Upper Carboniferous series are generally flat, and this applies, observe Drs. Dawson and Harrington, to a portion of the Triassic region north of Bedeque, where the beds seem to have been subjected to severe aqueous denudation. The minerals are unimportant, neither coal, gypsum, nor gold being found in any part of the island.

Climate and Vegetation.—The climate of Prince Edward Island is much milder than that of the adjacent provinces, and, though the winter is severe and cold, the air is invigorating and salubrious. The coldest month is January, when the thermometer registers a daily average of 15.9°. Fogs seldom occur. In the summer the heat is less extreme than in Quebec, the mean being 62.3°, and the pleasant autumn months attract visitors from all parts of the American continent. Vegetation develops rapidly, and agriculture is extensively prosecuted. Wheat, barley, oats, peas and beans, potatoes, turnips, and other crops ripen to perfection.

The amount of land under crop in 1881 was 467,211 acres, and in pasture 126,935 acres. The chief produce raised in that year was 546,986 bushels of wheat, 119,368 of barley, 3,538,219 of oats, 90,458 of buckwheat, 6,042,191 of potatoes, 1,198,407 of turnips, 42,572 of other roots, 143,791 tons of hay, and 15,247 tons of grass and clover seed. Of live stock there were 31,335 horses, 45,895 milch cows, 44,743 other horned cattle, 166,496 sheep, and 40,181 swine. 1,688,690 ℔ of butter, 196,273 of cheese, 14,945 of honey, and 25,098 of maple sugar were made during the year. Prince Edward Island does not grow much fruit, but the apple crop is usually good, though not large, and grapes, plums, and currants are grown in small quantities. The land which is not cultivable consists of soft spongy turf which may be used for fuel.

Commerce.—The forests of the island used to be very extensive, but lumbering operations, destructive fires, and the needs of the husbandmen have reduced them, though many trees still remain, the principal being beech, birch, pine, maple, poplar, spruce, fir, hemlock, larch, cedar, etc. The exports in 1883 were valued as follows: Produce of the forest, $28,385; agricultural produce, $377,614; animals and their produce, $238,952; manufactures, $183,986, the total being $1,318,549; that of the imports (manufactured goods, iron, hardware, wine, spirits, tobacco, tea, coffee, sugar, molasses, etc.) was $682,170.

Industries.—Shipbuilding in former years was a very active industry. It is still carried on, but to a considerably smaller extent,—the number of vessels built in 1883 having been only seventeen, with a tonnage of 5343. On the 31st of December, 1883, the vessels registered in the province and remaining on the registry books of the several ports amounted to 241, with a tonnage of 40,400. In that year there were engaged in the coasting trade (including steamers) 1162 vessels, representing a tonnage of 113,117. The manufactures are chiefly for domestic use, and include the making of woollen cloth, saws and files, saddles and harness, sashes, doors, and blinds; there are also saw-mills, starch factories, tanneries, tin and sheet-iron works, tobacco-pipe factories, etc. In 1881 the amount of capital invested in industries was $2,085,776, giving employment to 5767 hands, and the value of the products was $3,400,208.

Fisheries.—The fisheries are exceedingly valuable, particularly those on the north coast, the catch being chiefly mackerel, haddock, cod, hake, and herrings, though other kinds are taken. Of late years increased impetus has been given to this industry, and many men and boats are employed in conducting it. Enormous quantities of lobsters and oysters are annually shipped to all parts of the American continent as well as elsewhere. The value of the fisheries in 1883 was nearly half a million dollars.

Game, Etc.—Wild ducks, teal, brant, wild geese, woodcock, partridges, pigeons, and snipe occur in great abundance. Birds number 260 species. Of wild animals the principal are bears (found occasionally only), lynxes, foxes, musk-rats, hares, squirrels, etc. In the summer and autumn seals in large numbers frequent the shores.

Communication.—Good wagon roads are to be found wherever there is a settlement. The Prince Edward Island Railway, 200 miles long, runs from one end of the island to the other, and branches off to every town or point of importance. The main line extends from Souris and Georgetown on the east to Tignish on the northwestern extremity, connecting with Summerside and Charlottetown, the capital. During the season of navigation regular communication is had by steamer with Nova Scotia, New Brunswick, Quebec, and Boston. Navigation usually closes about the middle of December and opens before the first of May. In winter the mails and passengers are conveyed across the strait in ice-boats, which ply between Cape Traverse in Prince Edward Island and Cape Tormentine in New Brunswick. A steamer runs between Georgetown and Pictou, Nova Scotia, nearly the whole season. There is a post-office to every 400 of the inhabitants. Telegraphic communication is maintained with America and Europe by means of a submarine cable about 10 miles in length, connecting the island with New Brunswick. Telegraph offices are established throughout the province and along the line of railway.

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[1] [Greatest length, 130 miles; breadth, 34 miles.—In its narrowest part near the centre it is only four miles wide. Walker and Miles's *Standard Atlas of the Dominion of Canada* Montreal, 1875.—AM. ED.]

Population.—The province is divided into three counties, viz., King's, Queen's, and Prince, which are sudivided into sixty-seven townships and three royalties. The population is of mixed origin, a large proportion being emigrants from Great Britain, and the remainder natives of the country, descendants of the French Acadians, Scottish, English, and Irish settlers, and the loyalists who went to the island after the American revolution. The Indians number 281. In 1881 the population was 108,891 (54,729 males and 54,162 females). The Roman Catholic diocese is situated at Charlottetown, and authority over the spiritual affairs of the Episcopalians is exercised by the bishop of Nova Scotia. The following table shows the chief religious denominations and the number of their adherents:

Church of Rome	47,115	Church of England	7,192
Presbyterians	33,835	Baptists	6,236
Methodists	13,485		

The chief towns are Charlottetown (11,485), the capital of the island and the county town of Queen's, Summerside (2853), capital of Prince county, and Georgetown (1118), capital of King's county. Princetown is a flourishing seaport on Richmond Bay, and Rustico, famous for its bathing facilities, is a place of popular summer resort. Tignish and Alberton are stations much frequented by fishermen, and Souris, 60 miles east of Charlottetown, well furnished with harbor accommodation, is the outlet for the exports of the greater part of King's county. Other rising villages are Mount Stewart, Kensington, Montague, Breadalbane, and Crapaud.

Administration, Finance, etc.—The affairs of the province are administered by a lieutenant-governor and an executive council consisting of nine members, three with portfolios and six without, assisted by a legislative council of thirteen members and a legislative assembly of thirty members, both elective. The lieutenant-governor is appointed by the governor-general of Canada in council. A system of responsible government has existed in the island since 1851. Prince Edward Island returns six members to the Canadian House of Commons, and four Senators are appointed to the Canadian Senate by the crown. All males owning a freehold or leasehold property to the value of $400, or partly freehold and partly leasehold amounting together to $400, and in possession of the same for at least twelve months previous to election, have the right to vote for a member of the Legislative Council. The franchise for the House of Assembly is practically residential manhood suffrage.

In 1882 the public revenue was $233,464, and the expenditure $257,228. The chief source of revenue is the yearly subsidy granted by the Dominion Government under the terms of the British North America Act. In 1883 it amounted to $164,674. The remainder of the receipts is derived from the sale of Government lands, licenses, and miscellaneous fees. The provincial legislature meets at Charlottetown, where the public offices are situated. The judiciary consists of a supreme court with one chief and two assistant judges; a court of chancery, of which the lieutenant-governor is *ex officio* chancellor, and the judicial powers of which are exercised by a master of the rolls and vice-chancellor; a court of marriage and divorce, of which the lieutenant-governor and members of the executive council are judges; a court of vice-admiralty with one judge and two deputies; a court of probate and wills with one judge; three county courts with one judge for each; and stipendiary magistrates and justices of the peace. The province has authority to make its own civil laws, but in all criminal cases the form employed in the courts is the criminal law of the Dominion. Prince Edward Island is the twelfth military district in the militia of Canada. The established strength of the active force, by arms, is composed of three batteries of garrison artillery, one company of engineers, and ten companies of infantry,—total, 54 officers and 608 non-commissioned officers and men. The period of service in time of peace is three years.

Education.—The free-school system has obtained in the island since 1852. Previous to that date the schools were mainly supported by voluntary subscription and such local assistance as could be obtained. In 1877 the Public Schools Act—an ample and liberal measure—was passed, and a department of education was instituted. Two years later ladies were admitted to Prince of Wales College, an institution established in 1860, and amalgamated in 1879 with the normal school, and since then the department has introduced many improvements into the system. The total number of teachers in 1833 was 473, of school districts 419, and of schools 424. The number of pupils enrolled was 21,495, and the average daily attendance was 11,759. The total expenditure for education was, by the provincial Government $101,193, by the school districts $35,624, total $136,817. The Bible is read in all public schools. Besides the institutions named there are St. Dunstan's College (exceedingly well conducted, and Roman Catholic in religion), a model school, thirteen high schools, and several private schools and academies. The local government maintains a hospital for the care of the insane, and the marine hospital is under the control of the Dominion authorities.

History.—Sebastian Cabot is said to have discovered this island in 1497, but the authority on which this statement rests is at least doubtful. Certain it is that Jacques Cartier had the credit of naming it Isle St. Jean when he discovered it on 24th June, 1534, during one of his voyages up the St. Lawrence. That name clung to it for 265 years. Champlain, early in the next century, took possession of it for France, and in 1663 a grant was made of it to Captain Doublet, an officer in the army, who, however, failing to make settlements in the colony, soon afterwards lost his grant. Little attention was paid to the island until after the peace of Utrecht, when the French, allured by its fertility, made efforts to colonize it. In 1719 it was granted, *en seigneurie*, to the count of St. Pierre, who tried to establish fisheries and a trading company. He lavished considerable means on his enterprise, but the scheme proved unsuccessful and his grant was revoked. In 1755 the island was captured by the British, but after the treaty of Aix-la-Chapelle it was restored to France, from which it was again wrested in 1758. It was afterwards placed under the administration of Novia Scotia, and some years later it was erected into a separate government. The first parliament was called together in 1773, and a constitution was given to the colony. In November, 1798, the legislature passed an Act changing the name of the province to Prince Edward Island, out of compliment to the duke of Kent, who was at that time commander of the forces in British North America. In February, 1799, the Act was confirmed by the king in council.

After the peace of 1763 a plan was agreed to by which the island was divided into townships of about 20,000 acres each. Grants of these lands were made to individuals supposed to have claims on the Government. They were to pay a small sum as quit rents, and the conditions imposed provided for the establishment of churches and wharves, and *bona fide* settlement. The grantees, however, were in most cases mere speculators, who had no mind to brave the trials of colonization in a new country. Many promptly disposed of their "lots," and the lands fell into the hands of a large number of non-residents. The land question remained a vexed point of contention until 1860, when the Government was compelled to appoint a commission to appraise the rights of the absentee owners, and to formulate a scheme of adjustment. The commission advised the Government to buy the lands and resell them to the tenantry. A Bill for that purpose was passed, but the imperial authorities disallowed it. A second attempt proved more successful, and a measure having the same object in view was agreed to. The agitation was silenced, and the tenants eagerly availed themselves of their privileges. At the close of 1882, out of the 843,981 acres of land acquired by the Government, only 142,011 acres remained to be disposed of. Of that amount about 75,000 acres represented land held by parties who had not yet purchased.

Prince Edward Island declined to accept the Act of Confederation in 1867, but in July, 1873, it entered the union of American colonies which constitute the Dominion of CANADA (*q.v.*) (G. ST.)

PRINCE OF WALES ISLAND,[1] the official name of the island popularly known as PENANG or PULO-PENANG (*i.e.*, Areca Nut Island), which lies 8 or 9 miles off the west coast of the Malay peninsula in 5° 20′ N. lat. and 100° 20′ E. long. The island is about 15 miles long by 5 broad and has an area of 107 square miles or 69,000 acres,[1] considerably less than the Isle of Wight. When in 1785 it was ceded to the English by the rajah of Kedah in return for an annual pension of 10,000 dollars, it was almost uninhabited; at the census of 1881 its population amounted to 90,951 (comprising 612 Europeans, 21,772 Malays, 45,135 Chinese, 15,730 natives of India), and it has since been increased mainly by further Chinese and Indian immigration. The people from the east coast of India are locally known as Klings, a Malay corruption of Telinga or Telugu; and the half-breed race between Indian and Malay is distinguished as Jawi-Pekan. About two-fifths of Penang are lowland and the rest consists of hills, which towards the north reach their culminating point, 2922 feet above the sea, in the peak now utilized as a sanatorium. A considerable portion of the surface is still uncleared, and from the summit of the peak the whole island presents very much the appearance of a forest, the villages always lying in the midst of groves of the cocoa-nut palm. On the whole, however, vegetation is not so rich as on the neighboring mainland. Apart from the cocoa-nuts and areca-nuts, the principal products are sugar, coffee, and pepper; but increasing attention is again being given to nutmegs and cloves, which can be grown on the hillsides. Of the landholders 2280 were Chinese and 1482 Malays in 1882. In the lowlands the temperature ranges from 80° to 90°, but on the peak from 60° to 75°. The rainfall in 1882 was 126.50 inches—somewhat above the average. Georgetown or Penang, the only town on the island, lies on the east coast on a low plain stretching out into the sea; its harbor, always well filled with both European vessels and native craft, is the strait between island and mainland. Waterworks were undertaken in 1865. Among the public buildings are the town-hall (1872–80), the post-office, (1881), the free school with upwards of 600 pupils, the Christian Brothers' school, several Tamil schools, the general hospital (1882), and the pauper hospital. An important leper hospital is maintained on Pulo-Jarajah, a small but lofty island in the strait opposite the town. Though Singapore has withdrawn much of the trade that formerly found its way to Penang, there has been a great increase both in exports and imports, the aggregate value for 1859–60 being £3,530,000 [$17,155,800], and for 1882 £8,855,919 [$43,039,766.34].

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[1] Prince of Wales Island is also the name of an island separated by Endeavor Strait from York Peninsula in Queensland, Australia, discovered by Captain Cook in 1770, and since famous for its pearl fishery.

The attention of the East India Company was first called to Pulo-Penang by Captain Light in 1771, and it was under his personal command that the settlement was founded in July, 1786. At his death in 1794 he left "a compact little township with fort and public buildings." In 1798 Sir George Leith (for the purpose mainly of rooting out piracy) purchased from the rajah of Kedah for 2000 dollars the tract of land opposite Prince of Wales Island, which has since become known as Province Wellesley (area in 1885, 234 square miles). In 1806 the island was made a presidency of equal rank with Madras or Bombay; and after Singapore and Malacca were incorporated with it in 1826 it remained the seat of the general government till 1832. The commercial part of the town was destroyed by fire in 1808.

PRINCE OF WALES LAND, a large insular tract in the northern Arctic region opposite Boothia Felix, from which it is separated by Franklin Strait.

PRINCES ISLANDS, the Demonesi or Demonnesi of the ancients, a beautiful cluster in the Sea of Marmora opposite that part of the Asiatic coast which trends southeast from Scutari to the entrance of the Gulf of Ismid (Nicomedia). They are nine in number—Prote (Turkish, Tinaki), Antigone, Khalki or Karki (Chalcitis or "copper-mine island" of the ancients), Plate, Oxeia, Pitys, Antirobido (Terebinth or Rabbit Island), Neandro, and Prinkipo. Prinkipo or Principo (with an Italian *c*), Kyzyl-Ada or Red Island of the Turks, the largest of the group, is a broad green hill of red quartz rising with soft and verdant outlines into two peaks, the higher of which (500 feet) is crowned by the ex-monastery of St. George, embosomed amid its oaks. On the height above the town of Prinkipo is the monastery of the Transfiguration and on the coast opposite Antirobido that of St. Nicholas. A white-flowered heath (*Erica arborea*), two species of cistus (*Cistus villosus* and *salvifolius*), and lavender give character to the luxuriant vegetation. Khalki contains three convents and an Ottoman naval college; and the whole group, especially Khalki and Plate, form a great summer resort for the Greeks of Constantinople, from which city there is a regular steamer service.

The Princes Islands are intimately associated with Byzantine history. A convent in Prinkipo (now a mass of ruins at the spot called Kamares) was a place of exile for the empresses Irene, Euphrosyne, Zoe, and Anna Dalassena. Antigone was the prison of the patriarch Methodius, and its chapel is said to have been built by Theodora. In Khalki the monastery of the Theotokos (originally of St. John), which since 1831 has been a Greek commercial school, was probably founded by John VIII. Palæologus, and was rebuilt about 1680 by the famous Panagiotaki, and again by Alexander Ypsilanti of Moldavia. Close beside it is the tomb of Edward Barton, second English ambassador to the Porte. Hagia Trias (a school of theology since 1844) was rebuilt by the patriarch Metrophanes of bibliographical memory. Antirobido is associated with the exile of Ignatius and Theodosius; and Plate contained subterranean state prisons hewn out of the rock.

See Gustave Schlumberger, *Les Îles des Princes*, Paris, 1884; Grisebach, *Rumelien und Brussa*, 1839.

PRINCETON, a borough and township of the United States, in Mercer county, New Jersey, on the Delaware and Raritan Canal, 3 miles north by rail from Princeton Junction, which is 48 miles southwest of New York and 42 northeast of Philadelphia on the Pennsylvania Railway. Standing on high ground, it commands a fine prospect towards the east and south. The town is the seat of Princeton or New Jersey College, founded in 1746 by members of the presbytery of New York, chartered in the same year, and opened at Elizabethtown (now Elizabeth) in 1747, removed to Newark in the same year and rechartered in 1748, and finally transferred in 1756 to Princeton, where Nassau Hall, so called in honor of William III. of England, had been erected. Nassau Hall has been twice burned down, in 1802 and 1855, but was restored in 1856 in the old style. This building, Reunion Hall (1870), West College (1836), East College (1833), and the halls of the American Whig and Cliosophic literary societies enclose a quadrangle; and eastward, in the line of Nassau Hall or the north front, stand the library buildings (1873), consisting of an octagonal centre with two wings, the Dickinson Hall (1870), and the John C. Green School of Science (1873). Along the western border of the grounds are University Hall (1876), the Halstead observatory (1867), the gymnasium (1869), Witherspoon Hall (1876), and Edwards Hall (1879), while on the east are the Marquand Chapel (1881), Murray Hall (1877), and the residence of the president. Almost all these buildings are the gifts of generous benefactors, the most munificent of whom was Mr. John C. Green, by whom and by the trustees of his estate not less than $1,500,000 has been given in buildings and endowments. In 1884 the college, which is steadily growing, had 39 professors and 519 students, and the library contained 77,000 volumes. The endowments amount to $1,392,000. The governor of the State of New Jersey is *ex officio* president of the board of trustees, who are twenty-five in number besides the president of the college. The trustees appoint the members of the faculty and have entire control over the funds and property of the college. They fill all vacancies in their own body. Besides the Halstead observatory, there is another well-equipped observatory at the School of Science, and the laboratories and museum are well furnished for scientific study. In the cemetery, which lies to the north of the college, are the tombs of Jonathan Edwards, Aaron Burr, etc. Princeton is also the seat of the oldest theological seminary of the Presbyterian Church in the United States (founded in 1812), with 7 professors, 1 instructor, about 150 students, and an endowment of about a million dollars. The population of the township in 1870 was 3986 and of the borough 2798, and in 1880 respectively 4348 and 3209.

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[1] [The island is nine miles wide. See Whittaker's *Almanack* for 1886, p. 291.—AM. ED.].

At Princeton on 3d January, 1777, Washington defeated the British forces; the Continental Congress met in the town (Nassau Hall) from 26th June to 4th November, 1783.

PRINGLE, Sir John (1707–1782), a distinguished physician, was the younger son of Sir John Pringle of Stitchel, Roxburghshire, and was born on the 10th of April, 1707. He was educated at home under a private tutor, and subsequently at St. Andrews, at Edinburgh, and at Leyden, where he took the degree of doctor of physic. At the last-named university he was an intimate friend of Van Swieten and Haller. He at first settled in Edinburgh as a physician, but was soon after appointed assistant and successor to the professor of moral philosophy in the university. In 1742 he became physician to the earl of Stair, then commanding the British army in Flanders, and in 1745 was appointed by the duke of Cumberland physician-general to the forces in the Low Countries. In 1749, having settled in London, he was made physician in ordinary to the duke of Cumberland; and he afterwards received other court appointments as physician, and in 1766 a baronetcy. He read a series of papers to the Royal Society, which are to be found in the *Transactions*, and which gained for him the Copley gold medal. His first book was *Observations on the Nature and Cure of Hospital and Jayl-Fevers* (London, 1750). He married in 1752 a daughter of Dr. Oliver, a physician in Bath; and in the same year he published his important work, *Observations on the Diseases of the Army in Camp and Garrison*, which went through many editions and was also translated into French, German, Italian and Spanish. After having acted for many years as a member of the council of the Royal Society, he was in November, 1772, elected president of that body. In this capacity he delivered and published, in connection with the annual assignments of the Copley medal, six "discourses," which were afterwards collected into a single volume (1783). In 1776 he published *A Discourse on Improvements in preserving the Health of Mariners*. After passing his seventieth year he resigned his presidency and removed to Edinburgh in 1780, but returned to London in September, 1781, and died in January following. There is a monument to him in Westminster Abbey, executed by Nollekens.

A *Life* of Pringle by Kippis is prefixed to the volume containing the *Six Discourses*. The library of the College of Physicians of Edinburgh possesses ten folio volumes of his unedited MSS., including an essay "on air, climate, diet, and exercise." There are *Éloges* on Pringle by Vicq d'Azyr and Condorcet.

PRINTING, Typographic. See Typography.

PRIOR, Matthew (1664–1721), the most distinguished of English society poets, was the nephew, as Chaucer was the son, of a London vintner, and the lives of the two poets were parallel in a good many other respects. Their art earned for both of them social advancement and political employment; both had a turn for business and diplomacy; both were employed on embassies, both even in secret missions; both were officers of the royal household, and both were rewarded with posts in Government offices of trade; and there was besides not a little in common between them as poets. There are not two careers in literature that offer more numerous or more curious points of parallelism. The vintner's nephew in the reign of Charles II. (born July 21, 1664, either, it would appear, at Wimborne in Dorsetshire, or in or near London) attracted the notice of a noble patron while still at school at Westminster, under the famous Dr. Busby. The earl of Dorset was with a party at the tavern, and the school-boy was called in to decide some debate that had arisen about a passage in Horace. According to the story, Prior acquitted himself so well that the earl, the Mæcenas of his generation, at once undertook to send him to Cambridge, and he was entered at St. John's in 1682. As it happened a fellow school-boy at Westmninister was Charles Montague, who afterwards became earl of Halifax. The two continued comrades at Cambridge, and together wrote in 1687 the *City Mouse and Country Mouse*, in ridicule of Dryden's *Hind and Panther*. It was an age when satirists were in request, and sure of patronage and promotion. The joint production made the fortune of both authors. Montague, who was an earl's grandson, was promoted at once, and Prior had to languish only three years as a fellow of his college when he was gazetted secretary to the embassy at The Hague. After four years of this employment he was recalled to England and appointed one of the gentlemen of the king's bedchamber. Apparently also he acted as one of the king's secretaries, and in 1697 he was secretary to the plenipotentiaries who concluded the peace of Ryswick. Prior's talent for affairs was doubted by Pope, who had no special means of judging, but it is not likely that King William would have employed in this important business a man who had not given proof of diplomatic skill and grasp of details. The poet's knowledge of French is specially mentioned among his qualifications, and this was recognized by his being sent in the same year to Paris in attendance on the English ambassador. At this period Prior could say with good reason that "he had business enough upon his hands and was only a poet by accident." To poetry, however, which had laid the foundation of his fortunes, he still occasionally trusted as a means of maintaining his position, and composed odes on various public events that required celebration. His wit made him a favorite as a member of the English legation at Paris, although he used it sometimes in a patriotic manner at the expense of the French. After his return from France, and a brief tenure of other offices, Prior succeeded Locke as a commissioner of trade. In 1701 he sat in parliament for East Grinstead. About the same time for some undiscovered reason he changed his side in politics, and allied himself with Harley and St. John. Perhaps in consequence of this for nine years there is no mention of his name in connection with any public transaction. But when the Tories came into power in 1710 Prior's diplomatic abilities were again called into action, and till the death of Anne he held a prominent place in all negotiations with the French court, sometimes as secret agent, sometimes in an equivocal position, as ambassador's companion, sometimes as fully accredited but very unpunctually paid ambassador. From this greatness the poet had a sudden fall when the queen died and the Whigs regained power. He was considered of sufficient consequence not to be allowed to escape into obscurity. He was specially examined by a committee of the privy council, and kept in close custody for three years. During this imprisonment, maintaining his cheerful philosophy, he wrote his longest humorous poem, *Alma, or the Progress of the Mind*. This, along with his most ambitious work *Solomon*, and a collection of *Poems on several Occasions*, was published by subscription in 1718. The poet did not long survive his enforced retirement from public life, although he bore his ups and downs with rare equanimity. He died at Wimpole, Cambridgshire, a seat of the earl of Oxford, September 18th, 1721, and was buried in Westminster Abbey, where his monument may be seen in Poet's Corner. Prior had very much the same easy pleasure-loving disposition as Chaucer, combined with a similar capacity for solid work. Johnston lays stress with justice on the variety and the uniform excellence of Prior's poetry. This distinction may fairly be claimed for a poet who has received the enthusiastic praise, in different views of his work, of two men so different as John Wesley and Mr. Swinburne. Prior tried many kinds of grave and gay, and in the face of such testimony it would seem as if we ought to reconsider Johnson's verdict that he never rises high above mediocrity in any kind. Johnson might have been more lenient to Prior's love-verses if he had not made so much use in them of classical fictions. This was the one thing that the great critic would on no account tolerate; frigid allusions to Venus, Cupid, Diana, Ganymede, and such like "easy fictions and vulgar topics," put him out of temper at once, and excluded the unlucky composition from all chance of fair consideration at his hands. The truth was that what Johnson desiderated in love-verses was honest fervent passion. He had no taste for such elegant trifling as the poems in playful praise of Cloe. Even the pretty compliments in the love-letter to the lady of quality aged five would not have moved him to any ecstasy of admiration. "Whatever Prior obtains above a mediocrity," he says, "seems the effort of struggle and of toil. He has many vigorous but few happy lines; he has everything by purchase, and nothing by gift. . . . His expression has every mark of laborious study; the line seldom seems to have been formed at once; the words did not come till they were called, and were then put by constraint into their places, where they do their duty but do it sullenly." This criticism is too unqualified. It applies very happily to many of Prior's verses, but not to Prior at his best; and even when he is at his worst, it strikes us that the failure is rather owing to his not having labored long enough to conceal the labor. If Prior has nothing by gift, it is equally true—and Johnson admits this also—that he has nothing by theft. He is eminently original, and this will probably help to keep his reputation alive with students of poetry for a very long time. There is a fresh intellectual force and a pregnancy of thought in his writing that has made Prior exceedingly serviceable reading for subsequent poets, and there are some of his short poems in which every stanza has been the cause of happy thought and perfect expression in his successors. "Prior is a lady's book," Johnson once said to Boswell. He might have said with more propriety that Prior is a poet's book—a very good book, not exactly to steal from, but to get stimulus from. (W. M.)

PRISCIAN (PRISCIANUS CÆSARIENSIS), the most celebrated Latin grammarian, lived about 500 A. D., *i. e.* somewhat before Justinian. This is shown by the facts that he addressed to Anastasius, emperor of the East (491-518), a laudatory poem, and that the MSS. of his *Institutiones Grammaticæ* contain a subscription to the effect that the work was copied (526, 527) by Flav. Theodorus, a clerk in the imperial secretariat ("memorialis sacri scrinii epistolarum"). Three minor treatises are dedicated to Symmachus (the father-in-law of Boetius). Cassiodorus, writing in the ninety-third year of his age (560? 573?), heads some extracts from Priscian with the statement that he taught at Constantinople in his (Cassiodor's) time (Keil, *Gr. Lat.*, vii p. 207). His title *Cæsariensis* points, according to Niebuhr and others, to Cæsarea in Mauretania. Priscian's teacher was Theoctistus, "noster præceptor, omnis eloquentiæ decus, cui quicquid in me sit doctrinæ post deum imputo" (*Inst. Gr.*, vi. 51), who also wrote an *Institutio artis grammaticæ* (*ibid.*, xviii. 56). A later grammarian, Eutyches, pays Priscian himself a still higher compliment: "de quibus Romanæ lumen facundiæ, meus, immo communis omnium hominum, præceptor, summa cum subtilitate copiosissime grammaticus Priscianus disseruisse cognoscitur" (Eutych., i. 8; Keil, *Gr. Lat.*, v. p. 456). Priscian was quoted by several writers in Britain of the 8th century—Aldhelm, Bede, Alcuin—and was abridged or largely used in the next century by Hrabanus Maurus of Fulda and Servatus Lupus of Ferrara. Of the general use made of his great work the best proof is that, as Hertz says, there is hardly a library in Europe that did not and does not contain a copy, and that there are now about a thousand MSS. of it. The greater part of these contain only books i-xvi. (sometimes called *Priscianus major*); a few contain (with the three books *Ad Symmachum*) books xvii., xviii. (*Priscianus minor*); and a few contain both parts. The earliest MSS. are of the 9th century, though a few fragments are somewhat earlier. All are ultimately derived from the copy made by Theodorus. The first printed edition was in 1470 at Venice. It may fairly be said that from the beginning of the 6th century until recently Priscian has reigned over Latin grammar with almost as generally recognized an authority as Justinian has over Roman law. Some account of so remarkable a treatise may reasonably be required.

The *Institutiones Grammaticæ* is a systematic exposition of Latin grammar, dedicated to Julian, consul and patrician, whom some have identified with the author of a well-known epitome of Justinian's *Novellæ*, but the lawyer appears to be somewhat later than Priscian. In length the treatise is about twice the size of Quintilian's *Institutio Oratoria*, and about equal to Madvig's *Latin Grammar*. It is divided into eighteen books, of which the first sixteen deal mainly with sounds, word-formation, and inflections, the last two, which form from a fourth to a third of the whole work, deal with syntax. Priscian informs us in his preface that he has translated into Latin such precepts of the Greeks Herodian and Apollonius as seemed suitable, and added to them from Latin grammarians. Of the latter he occasionally refers to Caper, Donatus, Probus, and Servius; and more rarely to Charisius, Diomedes, Asper, Nonius, Remmius Palæmon, and others. He proceeds in orderly and almost exhaustive fashion, though with some digressions and repetitions, gives definitions, rules, examples, and exceptions, and constantly quotes passages from various writers to illustrate the use of a form. He has thus preserved to us numerous fragments which would otherwise have been lost, *e.g.*, from Ennius, Pacuvius, Attius, Lucilius, Cato, and Varro. But the authors whom he quotes most frequently are Virgil, and, next to him, Terence, Cicero, Plautus; then Lucan, Horace, Juvenal, Sallust, Statius, Ovid, Livy, and Persius. His industry in collecting forms and examples is both great and methodical. His style is somewhat heavy, but sensible and clear; it has not the admirable grace of Quintilian, nor the adroit use of a technical language such as is found in the Roman jurists; but there is no attempt at fine writing, and it is free not of course from usages of late Latin, but from anything that can be called barbarism. Considering the time at which it was written, it is very creditable to the author, and not unworthy of the high place it obtained in the grammatical world. Its defects are such as were till lately common more or less to all grammars.

These defects may be referred in the main to four heads. (1) Priscian avowedly treats Greek writers on (Greek) grammar as his supreme authorities (*cf.* i. 13; vi. 1; xii. 13, etc.), and, though noticing differences between the two languages, bears too little in mind that each has a history of its own and is a law to itself. (2) There had been no scientific study of phonetics, and consequently the changes and combinations of languages are treated in a mechanical way: *e.g.*, *i* passes into *a*, as *genus*, *generis*, *generatum*; into *o* as *saxi*, *saxosus* (i. 33); *q* passes into *s*, as *torqueo*, *torsi* (i. 48), etc. (3) The resolution of a word into root or stem and inflectional or derivative affixes was an idea wholly unknown, and the rules of formation are often based on unimportant phenomena, and yet are invested with an authority which is irrational and misleading: *e.g.*, *Venus*, like other names ending in *us*, ought to have genitive *Veni*, but, as this might be taken for a verb, it has *Veneris* (vi. 86; viii. 5). *Ador* has no genitive because two rules conflict; for neuters in *or* have a short penult (*e.g.*, *æquor*, *æquoris*), and *adoro*, from which it is derived, has a long penult (vi. 49; viii. 6). (4) The practical meaning of the inflections is not realized, and syntactical usages are treated as if they were arbitrary or accidental associations. Thus, after laying down as a general rule for declinable words that, when they refer to one and the same person, they must have the same case, gender, and number, Priscian adds, that when there are transitive words we may use different numbers, as *doceo discipulos*, *docemus discipulum* (xvii. 153–155). He often states a rule too broadly or narrowly, and then, as it were, gropes after restrictions and extensions.

His etymologies are of course sometimes very wild: *e.g.*, *cælebs*, from *cælestium vitam ducens*, *b* being put for *u* because a consonant cannot be put before another consonant (i. 23); *deterior* from the verb *detero*, *deteris; potior* (adj.) from *potior*, *potiris* (iii. 3); *arbor* from *robur* (vi. 48); *verbum* from *verberatus aeris* (viii. 1), etc. Nor is he always right in Greek usages: thus, in illustrating Latin moods by Greek he frequently uses the future optative with *ἀν*, *e.g.*, *ἐκδύσοιντο ἀν*, *πιστεύσοιμι ἀν* (xviii. 106), and still more strangely treats *ἀρα* as identical in force with *ἀν*, *e.g.*, *quasi tolleretur ac constitueretur*, *ἐπαίροιτο ἀν καὶ καταταττοιτο ἄρα*, and misuses both particles, *e.g.*, *in me causam conferebat quod eum codicem obsignassem*, *ἐσφράγισα ἀν ἄτοι ἐσφραγικῶς ειην ἀρα* (xviii. 110). He evidently regarded *ἀν* or *ἄρα* as normally required with the Greek optative or other moods corresponding to the Latin subjunctive (xviii. 117, etc.).

A rapid notice of the order and of some salient points will show both merits and defects in the treatment of his subject-matter. The references are to the book and to Krehl's paragraphs.

Book i. treats of vocal sound and of letters, their changes and combinations. *Elementa* are vowels, semi-vowels, or mutes. Vowels are named from their own sound; semi-vowels sound a vowel before them; mutes sound a vowel after them (i. 7). As semi-vowels he classes *f*, *l*, *m*, *n*, *r*, *s*, *x*, and in Greek names *z*. *F* was, among the earliest Latins, the Æolic digamma, but afterwards was equivalent to *ϕ*. It is, however, rather a mute, because it is not found at the end of a word, and can be placed before *l* and *r* in the same syllable (*ib.* 13). *K* is quite superfluous; *g* merely shows that a *u* following has no metrical effect; *h* is a mere aspiration; *i* and *u* sometimes pass into consonants, and then have a different metrical effect from what they have as vowels (*ib.* 14–17). *D* has often the sound of *z*: *e.g.*, in *meridies*, *hodie* (*ib.* 31).

Book ii. treats of the syllable and of the letters used to end it, then of the parts of speech. A syllable is an ordered combination of letters uttered with one accent and one breath (ii. 1). A word (*dictio*) is the unit of orderly speech (*ib.* 14). Speech (*oratio*) is a suitable arrangement of words expressing a complete meaning (*ib.* 15). The parts of speech are, according to Priscian, eight, viz., noun, verb, participle, pronoun, preposition, adverb, interjection, conjunction. Infinites (*i.e.*, infinitive moods) are included under the verbs, because they have tenses and no cases. Participles are not included, because they have cases and genders but no moods (*ib.* 18). Priscian obtains a framework for the arrangement of his facts from the "accidents" of each part of speech, and subordinate classifications are taken from the endings of the words. Nouns have the following accidents: *species*, *genus*, *numerus*, *figura*, *casus*. As regards *species* ("class") nouns are proper or appellative, and each of these classes are subdivided into many others. Adjectives are (rightly) treated by Priscian in common with other nouns (ii. 22 *sq.*). The rest of this book and books iii. and iv. treat of the formation of the different classes of nouns, *e.g.*, of patronymics, possessives, comparatives, superlatives, diminutives, and other derivatives. Book v. treats of gender, number, figure, and case. For gender, nouns are discussed by their endings. Figure is either simple or composite or decomposite (*i.e.*, derivative from composite), as, *magnus*, *magnanimus*, *magnanimitas* (v. 61). There are four modes of composition: (1) *ex duobus integris*, as *tribunusplebis*; (2) *ex duobus corruptis*, as *benivolus*; (3) *ex integro et corrupto*, *e.g.*, *inimicus*; (4) *ex corrupto et integro*, as *impius* (v. 58). There are six cases, thus arranged: (1) the nominative as the original; (2) the genitive, because it is born from the nominative, and begets the other oblique cases; (3) the dative, "qui magis amicis convenit;" (4) the accusative, "qui magis ad inimicos attinet;" (5) the vocative as the most imperfect; (6) the ablative as new and peculiar to the Latins (v. 74). In book vi. the formation of the genitive is discussed, each nominative termination being taken in order, irrespective of the declension. Book vii. treats of the other cases in each of the five declensions. Neither here nor in the books on the verb are full paradigms set out as in modern grammars. *Hic*, *hujus*, etc., are often prefixed as symbols of gender and case.

Books viii.–x. deal with the verb. Verbs have eight accidents—*genus*, *tempus*, *modus*, *species*, *figura*, *conjugatio*, *persona*, *numerus*. Some verbs (as other parts of speech) are defective, either by natural necessity or by chance. Necessity may lie in the meaning (*e.g.*, *puerperus* is not found) or in the incompatibility of sound (*e.g.*, *cursor* but not *cursrix*). Chance may lie simply in non-use, *e.g.*, *faux*, *prex*, *dicio*, *for*. *dor*; or because the form would be unpleasant, *e.g.*, *metuturus*, or *metuiturus*, *nutritrix* (from *nutritor*), for which *nutrix* is used. Sometimes a word is not used in order to avoid confusion, *e.g.*, *conjunx* has *conjugis*, lest *conjungis* should be taken for a verb; *maneo* has *mansi*, not *manui*; *fac*, *duc* avoid confusion with ablatives *face*, *duce*, etc. (viii. 4–6).

Genus or *significatio verbi* is its being active or passive. Verbs in *o* are active, neuter, and neutro-passive, *e.g.*, *amo*, *spiro*, *gaudeo* (*cf.* xi. 28). Verbs in *or* are passive, common, and deponent, *e.g.*, *amor*, *osculor te* and *a te*, *sequor*. Verbs whose meaning and use do not correspond with the form are enumerated (*ib.* 7–39). *Tempus* is present, past, and future. Past time is divided into past imperfect, past perfect, past pluperfect. Present and future time are not divided by the Romans (*ib.* 38). *Dixero* is called the subjunctive future (*ib.* 55, 57). The indicative and subjunctive have all tenses; the imperative has present, future, and, in passive, a past (*e.g.*, *amatus sit*). The optative and infinite have one form expressing both present and past imperfect, and another expressing perfect and pluperfect (*ib.* 38–43). The present tense embraces to some extent both past and future (*e.g.*, *Priscianus vocor*, *scribo versum*). The perfect corresponds to Greek aorist as well as to perfect (*ib.* 51–54). Priscian makes five moods—the optative (same in forms as the subjunctive) always requiring an adverb of wishing; the subjunctive, requiring not only an adverb or conjunction, but also another verb, *e.g.*, *cum faciam venito*. In expressions of command, as *ne dicas*, another verb is not required (*ib.* 68). Supines and gerunds (sometimes confused, sometimes distinguished, by Priscian) are nouns used in place of the infinite. *Amandus*, etc., is called *participiale* or *nomen verbale* (*ib.* 44, 70). Impersonal verbs have a peculiar meaning (*ib.* 69).

In class verbs are primitive or derivative. Derivatives are numerously classified as inchoatives, frequentatives, etc. (*ib.* 72 *sq.*). In figure verbs are simple or compound (*ib.* 81). Conjugations in Latin are determined by the vowel of the 2d person, and are thus four only, while the Greeks have ten. Person and number close the eighth book. *Fero*, *volo*, *edo* are specially treated (ix. 4–11). The formation of the perfect is first treated generally (ix. 13), and then the perfects and supines of 1st and 2d conjugations and (in book x.) of 3d and 4th conjugations.

Book xi. deals with participles, which were invented to act as verbs applied to nouns, especially in oblique cases. Hence we can say not only *bonus homo loquebatur* but *boni hominis loquentis orationem audivi*, etc. (xi. 3). The participle has six accidents—*genus*, *casus*, *significatio*, *tempus*, *numerus*, *figura* (*ib.* 13)—where *genus* is gender, and *significatio* and *figura* have same application as in verbs. The formation of the participles, especially of the past participle, is fully discussed.

Books xii. and xiii. deal with pronouns. They have six accidents—*species*, *persona*, *genus*, *numerus*, *figura*, *casus*. There are four declensions, viz., personal, *ille*, etc., *meus*, etc., *nostras*, etc. Priscian classes as nouns, and not as pronouns, *quis*, *qualis*, *talis*, *quantus*, *tantus*, *tot*, *unus*, *solus*, *totus*, *alius*, *nullus*, *uter*, *alter*, and their compounds (xiii. 11, 29–35).

Having finished the four declinable parts of speech, Priscian turns to the four indeclinable. Prepositions (book xiv.) are (except sometimes in verse) put before nouns both by apposition and composition; before pronouns only by apposition; before all else by composition (xiv. 8). He treats first of prepositions used with the accusative case, then of those used with the ablative, and lastly of those occurring only in composition. Adverbs (book xv.) have *species*, *significatio*, *figura*, where *species* refers to their being primitive or derivative, and *significatio* to their meaning as temporal, local, confirmative, optative, etc. Some are used with all tenses and moods, others with some only. They are arranged for discussion under their endings (*ib.* 7). Under the endings in *ā* are treated also ablatives of nouns used as adverbs, *e.g.*, *una*, *qua*, *Roma*, and also other local uses of nouns, *e.g.*, *Romæ sum*, *Romam eo*, etc. (*ib.* 9). Interjections are separated from adverbs by Roman writers, because they express fully an emotion of the mind, *e.g.*, *papæ*, *quid video*, where *papæ=mirror* (*ib.* 40). Conjunctions have *figura* and *species*, *species* denoting meaning and use as copulative, causal, disjunctive, etc. Some conjunctions belong to several of these classes.

The two books on syntax are looser in arrangement, and are not so clear and exhaustive as the former books. The truth is, Priscian lacked a good framework for the facts of construction, and first tries one and then another. The seventeenth book rests mainly on Apollonius; the eighteenth is less dependent on him, and ends with a long miscellaneous list, in alphabetical order, of Greek idioms, chiefly verbal, which he compares with corresponding Latin usages. Part of this list occurs twice over. Omitting duplicates, there are nearly 300 such comparisons. Hertz suggests (Præf. iii. p. vii.) that it was only closed by the fortunate occurrence of χορτάζομαι, illustrated by a line of Terence which ended with *satur!* These idioms are illustrated by copious quotations from Demosthenes and Plato, and not a few from Homer, Herodotus, Thucydides, and Xenophon, besides Latin authors.

The syntax commences with showing the analogy of elements, words, and speech. In each of these we have repetition, omission, conjunction, transposition, etc. (xvii. 3 *sq.*). Then Priscian discusses why interrogatives are all of two parts of speech only, viz., nouns and adverbs (*ib.* 22): why not also verbs (*ib.* 36)? He discusses the difference of pronouns from one another, their use with impersonals, particularly *interest*, *refert* (*ib.* 92), the use of the possessive and reflexive pronouns. He says that *mei ager* may be used for *meus ager*, but also for "the land of my husband" (*ib.* 129, 130). There are many possible unions and interchanges of different parts of speech and of their accidents. Such unions as *ille ego qui quondam*, etc., are justified analogically by the union of different cases, *e.g.*, *animalium quædam sunt mortalia*, or by the rise of compounds from different cases, as *mediterraneus a medio terræ* (*ib.* 144–152). Different numbers and genders are combined, as *pars secant; aperite aliquis; in Eunuchum suam;* or different cases, as *urbem quam statuo vestra est;* or different times, as *postquam cecidit . . . Ilion et omnis humo fumat Troja* (*ib.* 155–163). Often we find interchange, *e.g.*, of parts of speech, as *sublime* (*volas*) for an adverb, *genus unde Latinum* for *ex quo*, etc. (*ib.* 168).

In the eighteenth book he discusses the use of the cases. The nominative and vocative are absolute, and with substantival or vocatival verbs of the first or second person they do not require a pronoun, *e.g.*, *homo sum*, *Cicero nominor*, but with other verbs they do, *e.g.*, *ego Priscianus scribotu Apollonius* or (*Apolloni*) *scribis*. *Tu* may, however, be omitted with the vocative, but *Priscianus scribo* is a solecism, because nouns by themselves and participles, without the vocative case, are of the third person (*ib.* 2–4). If a noun requires an oblique case, we must have the verb substantive or participle, *e.g.*, *filius Herculis sum*. In *filius Pelei Achilles multos interfecit*, the participle *ens* ("for which we now use *qui est* or *qui fuit*") must be understood (*ib.* 6). The nominative is joined to the genitive when possession and a possessor are meant. In *Hector filius Priami* the genitive denotes the possessor; in *magnæ virtutis vir* it denotes the possession. In the latter use the Latins often have the ablative, as they have also for the Greek genitive of consequence, ἐμοῦ ζῶντος =*me vivo* (*ib.* 14). The genitive after comparatives and superlatives and after verbals in *-or* and *-rix* is mentioned; also such usages as *fidens animi*, *dives lactis* (*ib.* 18, 19). In *doctus grammaticam* we have a participle; in *doctus grammaticæ* a noun (*ib.* 21). The dative is used acquisitively, *e. g.*, *commodus tibi sum*, also after verbals in *-lis* and *-dus*. Words of equivalence or subjection or the reverse are used in any order with either genitive or dative, *e.g.*, *pater filii*, or *filio est pater;* so *similis*, *par*, *amicus*, etc. Nominatives are joined to accusatives when what belongs to a part is assigned to the whole, *e. g.*, *fortis dextram* for *fortem dextram habens*. In all (even in oblique) cases we must understand *qui est*, as *albi colorem equi =equi ejus qui est albi coloris* (*ib.* 27). The ablative is joined to the nominative to express the instrument, the possession, the consequence (see above). It is used also with words of passive meaning, *e. g.*, *viduus pharetra*, *dignus morte*, and in comparisons (*ib.* 32). He then proceeds (in awkward language) to point out that the nominative which is joined to a verb remains unchanged, and either takes no oblique cases of another declinable word or only such as are construed with the verb, *e. g.*, *Terentius ambulat; Cæsar vincit Pompeium; pater indulget filio*. But the nominative, which in consequence of the nature of the noun itself takes oblique cases, takes those cases, be its own case what it may; *e.g.*, *victor Pompeii Cæsar interfectus est a Bruto; victoris Pompeii Cæsaris filia fuit Julia; victori Pompeii Cæsari*, etc. (*ib.* 35, 36). Similarly datives like *curæ*, *cordi*, etc., are used with all cases, *e.g.*, *cordi hominis* for *jucundi hominis* (*ib.* 38; xi. 24). Priscian would have found it difficult to give an instance of this.

The syntax of the verb follows. The infinite is taken first as the most general. Infinites are often joined to nouns, *e.g.*, *bonum est legere*, and, by a beautiful figure, to adjectives, *e.g.*, *fortis bellare;* also to verbs and participles (xviii. 40–46). All verbs may be resolved into infinites, *e.g.*, *ambulo = dico me ambulare*, *scribebam = scribere cœpi*. Hence *cœpit* was sometimes omitted, *e.g.*, *ego illud sedulo negare factum* (*ib.* 48). Participials and supines have the same case as the verb; verbal nouns in *-dus* have the same case as the nouns to which they are joined (*ib.* 61–63). All transitive verbs are joined either to a genitive or dative or accusative or ablative, *e.g.*, *egeo tui*, *insidior tibi*, etc. Similarly participials or supines, *e.g.*, *miserendo tui moveor*, *nocitum tibi propero*, *nocitu tibi gaudet* (*ib.* 61). An instance of the last would be hard to find.

The uses of indicative, imperative, and optative moods are briefly treated. The subjunctive, which is the same in form as the optative (*ib.* 82), requires always to be joined to another mood or to another verb of the same mood. It is especially frequent with *si*, when expressing doubt and put for ἐάν (*ib.* 80). With the indicative *si* used for εἰ shows confirmation and belief. In *siqua id fortuna vetabit*, *vetabit* is put *metri gratia* for *vetet*. The subjunctive expresses doubt or approval or possibility, *e.g.*, doubt in *eloquar an sileam*, approval in *si non pertæsum thalami tædæque fuisset*, where *fuisset* = ἐγεγόνει ἄρα. *Ut* and *qui*, *quæ*, *quod*, giving a reason or expressing a doubt, are often used with subjunctive (*ib.* 82–93). In discussing *ut* for ἵνα, his examples carefully give the same tense of the principal verb (whether indicative or subjunctive) as that of the dependent subjunctive, *e.g.*, *doces ut proficias, doceres ut proficeres, docuisti ut profeceris, docuisses ut profecisses, docebis ut profeceris* (future subjunctive). But he also notes that *fecissem* or *facerem* are equally right with *nisi impedires*, and that *faciam* or *fecero* is used with either *nisi impedias* or *impedires* (*ib.* 101–104).

After then discussing the cases used after verbs according to the meaning of the verbs as transitive, passive, common, absolute (*e.g.*, *rubeo pudore*), or expressing various affections of the body or mind (*ib.* 127–167), he proceeds to the long list of idioms spoken of above.

Priscian's three short treatises dedicated to Symmachus are on weights and measures, the metres of Terence, and some rhetorical elements. He also wrote *De nomine, pronomine, et verbo* (an abridgment of part of his *Institutiones*), and an interesting specimen of the school teaching of grammar in the shape of complete parsing by question and answer of the first twelve lines of the *Æneid* (*Partitiones xii. versuum Æneidos principalium*). The metre is discussed first, each verse is scanned, and each word thoroughly and instructively examined. Its meaning, its form, its accent, its class, its other cases or tenses, its compounds and derivatives are all required from the pupil, as well as the rules to which they ought to conform. Such parsing, rarely, if ever takes place in modern schools. A treatise on accents is ascribed to Priscian, but is rejected by modern writers on the ground of matter and language. He also wrote two poems, not in any way remarkable, viz., a panegyric on Anastasius in 312 hexameters with a short iambic introduction, and a faithful translation into 1087 hexameters of Dionysius's *Periegesis* or geographical survey of the world. A few passages have, says Bernhardy, been altered by Priscian on account of their heathen contents.

The grammatical treatises have been critically edited, in excellent fashion, in Keil's *Grammatici Latini*, vols. ii. and iii., 1855–60; the *Institutiones* by Martin Hertz; and the smaller treatises by Keil. The poems have been recently edited by Bährens, in his *Poetæ Latini Minores*, vol. v., 1883. (H. J. R.)

PRISCILLIANISTS, an heretical sect which rose to some prominence in Spain towards the end of the 4th century and continued to subsist, in varying numbers, there and in Gaul, until after the middle of the 6th. Its founder was Priscillian, a wealthy and influential layman of considerable reading and ability who had devoted his life to a self-denying study of the occult sciences and the deeper problems of philosophy. In the course of his speculations he came under the influence of two teachers, Elpidius and Agape, who professed to have derived their views from a certain Marcus, a native of Egypt who had settled in Spain. The creed which Priscillian now formulated appears to have combined various features of Gnosticism and Manichæism; he seems, for example, to have held the theory of emanations—high in rank among these being the heavenly powers whom he called by the name of the twelve patriarchs, and brought also into close relations with the signs of the zodiac—the doctrine of the demiurge, the pre-existence of souls, the eternity of the devil, the essential sinfulness of the flesh, the unlawfulness of procreation, and the like. He and his followers retained their connection with the Catholic Church,—insisting, however, on fasting on Sundays, and refusing the bread in the sacrament; but they also held separate meetings in private at which they were accused by their adversaries (with what truth is not known) of practicing magic and indulging in licentious orgies. Many women joined the sect, and among the more prominent of its converts were two bishops, named Instantius and Salvianus. Bishop Hyginus of Cordova, who had been the first to raise the alarm against the new doctrines and practices, himself soon afterwards joined the sect; but through the exertions of Idacius of Emerita the leading Priscillianists, who had failed to appear before the synod of Spanish and Aquitanian bishops to which they had been summoned, were excommunicated at Saragossa in October, 380. The same synod passed certain canons against the heresy, and Ithacius of Ossonuba was charged with the publication of its decisions. Meanwhile, however, Priscillian was made bishop of Avila, and the orthodox party found it necessary to appeal to the emperor (Gratian), who issued an edict threatening the sectarian leaders with banishment. Priscillian, Instantius, and Salvianus now passed through Gaul to Italy with the object of enlisting the sympathies of Ambrose of Milan and Pope Damasus, but without result. They succeeded, however, by bribing the proconsul, it is said, in procuring the withdrawal of Gratian's edict, and the attempted arrest of Ithacius. With the murder of Gratian and accession of Maximus (383) the aspect of matters again changed; Ithacius fled to Treves, and in consequence of his representations a synod was held (384) at Bordeaux where Instantius was deposed. Priscillian for his part appealed to the emperor, with the unexpected result that along with six of his companions he was condemned to death and executed at Treves in 385. This first instance of the application of the Theodosian law against heretics caused a profound sensation throughout the Catholic world; it had the approval of the synod which met at Treves in the same year, but Ambrose of Milan and Martin of Tours can claim the glory of having lifted up their voices against it, and of having in some measure stayed the hand of persecution. The heresy, notwithstanding the severe measures taken against it, continued to spread in France as well as in Spain; and the barbarian invasions of the 5th century appear to have helped its further diffusion. About 444 it attracted the attention of Leo I. at Rome, along with other forms of Manichæism, and something was done for its repression by a synod held at the pope's instance by Turribius of Astorga in 446 and by that of Toledo in 447; as an openly professed creed it wholly disappeared after the second synod of Braga in 563.

PRISHTINA, or PRISTINA, a town of European Turkey, since 1877 at the head of a liwa in the vilayet of Kossovo, lies on an affluent of the Sitnitza, a subtributary of the Morava, and gives its name to one of the stations on the Salonica-Uskub-Mitrowica Railway, which runs at a distance of 6 or 7 miles to the west of the town. It stands at a height of 1700 feet above the sea on undulating ground, and presents in the distance a pleasant appearance with the minarets erected, according to the legend, by Turkish women whose husbands fell in the battle of Kossovo fought in the neighborhood. Prishtina is the seat of a Greek bishop. Its population is estimated at from 8000 to 10,000. To the southeast lies the partly ruined monastery of Gratchanitza founded by King Milutin of Servia, who reigned from 1275 to 1321. It is a graceful building with a large central dome surrounded by four smaller domes and a variety of arches, of which the higher are pointed and the lower round. Among the frescos are portraits of the founder and his queen Simonida, daughter of Andronicus II. Palæologus, and a remarkable head of Christ in the dome. See Mackenzie and Irby, *The Slavonic Provinces of Turkey*.

PRISON DISCIPLINE. Authority in every age and in every country has claimed to impose penalties on all who offend against it. Either coercion or protection has been the moving principle: the master extorted submission, or society, through its rulers, defended itself against evil doers. The most common punishments in early times were naturally those most easily inflicted. Offenders paid in their persons: they were put to death with every variety of the capital sentence, were branded, mutilated, or sold as slaves. They were fined also, were degraded, or forfeited civil rights, or yet again were simply banished from their homes. Enforced detention, incarceration within four walls, was another method of coercion which grew and gained favor under the feudal system. The lord temporal or spiritual or corporate body could thus hold the vassal safe until he yielded fealty or submitted to extortion. A dungeon told no tales, and served conveniently to bury the victims of mediæval oppression. The unrestrained and unjustifiable exercise of the power to imprison lingered long in lands where personal liberty was unknown; nor did arbitrary imprisonment terminate with the destruction of the Bastille. In England, however, freedom from illegal arrest, the dearest of the Briton's privileges, was resolutely fought for and early achieved. The Great Charters conceded it; and, although often in danger, it was confirmed finally and beyond all question by the Habeas Corpus Act passed in the reign of Charles II. But the theory was better than the practice: numbers always languished in jail, the victims of needlessly severe or misinterpreted laws, who nowadays would have been at large. Through long years of trouble and disquiet, when the country was torn with religious and political dissensions, the prisons were always full. Intolerance appealed to the strong arm, and the jail was the antechamber of the scaffold or stake. When party warfare ran high, when kings struggled for larger powers or their ministers and myrmidons ruled with a high hand, incarceration was the easy recompense for all on the losing side. The commercial laws of a nation wedded to trade kept a large contingent always in jail. The debtor was at the mercy of his creditor, who could command the best efforts of the law to assist him in recovering his own again. Irregularity in the administration of justice contributed largely to fill the prisons. Jail deliveries were frequently delayed indefinitely; while, even when tardy trial ended in an acquittal, release was not always accorded, and innocent men unable to meet extortionate demands in fees, were carried back to prison. This was one reason why jails were full; yet another was the laxity or entire absence of discipline which suffered the families of accused persons to share their confinement. Under such conditions, more or less universal, the state of prisons, not in England alone, but throughout the then civilized world, was deplorable in the extreme. Yet the terrors of incarceration were long but vaguely understood. Glimpses of light sometimes penetrated the dark recesses of the prison house, as when the atrocities perpetrated by the keepers of the chief debtors' prisons in London were made the subject of parliamentary inquiry. This was in 1730, forty-three years before the revelations of Howard. But in the interval voices were occasionally raised in protest, and there was a general sense of uneasiness throughout the country to which the great philanthropist gave point and expression. Howard began his journeys of inspection in 1773; in the following year he was examined by the House of Commons, and received the thanks of the House for his arduous and self-sacrificing labors for the mitigation of suffering in jails. What Howard found is sufficiently well known. The prisons of the kingdom were a disgrace to humanity: they were for the most part poisonous pestiferous dens, densely overcrowded, dark, foully dirty, not only ill-ventilated, but deprived altogether of fresh air. The wretched inmates were thrown into subterranean dungeons, into wet and noisome caverns and hideous holes to rot and fester, a prey to fell disease bred and propagated in the prison house, and deprived of the commonest necessaries of life. For food they were dependent upon the caprice of their jailers or the charity of the benevolent; water was denied them except in the scantiest proportions; they were half naked or in rags; their only bedding was putrid straw reeking with exhalations and accumulated filth. Every one in durance, whether tried or untried, was heavily ironed; women did not escape the infliction. All alike were subject to the rapacity of their jailers and the extortions of their fellows. Jail fees were levied ruthlessly—"garnish" also, the tax or contribution paid by each individual to a common fund to be spent by the whole body, generally in drink. Drunkenness was universal and quite unchecked; gambling of all kinds was practiced; vice and obscenity were everywhere in the ascendant. Idleness, drunkenness, vicious intercourse, sickness, starvation, squalor, cruelty, chains, awful oppression, and everywhere culpable neglect—in these words may be summed up the state of the jails at the time of Howard's visitation.

It must be borne in mind that all this time the prisons were primarily places of detention, not of punishment. The bulk of those committed to their safe keeping were accused persons awaiting trial in due process of law, or debtors; and of these again by far the most numerous class were the impecunious and the unfortunate, whom a mistaken system locked up and deprived of all means of paying their liabilities. Now and again an offender was sentenced to be imprisoned in default of payment of fine, or to pass the intervals between certain periods of disgraceful exposure on the pillory. Imprisonment had as yet no regular place in the code of penalties, and the jail was only the temporary lodging of culprits duly tried and sentenced according to law. The punishment most in favor in these ruthless times was death. The statute-book bristled with capital felonies, and the gallows was in perpetual requisition. These were days when the pickpocket was hanged; so was the sheep-stealer, and the forger of one-pound notes. Well might Sir Samuel Romilly, to whose strenuous exertions the amelioration of the penal code is in a great measure due, declare that the laws of England were written in blood. But even then there was another and a less sanguinary penalty. The deportation of criminals beyond seas grew naturally out of the laws which prescribed banishment for certain offences. The Vagrancy Act of Elizabeth's reign contained in it the germ of transportation, by empowering justices in quarter sessions to banish offenders and order them to be conveyed into such parts beyond the seas as should be assigned by Her Majesty's privy council. Full effect was given to this statute in the next reign, as is proved by a letter of James I., dated 1619, in which the king directs "a hundred dissolute persons" to be sent to Virginia. Another Act of similar tenor was passed in the reign of Charles II., in which the term "transportation" appears to have been first used. A further and more systematic development of the system of transportation took place in 1718, when an Act was passed by which offenders who had escaped the death penalty were handed over to contractors, who engaged to transport them to the American colonies. These contractors were vested with a property in the labor of the convicts for a certain term, generally from seven to fourteen years, and this right they frequently sold. Labor in those early days was scarce in the new settlements; and before the general adoption of negro slavery there was a keen competition for felon hands. The demand was indeed so great that it produced illegal methods of supply. An organized system of kidnapping prevailed along the British coasts; young lads were seized and sold into what was practically white slavery in the American plantations. These malpractices were checked, but the legitimate traffic in convict labor continued until it was ended peremptorily by the revolt of the American colonies and the achievement of their independence. In 1776 the British legislature, making a virtue of necessity, discovered that transportation to His Majesty's colonies (which three years previously had declared their independence[1]) was bound to be attended by various inconveniences, particularly by depriving the kingdom of many subjects whose labor might be useful to the community; and an Act was accordingly passed which provided that convicts sentenced to transportation might be employed at hard labor at home. At the same time the consideration of some scheme for their disposal was entrusted to three eminent public men—Sir William Blackstone, Mr. Eden (afterwards Lord Auckland), and John Howard. The result of their labors was an Act for the establishment of penitentiary houses, dated 1778. This Act is of peculiar importance. It contains the first public enunciation of a general principle of penal treatment, and shows that even at that early date the system since nearly universally adopted was fully understood. The object in view was thus stated. It was hoped, by sobriety, cleanliness, and medical assistance, by a regular series of labor, by solitary confinement during the intervals of work, and by due religious instruction, to preserve and amend the health of the unhappy offenders, to inure them to habits of industry, to guard them from pernicious company, to accustom them to serious reflection, and to teach them both the principles and practice of every Christian and moral duty. The experience of a century has added nothing to these the true principles of penal discipline; they form the basis of every species of prison system carried out since the passing of the Act 19 Geo. III. c 74 in 1779.

The first step towards giving effect to this Act was the appointment of a commission of three "supervisors" to select and acquire a site for the first penitentiary house. Howard was one, and no doubt the most influential, of these; but he could not agree with his colleagues as to the most suitable situation. One was for Islington, another for Limehouse, while Howard insisted upon some site which was healthy, well supplied with water, and in such a convenient spot that it could be readily visited and inspected. It is interesting to observe that the great philanthropist anticipated modern English practice in his preparation of the plans for the construction of the prison. He was strongly of opinion that the penitentiary should be built by convict labor, just as in recent years the new prison has been erected at Wormwood Scrubs, and large blocks added to the prisons of Chatham, Portsmouth, and Dartmoor. Howard, however, withdrew from the commission, and new supervisors were appointed, who were on the eve of commencing the first penitentiary when the discoveries of Captain Cook in the South Seas turned the attention of the Government towards these new lands. The vast territories of Australasia promised an unlimited field for convict colonization, and for the moment the scheme for penitentiary houses fell to the ground. Public opinion generally preferred the idea of establishing penal settlements at a distance from home. "There was general confidence," says Merivale in his work on colonization, "in the favorite theory that the best mode of punishing offenders was that which removed them from the scene of offence and temptation, cut them off by a great gulf of space from all their former connections, and gave them the opportunity of redeeming past crimes by becoming useful members of society." These views so far prevailed that an expedition consisting of nine transports and two men-of-war, the "first fleet" of Australian annals, sailed in March, 1787, for New South Wales. This first fleet reached Botany Bay in January, 1788, but passed on and landed at Port Jackson, where it entered and occupied the harbor of Sydney, one of the finest and most secure havens in the world. We shall return further on to the proceedings of these first criminal colonists when the progress of transportation as a secondary punishment will be described.

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[1] [The Declaration of Independence was passed in the same year.—AM. ED.]

The penitentiary scheme was not, however, abandoned on the adoption of transportation to New South Wales. It was revived and kept alive by Jeremy Bentham, who in 1791 published a work on prison discipline entitled *The Panopticon or Inspection House*, and followed it next year by a formal proposal to erect a prison house on his own plan. Bentham's main idea was "a circular building, an iron cage glazed, a glass lantern as large as Ranelagh, with the cells on the outer circumference." Within, in the centre, an inspection station was so fixed that every cell or part of a cell could be at all times closely observed,—the prisoners being themselves at liberty to communicate with visitors and make known their complaints by means of tubes. He hoped to effect much in the way of reformation from a system of solitude or limited seclusion, with constant employment on work in the profits of which the prisoners were to share. His project was warmly approved by Pitt, but secret influences—the personal hostility, it was said, of George III. to Bentham as an advanced Radical, hindered its adoption until 1794. A contract was then made between the treasury and Bentham, by which the latter was to erect a prison for a thousand convicts, with chapel and other necessary buildings, for £19,000 [$92,340]. A portion of this sum was advanced, and Bentham also acquired on behalf of the Government certain lands in the neighborhood of Tothill Fields. But the undertaking languished, and never took practical shape. Nearly fifteen years later, when the penitentiary question was again revived, Bentham's claims were referred to arbitration, and the Government proceeded to erect the prison on its own account, "fully recognizing the importance of attempting reformation by the seclusion, employment, and religious instruction of prisoners." This had been tried already on a small scale but with satisfactory results, first at the Gloucester prison erected in 1791 and afterwards in the house of correction at Southwell. A larger and more ambitious experiment was resolved upon, worthy of the state; and the great penitentiary still standing after many vicissitudes, but practically unaltered, at Millbank, was the result of this determination. It was built on the lands originally acquired by Bentham, and the work commenced in 1813 was continued at great outlay until 1816, when a portion was ready for the reception of prisoners. A great flourish attended its opening. Its affairs were entrusted to a specially appointed committee of eminent and distinguished personages, the chairman being the Speaker of the House of Commons. Crowds of visitors—royal dukes, foreign princes, the élite of society—came to see the new prison; most elaborate arrangements were made for its internal government, and no money was spared either upon the staff or upon the completion of the buildings. The sum total expended upon the latter amounted to half a million of money [$2,430,000], and the yearly charges of the establishment were a heavy burthen on the exchequer.

The erection of Millbank was, however, a step in the right direction. The energy with which it was undertaken was the more remarkable because elsewhere throughout the United Kingdom the prisons, with but few exceptions, remained deplorably bad. Mr. Neild, who in 1812 followed in the footsteps of John Howard, found that the old conditions, overcrowding and indiscriminate intercourse, remained unchanged. "The great reformation produced by Howard," to use Neild's own words, "was merely temporary; . . . . prisons were relapsing into their former horrid state of privation, filthiness, severity, and neglect." Yet the legislature was alive to the need for prison reform. Besides the building of Millbank it had promulgated many Acts for the amelioration of prisoners. Jail fees were once more distinctly abolished; the appointment of chaplains was insisted upon; the erection of improved prison buildings was rendered imperative upon local authorities. But these with other and much older Acts remained in abeyance. Thus an Act which provided for the classification of prisoners had remained a dead letter; even the separation of the males from the females was not an universal rule. Humane provisions intended to secure the good government of prisons, their cleanliness and ventilation and the proper supply of food, clothing and bedding to the prisoners were still systematically ignored. Roused by these crying evils a small band of earnest men, philanthropists and members of the Society of Friends, formed themselves into an association for the improvement of prison discipline and devoted themselves with rare energy and singleness of purpose to their self-constituted task. They perambulated the country inspecting all the prisons; they issued lengthy interrogatories to prison officials; they published periodical reports giving the result of their inquiries, with their views on the true principles of prison management and much sound advice, accompanied by elaborate plans, on the subject of prison construction. The labors of this society brought out into strong relief the naked deformity of the bulk of the British jails. It was the old story. Jails, speaking broadly, were lamentably inadequate for the numbers crowded into them. Hence there was the most terrible overcrowding. By day in some prisons it was nearly impossible to push through the throngs in the yards; by night the wretched prisoners ran the risk of suffocation. Prisoners were still very generally obliged to wear heavy irons. They had no regular diet—at best only dry bread. Speaking of St. Alban's from his personal observation, Mr. Buxton, a most active member of the Society, says, "All were in ill-health; almost all were in rags; almost all were filthy in the extreme. The state of the prison, the desperation of the prisoners, broadly hinted in their conversation and plainly expressed in their conduct, the uproar of oaths, complaints and obscenity, the indescribable stench, presented together a concentration of the utmost misery and the utmost guilt." This was no over-colored picture, nor did it portray a solitary instance. The reports of the Society laid bare the existence of similar horrors in numbers of other jails. Yet this was in 1818, when the legislature was setting a praiseworthy example—when half a million had been spent in providing large airy cells for a thousand prisoners. Even in London itself, within easy reach of this palatial Millbank penitentiary, the chief prison of the city, Newgate, was in a disgraceful condition. This had been exposed by a parliamentary inquiry as far back as 1814, but nothing had been done to remedy the evils laid bare. All the shameful conditions of neglect, ill-treatment and overcrowding were present in Newgate and to the same extent as in any of the provincial prisons. The state of the female side had already attracted the attention of that devoted woman, Mrs. Fry, whose ministrations and wonderful success no doubt encouraged, if they did not bring about, the formation of the Prison Society. Mrs. Fry went first to Newgate in 1813, but only as a casual visitor. It was not till 1817 that she entered upon the great and noble work with which her name will ever be associated. She worked a miracle there in an incredibly short space of time. The ward into which she penetrated, although strongly dissuaded by the officials, was like a den of wild beasts, it was filled with women unsexed, fighting, swearing, dancing, gaming, yelling, d justly deserved its name of "hell above ground." ithin a month it was transformed, and presented, s an eye-witness, "a scene where stillness and pro- iety reigned." The wild beasts were tamed. It was t strange that such marvellous results should be uited abroad, that public attention should be attracted Mrs. Fry's labors and that others should seek to low in her footsteps. Movements similar to that ich Mrs. Fry headed were soon set on foot both in gland and on the Continent, and public attention s generally directed to the urgent necessity for prison orm.

Stimulated no doubt by the success achieved by Mrs. y, the Prison Discipline Society continued its useful ors. Hostile critics were not wanting; many voices re raised in protest against the ultra-humanitarianism ich sought to make jails too comfortable and tended pamper criminals. But the society pursued its way deterred by sarcasm, through evil and good report, iving earnestly after the objects it had in view. ny of these are now accepted as axioms in prison atment. It is, for instance, established beyond estion that female officers only should have charge female prisoners, that prisoners of both sexes should kept constantly employed. Yet these principles re unacknowledged at that time and were first enun- ted in Acts such as the 4 Geo. IV. c. 65 and the 5 o. IV. c. 85 (1823–24), the passing of which were inly due to the strenuous exertions of the Prison cipline Society. It was laid down in these that r and above safe custody it was essential to preserve lth, improve morals and enforce hard labor on all soners sentenced to it. These Acts also provided t male and female prisoners should be confined in arate buildings, that matrons should be appointed, l schoolmasters, and that there should be divine vice daily in the jails. Now at last irons were ctly forbidden except in cases of "urgent and abso- e necessity," and it was ruled that every prisoner uld have a bed to himself—if possible, a separate l, the last being the first formal statement of a prin- le upon which all future prison discipline was to be ed.

The importance of these Acts cannot be over- imated as supplying a legal standard of efficiency which all prisons could be measured. Still the gress of improvement was extremely slow, and rs after the managers of jails still evaded or ignored Acts. Many local authorities grudged the money rebuild or enlarge their jails; others varied much their interpretation of the rules as to hard labor l the hours of employment. One great drawback general reform was that a large number of small sons lay beyond the reach of the law. Those under all jurisdictions in the boroughs and under the ty corporate bodies continued open to the strongest robation. Not only were they wanting in all the ispensable requirements as laid down by the most ent Acts, but they were often unfit for the confine- nt of human beings, and were described "as fruitful rces of vice and misery, debasing all who are con- d within their walls." They thus remained until y were swept away by the measure which brought ut the reform of the municipal corporations in 5. But by this time a still more determined effort l been made to establish some uniform and improved tem of prison discipline. In 1831 a select committee the House of Commons went into the whole subject secondary punishment and reported that, as the ficulties in the way of an effective classification of soners were insurmountable, they were strongly in or of the confinement of prisoners in separate cells, ommending that the whole of the prisons should altered accordingly and the expense borne by the blic exchequer. There can be little doubt that this nmittee, like every one just then, was greatly uck by the superior methods of prison discipline rsued in the United States. The best American prisons had recently been visited by two eminent Frenchmen, MM. Beaumont and De Tocqueville, who spoke of them in terms of the highest praise. It was with the object of appropriating what was best in the American system that Mr. Crawford was dispatched across the Atlantic on a special mission of inquiry. His able and exhaustive report, published in 1834, was a valuable contribution to the whole question of penal discipline and it was closely and attentively studied at the time. Another select committee, this time of the House of Lords, returned to the subject in 1835, and after a long investigation re-enunciated the theory that all prisoners should be kept separate and apart from one another. It also urged in strong terms the necessity for one uniform system of treatment, more especially as regarded dietaries, labor and education, and strongly recommended the appointment of official inspectors to enforce obedience to the Acts. These recommendations were eventually adopted and formed the basis of a new departure. This was the first indication of a system which, although greatly modified, enlarged and improved, is in its main outlines the same as that now in force.

It must, however, be borne in mind that the prisons at home still formed an item only, and not the largest, in the scheme of secondary punishment. The jail was only a place of temporary detention, where prisoners awaited trial, suffered short terms of imprisonment, or passed on to the gallows or the penal colonies. The last-named was the chief outlet, for by this time the country was fully committed to the system of deportation. Since the first fleet in 1787 convicts had been sent out in constantly increasing numbers to the antipodes. Yet the early settlement at Sydney had not greatly prospered. The infant colony, composed of such incongruous materials, of guards and criminals, had had a bitter struggle for existence. It had been hoped that the community would raise its own produce and speedily become self-supporting. But the soil was unfruitful; the convicts knew nothing of farming; there was no one fully competent to instruct them in agriculture. All lived upon rations sent out from home; and when convoys with relief lingered by the way famine stared all in the face. The colony was long a penal settlement and nothing more, peopled only by two classes, convicts and their masters—criminal bondsmen on the one hand who had forfeited their independence and were bound to labor without wages for the state, on the other officials to guard and exact the due performance of tasks. From the first it had been felt that the formation of a steady respectable class was essential to the future healthy life of the colony. But such an element was not easy to infuse into the community. A few free families were encouraged to emigrate, but they were lost in the mass they were intended to leaven, swamped and outnumbered by the convicts, shiploads of whom continued to pour in year after year. As the influx increased difficulties arose as to their employment. Free settlers were too few to give work to more than a small proportion. Moreover, a new policy was in the ascendant, initiated by Governor Macquarie, who considered the convicts and their rehabilitation his chief care, and steadily discouraged the immigration of any but those who "came out for their country's good." The great bulk of the convict labor thus remained in Government hands. This period marked the first phase in the history of transportation. The penal colony, having triumphed over early dangers and difficulties, was crowded with convicts in a state of semi-freedom, maintained at the public expense, and utilized in the development of the latent resources of the country. The methods employed by Governor Macquarie were not perhaps invariably the best; the time was hardly ripe as yet for the erection of palatial buildings in Sydney, while the congregation of the workmen in large bodies tended greatly to their demoralization. But some of the works undertaken and carried out were of incalculable service to the young colony; and its early advance in wealth and prosperity was greatly due to the magnificent roads, bridges, and other facilities of inter-communication for which it was indebted to Governor Macquarie.

But now the criminal sewage flowing from the Old World to the New was greatly increased in volume under milder and more humane laws. Many now escaped the gallows, and much of the overcrowding of the jails at home already mentioned was caused by the gangs of convicts awaiting transshipment to the antipodes. They were packed off, however, with all convenient despatch, and the numbers on Government hands in the colonies multiplied exceedingly, causing increasing embarrassment as to their disposal. Moreover, the expense of the Australian convict establishments was enormous, and some change in system was inevitable. These were the conditions that brought about the plan of "assignments," in other words of freely lending the convicts to any who would relieve the authorities of the burdensome charge. By this time free settlers were arriving in greater number, invited by a different and more liberal policy than that of Governor Macquarie. Inducements were especially offered to persons possessed of capital to venture in the development of the country. Assignment developed rapidly; soon eager competition arose for the convict hands that were at first very reluctantly taken. Great facilities existed for utilizing them on the wide areas of grazing land and on the new stations in the interior. A pastoral life, without temptations and contaminating influences, was well suited for convicts. As the colony grew richer and more populous, other than agricultural employers became assignees, and numerous enterprises were set on foot. The trades and callings which minister to the needs of all civilized communities were more and more largely pursued. There was plenty of work for skilled convicts in the towns, and the services of the more intelligent were highly prized. It was a great boon to secure gratis the assistance of men specially trained as clerks, book-keepers, or handicraftsmen. Hence all manner of intrigues and manœuvres were set agoing on the arrival of drafts, and there was a scramble for the best hands. Here at once was a flaw in the system of assignment. The lot of the convict was altogether unequal. Some, the dull unlettered and unskilled, were drafted to heavy manual labor at which they remained, while clever and expert rogues found pleasant, congenial, and often profitable employment. The contrast was very marked from the first, but it became the more apparent, the anomaly more monstrous, as time passed on and some were still engaged in unlovely toil while others, who had come out by the same ship, had already attained to affluence and ease. For the latter transportation was no punishment, but often the reverse. It meant too often transfer to a new world under conditions more favorable to success, removed from the keener competition of the old. By adroit management, too, they often obtained the command of funds, the product of nefarious transactions at home, which wives or near relatives or unconvicted accomplices presently brought out to them. It was easy for the free new-comers to secure the assignment of their convict friends; and the latter, although still nominally servants and in the background, at once assumed the real control. Another system productive of much evil was the employment of convict clerks in positions of trust in various Government offices; convicts did much of the legal work of the colony; a convict was clerk to the attorney-general; others were schoolmasters, and were entrusted with the education of youth.

Under a system so anomalous and uncertain the main object of transportation as a method of penal discipline and repression was in danger of being quite overlooked. Yet the state could not entirely abdicate its functions, although it surrendered to a great extent the care of criminals to private persons. It had established a code of penalties for the coercion of the ill-conducted, while it kept the worst, perforce, in its own hands. The master was always at liberty to appeal to the strong arm of the law. A message carried to a neighboring magistrate, often by the culprit himself, brought down the prompt retribution of the lash. Convicts might be flogged for petty offences, for idleness, drunkenness, turbulence, absconding, and so forth. At the out-stations some show of decorum and regularity was observed, although the work done was generally scanty, and the convicts were secretly given to all manner of evil courses. The town convicts were worse, because they were far less under control. They were nominally under the surveillance and supervision of the police, which amounted to nothing at all. They came and went, and amused themselves after working hours, so that Sydney and all the large towns were hot-beds of vice and immorality. The masters as a rule made no attempt to watch over their charges; many of them were absolutely unfitted to do so, being themselves of low character, "emancipists" frequently, old convicts pardoned or who had finished their terms. No effort was made to prevent the assignment of convicts to improper persons; every applicant got what he wanted, even though his own character would not bear inspection. All whom the masters could not manage—the incorrigibles upon whom lash and bread and water had been tried in vain—were returned to Government charge. These, in a word, comprised the whole of the refuse of colonial conviction. Every man who could not agree with his master, or who was to undergo a penalty greater than flogging or less than capital punishment, came back to Government, and was disposed of in one of three ways—the road parties, the chain gangs, or the penal settlements. The convicts in the first might be kept in the vicinity of the towns or marched about the country according to the work in hand; the labor was irksome, but, owing to inefficient supervision, never intolerable; the diet was ample, and there was no great restraint upon independence within certain wide limits. To the slackness of control over the road parties was directly traceable the frequent escape of desperadoes, who, defying recapture, recruited the gangs of bush-rangers, which were a constant terror to the whole country. In the chain or iron gangs, as they were sometimes styled, discipline was far more vigorous. It was maintained by the constant presence of a military guard, and, when most efficiently organized, was governed by a military officer who was also a magistrate. The work was really hard, the custody close—in hulk, stockaded barrack, or caravan; the first was at Sydney, the second in the interior, the last when the undertaking required constant change of place. All were locked up from sunset to sunrise; all wore heavy leg irons: and all were liable to immediate flagellation. The convict "scourger" was one of the regular officials attached to every chain gang. The third and ultimate receptacle was the penal settlement, to which no offenders were transferred till all other methods of treatment had failed. These were terrible cesspools of iniquity, so bad that it seemed, to use the words of one who knew them well, "the heart of a man who went to them was taken from him and he was given that of a beast." The horrors accumulated at Norfolk Island, Moreton Bay, Port Arthur, and Tasman's Peninsula are almost beyond description. The convicts herded together in them grew utterly degraded and brutalized; no wonder that reckless despair took possession of them, that death on the gallows for murder purposely committed, or the slow terror from starvation following escape into surrounding wilds, was often welcomed as a relief.

The stage which transportation was now reaching, and the actual condition of affairs in the Australian colonies about this period, do not appear to have been much understood in England. Earnest and thoughtful men might busy themselves with prison discipline at home, and the legislature might watch with peculiar interest the results obtained from the special treatment of a limited number of selected offenders in Millbank penitentiary. But for the great mass of criminality deported to a distant shore no very active concern was shown. The country for a long time seemed satisfied with transportation. Portions of the system might be open to criticism. Thus the Commons committee of 1832 freely condemned the hulks at Woolwich and other arsenals in which a large number of convicts were kept while waiting embarkation. The indiscriminate association of prisoners in them produced more vice, profaneness, and demoralization than in the ordinary prisons. After dark the wildest orgies went on in them—dancing, fighting, gambling, singing, and so forth; it was easy to get drink and tobacco, and see friends from outside. The labor hours were short, the tasks light; "altogether the situation of the convict" in the hulks, says the report, "cannot be considered penal; it is a state of restriction, but hardly of punishment." But this same committee spoke well of transportation, considering it "a most valuable expedient in the system of secondary punishment." All that it felt necessary to suggest was that exile should be preceded by a period of severe probationary punishment in England, a proposal which was reiterated later on and actually adopted, as we shall see. It was in the country most closely affected that dissatisfaction first began to find voice. Already in 1832 the most reputable sections of Australian society were beginning to find grave fault with transportation. It had fostered the growth of a strong party—that representing convict views—and these were advocated boldly in unprincipled prints. This party, constantly recruited from the emancipists and ticket-of-leave holders, gradually grew very numerous, and threatened soon to swamp the respectable and untainted parts of the community. As years passed the prevalence of crime, and the universally low tone of morality due to the convict element, became more and more noticeable, and created greater disgust. At length, in 1835, Judge Burton raised a loud protest, and in a charge to the grand jury of Sydney plainly intimated that transportation must cease. While it existed, he said, the colonies could never rise to their proper position; they could not claim free institutions; in a word, Australia suffered in its whole moral aspect. This bold but forcible language commanded attention. It was speedily echoed in England, and by none more eloquently than Archbishop Whately, who logically argued that transportation failed in all the leading requisites of any system of secondary punishment. It was not formidable—criminals did not dread it; it was not corrective, but tended obviously to produce farther moral debasement; it was not cheap—on the contrary it entailed great outlay without bringing any adequate returns. In the first most important object it had certainly failed. Transportation exercised no salutary terror in offenders; it was no longer exile to an unknown inhospitable region, but to one flowing with milk and honey, whither innumerable friends and associates had gone already. There was every chance of doing well in the new country. The most glowing descriptions came back of the wealth which any clever fellow might easily amass; stories were told and names mentioned of those who had made ample fortunes in Australia in a few years. As a matter of fact the convicts, or at least large numbers of them, had prospered exceedingly. Some had incomes of twenty [$97,200], thirty [$145,800], even forty thousand [$194,400] pounds a year. They owned shops and farms and public houses and ships, drove in carriages, and kept up grand establishments. It could be no great punishment to be put within reach of such advantages. As regarded the deteriorating effects of the system, these were plainly manifest on the surface from the condition of the colony—the profligacy of the town, the leniency shown to crimes and those who had committed them. Down below, in the depths where the dregs rankled perpetually, in the openly sanctioned slavery called assignment, in the demoralizing chain gangs, and in the inexpressibly horrible penal settlements, were more abundant and more awful proofs of the general wickedness and corruption. Moreover, these appalling results were accompanied by a vast expenditure. The cost of the colonial convict establishments, with the passages out, amounted annually to upwards of £300,000 [$1,458,000]; another hundred thousand [$486,000] was expended on the military garrisons; and various items brought the whole outlay to about half a million [$2,430,000] per annum. It may be argued that this was not a heavy price to pay for peopling a continent and laying the foundations of our vast Australasian empire. But that empire could never have expanded to its present dimensions if it had depended on convict immigration alone. There was a point, too, at which all development, all progress, would have come to a full stop had it not been relieved of its stigma as a penal colony.

That point was reached between 1835 and 1840, when a powerful party came into existence in New South Wales, pledged to procure the abandonment of transportation. A strongly hostile feeling was also gaining ground in England. In 1837 a new committee of the House of Commons had made a patient and searching investigation into the merits and demerits of the system, and freely condemned it. The Government had no choice but to give way; it could not ignore the protests of the colonists backed up by such an authoritative expression of opinion. In 1840 orders were issued to suspend the deportation of criminals to New South Wales. But what was to become of the convicts? It was impossible to keep them at home. The hulks, which might have served, had also failed; the faultiness of their internal management had been fully proved. The committee last mentioned had recommended the erection of more penitentiaries. But the costly experiment of Millbank had been barren of results. The model prison at Pentonville, now in process of construction under the pressure of a movement towards prison reform, could offer but limited accommodation. A proposal was put forward to construct convict barracks in the vicinity of the great arsenals; but this, which contained really the germ of the present British penal system, was premature. The Government in this dilemma steered a middle course, and resolved to adhere to transportation, but under a greatly modified and, it was hoped, much improved form. The colony of Van Diemen's Land, younger and less self-reliant than its neighbor, had also endured convict immigration, but had made no protest. It was resolved to direct the whole stream of deportation upon Van Diemen's Land, which was thus constituted one vast colonial prison. The main principle of the new system was one of probation; hence its name. All convicts were to pass through various stages and degrees of punishment according to their conduct and character. Some general depôt was needed where the necessary observation could be made, and it was found at Millbank penitentiary. Thence boys were sent to the prison for juveniles at Parkhurst; the most promising subjects among the adults were selected to undergo the experimental discipline of solitude and separation at Pentonville; less hopeful cases went to the hulks; and all adults alike passed on to the antipodes. Fresh stages awaited the convict on his arrival at Van Diemen's Land. The first was limited to "lifers" and colonial convicts sentenced a second time. It consisted in detention at one of the penal stations, either Norfolk Island or Tasman's Peninsula, where the disgraceful conditions already described continued unchanged to the very last. The second stage received the larger number, who were subjected in it to gang labor, working under restraint in various parts of the colony. These probation stations, as they were called, were intended to inculcate habits of industry and subordination; they were provided with supervisors and religious instructors; and, had they not been soon tainted by the vicious virus brought to them by others arriving from the penal stations, they might have answered their purpose for a time. But they became as bad as the worst of the penal settlements, and contributed greatly to the deplorable breakdown of the whole system. The third stage, and the first step towards freedom, was the concession of a pass which permitted the convict to be at large under certain conditions to seek work for himself; the fourth was a ticket-of-leave, the possession of which allowed him to come and go much as he pleased; the fifth, and last, was absolute pardon, with the prospects of rehabilitation.

This scheme seemed admirable on paper; yet it failed completely when put into practice. Colonial resources were quite unable to bear the pressure. Within two or three years Van Diemen's Land was fairly inundated with convicts. Sixteen thousand were sent out in four years; the average annual draft in the colony was about thirty thousand, and this when there were only thirty-seven thousand free settlers. Half the whole number of convicts remained in Government hands and were kept in the probation gangs, engaged upon public works of great utility; but the other half, pass-holders and ticket-of-leave men in a state of semi-freedom, could get little or no employment. The supply greatly exceeded the demand; there were no hirers of labor. Had the colony been as large and as prosperous as its neighbor it could scarcely have absorbed the mass of workmen; but it was really on the verge of bankruptcy—its finances were embarrassed, its trades and industries at a standstill. But not only were the convicts idle; they were utterly depraved. It was soon found that the system which kept large bodies always together had a most pernicious effect upon their moral condition. "The congregation of criminals in large batches without adequate supervision meant simply wholesale widespread pollution," as was said at the time. These ever-present and constantly increasing evils forced the Government to reconsider its position; and in 1846 transportation to Van Diemen's Land was temporarily suspended for a couple of years, during which it was hoped some relief might be afforded. The formation of a new convict colony in North Australia had been contemplated; but the project, warmly espoused by Mr. Gladstone, then under secretary of state for the colonies, was presently abandoned; and it now became clear that no resumption of transportation was possible.

Some fresh scheme had to be devised, and that without delay. The task fell upon Sir George Grey[1] as home secretary, who, in dealing with it laid the foundations of the present British penal system. This system was to consist (1) of a limited period of separate confinement in a home prison or penitentiary, accompanied by industrial employment and moral training; (2) of hard labor at some public works prison either at home or abroad; and (3) of exile to a colony with a conditional pardon or ticket-of-leave. No pains were spared to give effect to this plan as soon as it was decided upon. Pentonville was available for the first phase; Millbank was also pressed into the service, and accommodation was hired in some of the best provincial prisons, as at Wakefield, Leicester, and elsewhere. Few facilities existed for carrying out the second stage, but they were speedily improvised. Although the hulks at home had been condemned, convict establishments in which these floating prisons still formed the principal part were organized at Bermuda and Gibraltar. Neither of these, it may be stated at once, was a conspicuous success; they were too remote for effective supervision; and, although they lingered on for some years, they were finally condemned. The chief efforts of the authorities were directed to the formation of public works prisons at home, and here the most satisfactory results were soon obtained. The construction of a harbor of refuge at Portland had been recommended in 1845; in 1847 an Act was passed to facilitate the purchase of land there, and a sum of money taken up in the estimates for the erection of a prison, which was commenced next year. At another point, Dartmoor, a prison already, stood available, although it had not been occupied since the last war, when ten thousand

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[1] [Second baronet (1799-1882), under secretary for colonies under Melbourne, suppressed Charist insurrection in 1848, twice chancellor of duchy of Lancaster.—Am. Ed.]

French and American prisoners had been incarcerated in it. A little reconstruction made Dartmoor into a modern jail, and in the waste lands around there was ample labor for any number of convict hands. Dartmoor was opened in 1850; two years later a convict prison was established at Portsmouth in connection with the dockyard, and another of the same class at Chatham in 1856. The works undertaken at these various stations were of national importance, and the results obtained extremely valuable, as will presently be shown. The usefulness of these public works prisons and the need for their development soon became apparent. Although the authorities still clung to the principle of transportation, that punishment grew more and more difficult to inflict. The third stage in Sir George Grey's scheme contemplated the enforced emigration of released convicts, whom the discipline of separation and public works was supposed to have purged and purified, and who would have better hopes of entering on a new career of honest industry in a new country than when thrown back among vicious associations at home. The theory was good, the practice difficult. No colony would accept these ticket-of-leave men as a gift. Van Diemen's Land, hitherto submissive, rebelled, and positively refused to receive them, even though this denial cut off the supply of labor, now urgently needed. Other colonies were no less resolute in their opposition. The appearance of a convict ship at the Cape of Good Hope nearly produced a revolt. Although Earl Grey addressed a circular to all colonial Governments, offering them the questionable boon of transportation, only one, the comparatively new colony of Western Australia, responded in the affirmative. But this single receptacle could not absorb a tithe of the whole number of convicts awaiting exile. It became necessary therefore to find some other means for the disposal of those so rapidly accumulating at home. Accordingly, in 1853 the first Penal Servitude Act was passed, substituting certain shorter sentences of penal servitude for transportation. It was only just to abbreviate the terms; under the old sentence the transportee knew that if well conducted he would spend the greater part of it in the comparative freedom of exile. But, although sentences were shortened, it was not thought safe to surrender all control over the released convict; and he was only granted a ticket-of-leave for the unexpired portion of his original sentence. But no effective supervision was maintained over these convicts at large. They speedily relapsed into crime; their numbers, as the years passed, became so great, and their depredations so serious, especially in garotte robberies, that a cry of indignation, led by general alarm, was raised against the system which exposed society to such dangers. There was a vague desire to return to transportation—to rid the country once more, by removal to far-off points, of the criminals who preyed upon it. The usual panacea for all public grievances was presently tried, and the system with which Sir Joshua Jebb's name had come to be identified was arraigned before a select committee of the House of Commons in 1863.

Before reviewing the report of this committee, it will be well to retrace our steps and examine the phases through which prison dicipline had passed since 1836. We left this, which embraces the preliminary stages of secondary punishment, at a date when public attention was very generally drawn to it. The true object of penal treatment had begun to be understood, and keen controversy had arisen as to the best methods for securing it. This object broadly stated, was to compass the reformation of the convicted offender and at the same time deter others from crime. The chief experiments in this direction had been made in the United States, where two remarkable systems of penal discipline had for some time been in operation. Each had its warm supporters and friends. One had originated with the Quakers of Pennsylvania, who, as far back as 1786, had abolished capital punishment and all other purely personal penalties, and had subjected all offenders instead to solitary confinement without occupation for mind or body.[1] This, as developed in the years following, became the purely solitary system, and was the first of the two methods mentioned above. The idea, although not absolutely new, having been already accepted in the United Kingdom both in the Gloucester penitentiary and the Glasgow bridewell, was hailed with enthusiasm as a solution of all difficulties of prison treatment. Many other States in the Union followed the lead of Pennsylvania. That of New York built the great Auburn penitentiary in 1816 to carry out the new principles. There every prisoner was kept continuously in complete isolation. He saw no one, spoke to no one, and did no work. But within a short period very deplorable results began to show themselves at Auburn. Many prisoners became insane; health was impaired, and life greatly endangered. Mr. Crawfurd, whose mission to the United States has been already referred to, was in favor of solitary confinement, but he could not deny that several cases of suicide followed this isolation. Some relaxation of the disastrous severity seemed desirable, and out of this grew the second great system, which was presently introduced at Auburn, and afterwards at the no less renowned prison of Sing Sing. It was called the silent system. While the prisoners were still separated at night or meals, they were suffered to labor in association, but under a rule of silence ruthlessly and rigorously maintained. The latter, entrusted to irresponsible subordinates, degenerated into a despotism which brought the system into great discredit. All discipline officers were permitted to wield the whip summarily and without the slightest check. "The quantity of punishment," says Mr. Crawfurd, "is entirely dependent on the will of the overseers, against whose acts there is no appeal." Under such a system the most frightful excesses were possible, and many cases of brutal cruelty were laid bare. Reviewing the merits and demerits of each system, Mr. Crawfurd gave in his adhesion to that of unvarying solitude as pursued in the Eastern Penitentiary in Pennsylvania. "I have no hesitation in declaring my conviction," he says, "that its discipline is a safe and efficacious mode of prison management"; of the opposite system, that of Auburn, he reports that, notwithstanding the order and regularity with which its discipline was enforced, "its effects were greatly overrated."

Mr. Crawfurd came back from the United States an ardent champion of the solitary system. To use his own words, "so greatly does increasing experience prove the importance of solitude in the management of prisons that I could not, if circumstances admitted, too strongly advocate its application in Great Britain, for every class of offenders as well as for persons before trial, under modifications which would divest seclusion of its harshest character." He saw great difficulties in making this the universal rule, chief among which was the enormous expense of providing suitable prisons. Some modification of the rule of unbroken solitude would be inevitable; but he strongly urged its adoption for certain classes, and he was equally convinced of the imperative necessity for giving every prisoner a separate sleeping cell. It is clear that the Government endorsed Mr. Crawfurd's views. Where it was possible they gave effect to them at once. At Millbank, with its spacious solitary cells, the rule of seclusion was more and more strictly enforced under the supervision of a reverend governor, also a warm partisan of the system. Ere long permissive legislation strove to disseminate the new principles. In 1830

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[1] [By the Act of 1786 "the code was ameliorated by the punishment at hard labor, instead of death, for robbery, burglary, and the 'crime against nature.'" But capital punishment for murder has never been abolished in Pennsylvania, and solitary confinement has been accompanied by labor in the cell, reading and instruction. See *Sketch of Eastern Penitentiary of Pennsylvania*, by Richd. Vaux, Phila., 1872.—AM. ED.]

Lord John Russell had given it as his opinion that cellular separation was desirable in all prisons. But it was not until 1839 that an act was passed which laid it down that individuals might be confined separately and apart in single cells. Even now the executive did not insist upon the construction of prisons on a new plan. It only set a good example by undertaking the erection of one which should serve as a model for the whole country. In 1840 the first stone of Pentonville prison was laid; and, after three years of very considerable outlay, its cells, 520 in number, were occupied on the solitary, or more exactly the separate, system,—the latter being somewhat less rigorous and irksome in its restraints. To the credit of many local jurisdictions, they speedily followed the lead of the central authority. Within half a dozen years no less than fifty-four new prisons were built on the Pentonville plan, which now began to serve generally as a "model" for imitation, not in England alone, but all over the world. That able administrator, Sir Joshua Jebb, who presided over its erection, may fairly claim indeed to be the author and originator of modern prison architecture.

Other jurisdictions were less prompt to recognize their responsibilities, the city of London among the number. They were satisfied with small makeshifts and modifications, without entering upon that complete and radical reconstruction which could alone meet the case. From this inertness there followed a lamentable want of uniformity in the administration of legal penalties. Criminals suffered more or less punishment according to the locality in which they were incarcerated. Dietaries differed—here too high, there too low. The amount of exercise allowed varied greatly; there was no universal rule as to employment. In some prisons hard labor was insisted upon, and embraced treadwheels or the newly invented cranks: in others it was industrial, devoted to manufactures; while in some it did not exist at all. The cells inhabited by prisoners (and separate cellular confinement was now very general) were of different dimensions,—variously lighted, warmed and ventilated. The time spent in these cells was not invariably the same, and as yet no authoritative decision had been made between the solitary and silent systems. The first-named had been tried at Pentonville, but the period for which it was deemed possible had been greatly reduced. The duration had been at first fixed at eighteen months, but it was incontestably proved that the prisoners' minds had become enfeebled by this long isolation, and the period was limited to nine months. In many jurisdictions, however, the silent system, or that of associated labor in silence, was still preferred; and there might be prisons within a short distance of each other at which two entirely different systems of discipline were in force. In 1849 Mr. Charles Pearson, M.P., moved for a select committee to report upon the best means of securing some uniform system which should be at once punitive, reformatory, and self-supporting. He urged that all existing plans were inefficacious, and he advocated a new scheme by which the labor of all prisoners should be applied to agriculture in district prisons. The result of a full inquiry was the reiteration of views already accepted in theory, but not yet generally adopted in practice. The committee recommended separation, so long as it was conducted under proper safeguards; it animadverted upon the great variety which still existed in prison discipline and the construction of jails and strongly urged the legislature to entrust full powers to some central authority who would exact adherence to the rules laid down. Thirteen more years elapsed and still no such steps had been taken. A new committee sat in 1863, and in its report again remarked, and in no measured terms, upon the many and wide differences that still existed in the jails of Great Britain as regards construction, diet, labor, and general discipline, "leading to an inequality, uncertainty, and inefficiency of punishment productive of the most prejudicial results." Even yet separation was not universal; labor, dietaries, education—everything varied still. Matters could only be mended by the exercise of legislative authority, and this came in the Prison Act of 1865, an Act which consolidated all previous statutes on the subject of prison discipline, many of its provisions being still in force. It promulgated minute and precise regulations on every item of prison management, and backed them up with pains and penalties that ought to have ensured attention. Yet the years passed and uniformity was still far from secured; it was impossible, indeed, while prison administration was still left to a number of local authorities, no two of which were often of the same mind. Great varieties of practice still obtained. The number of feet ascended at hard labor on the treadwheel differed in different districts; each jurisdiction still pleased itself as to dietaries; and it was still, as of old, a mere accident of locality whether imprisonment was light or heavy. The legislature had tried its best, but its best had failed. It had exercised some supervision through its inspectors, had forbidden cells to be used until duly certified as fit, had threatened to withhold exchequer contributions from prisons of which unfavorable reports were received. Such penalties had exercised no sufficient terrors. It began to be understood, moreover, that the prisons under local jurisdictions were not always conveniently and economically situated. In one district there might be too many, in another not enough; one prison was empty and its neighbor full to overflowing; yet there was no power to make transfers and equalize accommodation. All this produced excessive, even wasteful expenditure. Nor was its incidence, under altered conditions, exactly fair. Crime, with the many facilities offered for rapid locomotion to those who committed it, had ceased to be merely local, and the whole state rather than individual communities ought to be taxed; prison charges should be borne by the exchequer, and not by local rates. These considerations gained strength, and led at length to the introduction of the Prison Bill which became law in 1877, and which is the last Act passed for the regulation of prisons. By the Act of 1877 the control of all jails was vested in a body of prison commissioners appointed by, and responsible to, the home secretary. These commissioners had power to consolidate by closing superfluous prisons, to establish one system of discipline, and generally by watchful supervision, aided by the experience of specialists, to maintain that much desired uniformity which had been so long and unsuccessfully sought. At the same time the co-operation of the local magistrates was invited so far as advice and assistance were concerned; but all real power and control had passed from their hands into that of the commissioners of prisons. The system established by the Act of 1877 is that now in force, and we shall recur to it directly, in recapitulating the whole of our present method of secondary punishment.

Meanwhile considerable changes had been introduced into penal servitude, the punishment reserved for the gravest offences. We left this branch of the subject at a date (1863) when its efficiency was about to be tested by a parliamentary inquiry. The verdict given was in the main satisfactory; but doubts were expressed as to the severity of the discipline inflicted, the principal features of which were moderate labor, ample diet, and substantial gratuities. The first was far less than the work free men did for a livelihood, the second larger, the third excessive, so that convicts often left prison with thirty, forty, even eighty pounds in their pockets. Penal servitude, to use the words of the lord chief justice, Sir Alexander Cockburn, one of the members of the committee, "was hardly calculated to produce on the mind of the criminal that salutary dread of the recurrence of the punishment which may be the means of deterring him, and through his example others, from the commission of crime." The chief recommendations put forward to mend the system comprised lengthening of all sentences, a diminution in the dietaries, the abolition of large gratuities, and, speaking broadly, a general tightening of the reins. The most notable change, however, was in regard to labor, the quantity and value of which was to be regulated in future by the so-called "mark system." This plan had originated with Captain Maconochie, at one time superintendent in Norfolk Island, who had recommended that the punishment inflicted upon criminals should be measured, not by time, but by the amount of labor actually performed. In support of his theory he devised an ingenious system of recording the convicts' daily industry by marks, which on reaching a given total would entitle them to their release. The mark system had already been tried with good results in Ireland, where the Irish system, as it was called, introduced by Sir Walter Crofton had attracted widespread attention from the extraordinary success which seemed to follow it. There had been a very marked diminution in crime, attributable it was supposed to the system, which was in almost all respects the same as the English, although the Irish authorities had invented an "intermediate stage" in which convicts worked in a state of semi-freedom, and thus practiced the self-reliance which in many superinduced reform. As a matter of fact the diminution in crime was traceable to general causes, such as a general exodus by emigration, the introduction of a poor law, and an increase in the facilities for earning an honest livelihood. It may be added here that, judged by later experience, the Irish system has evinced no transcendent merits, and it is now (1885) moribund. But we owe something to the Irish practice which first popularised the idea of maintaining a strict supervision over convicts in a state of conditional release, and it reconciled us to a system which was long wrongfully stigmatised as espionage. The mark system, as recommended by the committee of 1863, and as subsequently introduced, had, however, little in common with either Maconochie's or the Irish plan. It was similar in principle, and that was all. According to the committee every convict should have it in his power to earn a remission —in other words, to shorten his sentence by his industry. This industry was to be measured by marks, earned by hard labor at the public works, after a short probational term of close "separate" confinement. But the remission gained did not mean absolute release. All males were to be sent, during the latter part of their sentences, "without disguise to a thinly peopled colony," to work out their time and their own rehabilitation. The committee, it will be seen, still clung to the old theory of transportation, and this in spite of the lively protests of some of its members. The one outlet remaining, however, that of Western Australia, was soon afterwards (1867) closed to convict emigrants; and this part of the committee's recommendations became a dead letter. Not so the mark system, or the plan of earning remission by steady industry. This was carried out on a broad and intelligent basis by officials prompt to avail themselves of the advantages it offered; a readiness to move with the times, to adopt suggestions tending towards improvement, and generally to benefit by external advice and experience, has always characterized convict prison administration in recent years. Remedies have been at once applied where flaws were found. Thus in 1877-78 efforts were made to minimize contamination by segregating the worst criminals, and restricting conversation at exercise. Again, the recommendation of the latest commission of inquiry, that of 1878-79, tending in the same direction was immediately adopted, and a special class was formed in 1880 in which all convicts "not versed in crime," first offenders or at least comparatively innocent men, are now kept apart from the older and more hardened criminals. While concessions have been cheerfully made, the stern necessities of a penal system have been rigorously maintained. The committee last quoted gave it as their opinion that "penal servitude as at present administered is on the whole satisfactory; it is effective as a punishment and free from serious abuses; . . . . a sentence of penal servitude is now generally an object of dread to the criminal population." This change is ascribed to the various improvements introduced— "longer sentences, spare diet, and generally a more strict enforcement of work and discipline."

Having thus traced the history of secondary punishments and prison discipline in England from the earliest times to the present day, it will be well to describe briefly the system of penal repression as now actually in force. This will best be effected by following those who break the law through all stages from that of arrest, through conviction, to release, conditional or complete. After a short detention in a police cell—places of durance which still need improvement—an offender, unless disposed of summarily, passes into one of Her Majesty's local prisons, there to await his trial at sessions or assizes. The period thus spent in the provinces will never exceed three months; in London, with the frequent sittings at Clerkenwell and of the Central Criminal Court, it is seldom more than one month. While awaiting trial the prisoner may wear his own clothes, provide his own food, see and communicate with his friends and legal adviser, so as to prepare fully for his defence. His fate after conviction depends on his sentence. If this be imprisonment, so called to distinguish it from penal servitude, although both mean deprivation of liberty and are closely akin, it is undergone in one of the "local" prisons—the prisons till 1878 under local jurisdiction, but now entirely controlled by the state through the home secretary and the commissioners of prisons. The régime undergone is cellular; able-bodied prisoners are kept in strict separation for at least one month, and during that time subjected to first-class hard labor, which is purely penal in character; and nowadays, under the uniform system introduced by the commissioners, consists of the treadwheel, in which each individual ascends 8640 feet in a day's work, or six hours' work on cranks or hard labor machines is exacted where there are no treadwheels; and the labor whether of treadwheel or crank, is generally utilized as the motive power for grinding corn or pumping water for prison use. Beating oakum with a heavy beater and mat-making with heavy implements are also considered first-class hard labor. A system of progressive stages not unlike the mark system has been adopted in the local prisons, and the prisoner's progress through each depends on his own industry and good conduct. During the first month he sleeps on a plank bed, a wooden frame raised from the floor, with bedding but without mattress. When he has earned the proper number of marks, which at the earliest cannot be until one month has elapsed, he passes into the second stage, and is allowed better diet, and a mattress twice a week. The third stage, at the end of the third month, gives him further privileges as regards diet and bed. The fourth stage concedes to the prisoner a mattress every night, and the privilege, if well conducted, to communicate by letter or through visits with his friends outside. These stages are applicable to females except as regards the plank bed; while youths under sixteen and old men above sixty are also allowed mattresses. A small gratuity may be earned during the second and three following stages, amounting in the aggregate to ten shillings [$2.43]. The labor, too, may be industrial, and include instruction in tailoring, shoemaking, basket-making, bookbinding, printing and many more handicrafts. Throughout the sentence the prisoner has the advantage of religious and moral instruction; he attends divine service regularly and according to his creed is visited by the chaplain, and receives educational assistance according to his needs. His physical welfare is watched over by competent medical men; close attention is paid to the sanitary condition of prisons; strict rules govern the size of the cells, with their lighting, warming, and ventilation. Dietaries are everywhere the same; they are calculated with great nicety according to the terms of durance, and afford variety and ample nutrition without running into excess. In a word, as regards discipline, labor, treatment, exactly the same system obtains throughout the United Kingdom from Bodmin to the far north, from Cork to Belfast.

Where the sentence passes beyond two years it ceases to be styled imprisonment and becomes penal servitude, which may be inflicted for any period from five years to life. The prisoner becomes a convict, and undergoes his penalty in one or more of the convict prisons. These are entirely under state management. A sentence of penal servitude, as now administered, consists of three distinct periods or stages: (1) that of probation endured in separate confinement at a so-called "close" prison; (2) a period of labor in association at a public works prison; and (3) conditional release for the unexpired portion of the sentence upon license or ticket-of-leave. (1) In the first stage, which is limited to nine months for reasons already given, the convict passes his whole time in his cell apart from other prisoners, engaged at some industrial employment. He exercises and goes to chapel daily in the society of others, but holds no communication with them; his only intercourse with his fellow creatures is when he is visited by the governor, chaplain, schoolmaster, or trade instructor. This period of almost unbroken solitude, when the mind, thrown in on itself, is supposed to be peculiarly open to lessons of admonition and warning, is one of severely penal character, and its duration has therefore been wisely limited. It is deemed, moreover, that perpetual seclusion in a cell is an artificial state of existence, that its infliction for long terms would altogether unfit an offender for a return to the ordinary conditions of daily life. (2) The second is a longer stage, and endures for the whole or a greater part of the remainder of the sentence—its duration being governed by the power a convict holds in his own hands to earn a remission. It is passed at a public works prison,—either at Borstal, Chatham, Chattenden, Portsmouth, Portland, Dartmoor, or (for the present) Wormwood Scrubs. While cellular separation, except at work, at prayers, or exercise, is strictly maintained, labor is in association under the close and constant supervision of officials. Intercommunication no doubt takes place; men working together in quarry, brickfield, or barrow-run, and out of earshot of their guardians, may and do converse at times. But the work is too arduous to allow of long and desultory conversation; while the chance of mutual contamination is now minimized by the separation of the less hardened from the old offenders in the manner already pointed out. There is no reason to suppose that any great evils result from this association, and without it the execution of the many important national public works which now attest its value would have been impossible. Among these may be mentioned the following: the quarrying of stone for the great Portland breakwater, which is nearly two miles in length, and between 50 and 60 feet deep in the sea, with the defensive works on the Verne, batteries, casemates, and barracks intended to render the island of Portland impregnable, and the enlargement and extension of the dockyards at Chatham and Portsmouth; at the former three grand basins 20, 21, and 28 acres respectively in extent have been completed on the marshy lands and reaches of the Medway, and at the latter extensive operations of the same kind have long been in progress. At Borstal a line of forts intended to protect Chatham on the southern and western side are being erected by convicts; they are also building magazines at Chattenden on the left bank of the Medway; they will soon be at work at Dover on the vast improvements for the enlargement of the harbor and port. Besides this, convict labor has been usefully employed in the erection of prison buildings at new points or in extension of those at the old; at Borstal cells for five hundred, and at Wormwood Scrubs for ten hundred and fifty-two have been built, with chapel, quarters, hospitals, and so forth; large additions have been made to the prisons of Woking, Pentonville, Chatham, Portsmouth, Dartmoor, Parkhurst, and Brixton. In all cases the bricks have been made, the stone quarried and dressed, the timber sawn, the iron cast, forged, and wrought by the prisoners; only one article was bought ready made, and that was the locks. The great merit of this system is the skill acquired in handicrafts by so many otherwise idle and useless hands. Convict mechanics are rarely found ready made. A return dated July, 1882, shows that 82 per cent. of the total number employed at trades had learnt them in prison. These results are no doubt greatly aided by the judicious stimulus given to the highest effort by the mark system. The chief objection to enforced labor has been the difficulty in ensuring this; but the convict nowadays eagerly tries his best, because only thus can he win privileges while in prison and an earlier release from it. Every day's work is gauged, and marks recorded according to its value; upon the total earned depend his passage through the stages or classes which regulate his diet and general treatment, and more especially his interviews and communications with his relations and friends. Yet more; steady willing labor continuously performed will earn a remission of a fourth of the sentence, less the time spent in separate confinement. It must be borne in mind that the marks thus earned may be forfeited at any time by misconduct; but only to this extent does conduct affect remission, and the latter is really directly dependent upon industry. The full remission in a five years' sentence is one year and twenty-three days; in seven years, one year two hundred and seventy-three days; in fourteen, three years one hundred and eighty-one days; in twenty, four years eighty-six days. "Lifers" cannot claim any remission, but their cases are brought forward at the end of twenty years, and then considered on their merits. (3) Having earned his remission, the convict enters upon the third stage of his punishment. He is released, but only conditionally, on license or ticket-of-leave. This permission to be at large may easily be forfeited. Stringent conditions are endorsed upon the license, and well known to every license holder. He has to produce the license when called upon; he must not break the law, nor associate with notoriously bad characters, nor lead an idle dissolute life, without visible means of obtaining an honest livelihood. The observance of these rules is enforced by the police, to whom Acts known as the Prevention of Crimes Acts give large powers. The license holder is ordered to report himself at intervals to the police, to whom also he must notify any change in his place of residence; he must take care that he is not found in any suspicious locality under suspicious circumstances. A breach of the regulations may entail the forfeiture of the license, with imprisonment and the obligation to return to a convict prison to serve out the unexpired term of penal servitude. Police supervision by special sentence of a court may be extended in the case of habitual criminals to longer periods than that of the original sentence. An elaborate machinery also exists for the registration of these habitual criminals, and voluminous official records are regularly published and circulated giving detailed information, distinctive marks, and previous history, to enable the police in all parts of the country to identify habitual criminals. A system so rigorous towards offenders who have already expiated their crimes may be deemed to bear heavily on any who have repented of their evil ways and are anxious to turn over a new leaf. To be ever subjected to the intrusive watchfulness of the myrmidons of the law must often increase the license holder's difficulty of leading an honest life. The struggle is often severe; employers of labor are not too ready to accept the services of "jail birds," and free workmen often resent the admission of an old convict amongst their number. Private charity has happily come forward to diminish or remove this hardship, and many societies have been called into existence for the special purpose of assisting discharged prisoners. The first of these, now honored with the title of "Royal," was organized in 1856, and had assisted, up to 1879, some eleven thousand prisoners. This society labors chiefly in the metropolis; it is supported by private subscriptions, but it has control also over the gratuities of the licensees who accept its aid. The prisoners on release are first examined at the society's office as to their prospects and wishes; they are given some pocket money out of their own gratuities; and their "liberty clothing," a present from the prison, is changed for more suitable clothes. They are then placed in respectable lodging-houses until in due course employment is obtained for them, after which the society undertakes the reporting to the police, and by its own agents exercises a watchful care over its protegés. There are now upwards of twenty societies established in various parts of the country, and the number is rapidly increasing.

The foregoing system is applicable more particularly to adult males; but for females the rules are much the same as regards imprisonment and penal servitude. But the remission a female convict can earn is greater, and amounts to a third of the sentence, less the separate confinement. Moreover, female convicts whose conduct and character warrant a hope of complete amendment are admitted into "refuges" nine months before the date of their conditional release on leave. There are two of these refuges, which are more like "homes" than prisons,—the Westminster Memorial Refuge at Streatham for Protestants, and the East End House, Finchley, for Roman Catholics. The training of these refuges is calculated to fit the licensee for more complete freedom, and many of the women who go from them into the world do well. The aid societies also help effectually in obtaining situations, often very good ones, for the released female convicts.

Juvenile criminals are now subjected to special treatment. Young offenders, although liable to be treated as adults by the court before which they are brought, are generally dealt with summarily under various powers, exercised, in some cases in England and Ireland, with the consent of the accused, or, in the case of a child, of the parent or guardian. The discretionary powers of summary courts are wide, ranging in many cases from dismissal (although the charge is proved) to payment of damages and costs, or fine, or limited imprisonment, and in the case of a male child with private whipping either in addition to or instead of any other punishment; and whipping in addition to other punishment may be imposed by all courts on the trial of male offenders under sixteen for the majority of offences. For the very important power of relegating juvenile offenders to reformatory schools and vagrant and neglected children to industrial schools see the separate article, REFORMATORY AND INDUSTRIAL SCHOOLS (*q.v.*).

Juvenile offenders and children while detained in reformatory or industrial schools are not subject to prison discipline, but the rules for the management and discipline of the schools and the detention in them may be enforced by imprisonment. Very beneficial results as regards the diminution of crimes, are undoubtedly obtained by various institutions, both public and private. The possible criminal is removed from evil associations while still amenable to better influences; and while still malleable he is taught to labor honestly with his hands. Prison statistics, more especially of the convict prisons, show a marked decrease in the number of youthful offenders in durance, and it is reasonable to suppose that from the causes above mentioned there is a gradual stoppage in the supply. In the ten years between 1871 and 1881 the number in custody of ages between fifteen to twenty-four fell from 2948 to 1957, and this although the general population had increased four millions. The same reduction has shown itself as regards the number of the same ages in local prisons; and it is clear that the improvement is general.

Uniformity in prison discipline is now general throughout the United Kingdom. The Prisons Act of 1877 also extended to Scotland and Ireland, and in both those countries the system of imprisonment for terms of two years and under has been assimilated to that in force in England. As regards penal servitude, convicts pass through the same stages or periods; but Scottish convicts, after undergoing their separate confinement in the general prison at Perth, have been drafted into the English public works prisons. Of late there has been a movement towards securing some of the advantages of convict labor for works north of the Tweed, and it is probable that harbor works will soon be undertaken at one or more points on the Scottish coast. For Ireland, the progressive periods are passed in that country—separate confinement in Mountjoy prison, public works at Spike Island. The administration of prisons has also been assimilated in Great Britain and Ireland, and has been centralized in each capital under the authority of the state. Boards of prison commissioners in London, Edinburgh and Dublin, and acting under the immediate orders of the executive, control all local prison affairs, including finance, victualling, clothing, the appointment of officers of all grades, and the discipline of prisoners. The English convicts are still managed by an independent board called the directors of convict prisons, but both commissioners and directors have the same chairman and chief, while the staff of clerks and accountants and storekeepers—in a word, the whole administrative machinery—is identical for both. The welfare of the inmates of all prisons is not, however, left entirely at the discretion of official managers. The local magistracy have still a certain jurisdiction in the local prisons; through elected representatives styled "visiting committees," they constantly inspect the prisons and exercise supervision over their inmates. They have retained their power to punish and generally deal with all cases of aggravated misconduct. The functions exercised by these visiting committees might seem to constitute a dual authority in prison management. But so far the two powers have worked harmoniously and well. Since 1880 unofficial and unpaid visitors have also been appointed to undertake an independent inspection of the convict prisons. This practice was introduced, not on account of any administrative failure in the system, but as a safeguard against possible abuses, and to strengthen public confidence. These visitors can give no orders, but they are empowered to make full inquiries into the state of the prisoners and the condition and discipline of the prison.

The sum voted in 1883–84 for convict establishments in England was £414,463 [$2,014,290.18], but this includes £18,100 [$87,966] for expenditure in colonies where a few imperial convicts still survive, and grants in aid of colonial magistrates, police and jails. The vote for local prisons in the same year was £481,852 [$2,341,800.72]. The returns from male prisoners' labor in the convict prisons in 1883–84 amounted to £248,995, 11s. 3d. [$1,210,118.43]. Of this total, £121,956, 5s. 2d. [$592,707.42] represented the estimated value, by measurement, of labor on public works, and £42,159, 8s. 4d. [$204,894.76] more the value of prison buildings erected, while the earnings in manufactures amounted to £37,581, 8s. 8d. [$182,645.76]. The balance was the farm and the work performed for the prisons. The female convicts' labor amounted in the same year to £9,933, 9s. 5d. [$48,276.67], half of which was in washing and manufactures. In the local prisons in England manufactures brought in £39,790, 3s. 11d. [$193,380.35]. The value of the labor on prison buildings was £24,510, 4s. 2d. [$119,119.61], and that in the service of the prisons £59,562, 0s. 8d. [$289,471.48]. The prison vote in Scotland for 1883–84 was £110,170 [$535,426.20], the returns from earnings £6000 [$29,160]; in Ireland the vote was £145,689 [$708,048.54] and the earnings £4000 [$19,440]. The above terms of expenditure include all outlay—staff (superior and subordinate) maintenance, travelling expenses, etc.

Most civilized nations have considered the question of prison discipline from time to time, and have endeavored, but with varying degrees of earnestness, to conform to accepted modern ideas as to the proper method of dealing with criminals. The subject has also been dealt with at two international congresses, one of which assembled in London in 1872, and the other at Stockholm in 1878, when views were exchanged and matters of much interest discussed. It is proposed now to supplement the foregoing account of British prison discipline by a brief survey of the prison systems in force in the British dependencies and in various other countries.

British Colonies and India.—The prison systems of most of the British colonies have been assimilated as far as possible to that in force in the mother country. In all the larger colonies there are convict prisons and local prisons, and in all cellular separation for the whole or part of the sentence is the rule. This is the case in the Australian colonies, in Tasmania and in New Zealand.

The prison system of Canada is advanced and enlightened. The numbers incarcerated are not great, and crime is not very prevalent. Six establishments suffice for the Dominion—Kingston, St. Vincent de Paul (for the province of Quebec), Halifax, Manitoba, British Columbia and Dorchester. The last-named has replaced that at St. John's. All these are cellular prisons; and they receive prisoners of all categories, for trial and after sentence whatever the term. Females have a special quarter in each prison. Isolation is strictly carried out for all short sentences; but for the longer labor is in association. A great deal of good work is turned out in the Canadian prisons. All the rolling stock for railways in Government hands, iron-work, clothing and boots and shoes are produced at the various prisons, but not to an extent to allow all prisoners to be instructed in trades. Most of the prisons possess land in their vicinity which is tilled by the prisoners. There are no prisoners' aid societies as yet in Canada, although their formation has been earnestly recommended.

For the Cape of Good Hope there is a good prison at Cape Town. In Ceylon, since 1867, cellular separation has been enforced for the whole period of short sentences, and the first six months of long sentences. In Jamaica there are several kinds of prisons, but only the principal, the general penitentiary, has any number of separate sleeping cells.

In India the jails number upwards of 230, with an indefinite number of small lock-ups. There is also the large convict depôt at Port Blair in the Andaman Islands. Very few of the Indian jails are entirely cellular; two in particular may be mentioned, that of Utakamand and that of Hazaribagh, both of which are for European convicts. "The remainder," says Dr. Mouatt, formerly inspector general of prisons in Bengal, "are built on every conceivable plan; a large number of them are miserable mud structures, which are constantly being washed away by heavy rain, and as constantly provide work for the prisoners in repairing them." A few of them are radiating, and nearly all provide for the separation by night of the male and female prisoners; and there is a certain rough classification according to sentence. All work is in association, except when prisoners are kept in cells for misconduct. The proportion of cell accommodation, when Dr. Mouatt wrote, was barely 10 per cent. Work is mostly intramural, and generally remunerative and industrial. Prisoners are occasionally employed out of doors in gangs upon canals and other public works. The ironing of prisoners where prisons are insecure still prevails as a safeguard against escape. Prison punishments are generally severe, and include flogging, fetters, penal labor, and complete isolation. The whole question of prison discipline in India is strictly subordinated to financial considerations, and the system in consequence lacks uniformity and completeness.

Austria.—It was not until 1867 that the Austrian Government declared in favor of a system of cellular imprisonment. Till then all prisoners had been kept in association, but at the date above mentioned a recommendation that separation should be the rule was made to the Reichsrath and approved. Owing to the expense of reconstructing or converting prisons, the principle could not be generally adopted; moreover. the Austrian authorities were not in favor of continuous isolation. Hence the practice adopted was a combination of the two methods. Short imprisonments might be endured entirely in separate cells; every prisoner might pass the first part of a long term in a cell, but the isolation was not to exceed eight months, the remainder of the sentence to be undergone in association or collectively, due regard being had to the classification of the prisoners brought together. This classification is based upon the individual's age, education, state of mind, and former life, and the nature of his crime. The progress made in the erection of cellular prisons has not been very rapid. Although the total number of prisoners in Austria-Hungary exceeds 17,000, up to the end of 1879 only 1050 cells had been provided, viz., at Gratz 252, at Stein 348, at Pilsen 387, and at Karthaus 63, while two small prisons for trial prisoners have also been built at Cilli and Reichenberg. These new prisons are, however, very complete and perfect; they have all modern appliances, chapels, hospitals, workshops, and baths; the cells are spacious, and well ventilated, lighted, and warmed. Two days of cellular imprisonment, after three months have elapsed, count as three in association. There is no distinctly penal labor. In separation prisoners follow such trades as shoemaking, tailoring, weaving, button-making, wood-carving; women are employed in embroidery, spinning, quill-pen making, and knitting. In association the principal employments are carpentering, coopering, smith's work, brick-making; and a number of the more trustworthy prisoners have helped to construct railways and lay down roads. As a rule the prisoners' labor is let out to contractors; this plan is preferred as relieving the state of all risks, while officials are more at liberty to attend to the pure disciplinary treatment of the prisoners. As a rule every prisoner who enters ignorant of a trade is taught one in prison. Prisoners can earn substantial wages; where contractors are employed, the prisoners receive half what is paid over, after all costs have been deducted. Half of the earnings may be spent in the prison canteen in the purchase of luxuries, including beer and tobacco, or in the support of a prisoner's family, or in the purchase of clothing to be worn on discharge. There is only one "Liberated Prisoner Aid Society," which is established at Vienna, and which does good service in supporting prisoners until they find occupation, and providing them with money, clothes and tools. Speaking generally, there are three classes of prisons in Austria-Hungary, viz., for minor offences, and for prisoners sentenced to terms less than one year and to terms of one year and upwards respectively. The treatment of the incarcerated is humane: their diet is sufficient; they have good beds and bedding; the sick are cared for in hospitals; the labor of the able-bodied is not excessive, although supposed to extend over ten hours daily. Religious services are provided for, and non-Roman-Catholic prisoners may be seen by ministers of their own form of faith. Prison administration is under the minister of justice, who delegates his powers to an inspector general of prisons. Commissions of inspection are appointed to visit all the cellular prisons monthly, and there are also local boards of management and control.

Belgium.—Prison discipline has perhaps received as close attention in Belgium as anywhere in the world. In 1835, when the great movement towards prison reform was in progress, Belgium first adopted the cellular system experimentally by constructing thirty-two cells in connection with the old prison at Ghent. After a trial of nine years a verdict was passed in favor of cellular separation and it was authoritatively adopted in 1844. Progress was steady if not rapid; by degrees many cellular prisons were built; and up to the present date (1885) twenty-four are in existence. A model prison for 600 on the same plan is in process of construction at Brussels, and three others, smaller, will soon be finished. Belgium has unhesitatingly accepted the rule of absolute separation as regards all prisoners, whatever the duration of their sentences. That solitude which disastrous results in England have strictly limited to either nine months, or, under certain modifications, to two years, may be enforced in Belgian prisons for at least ten years. At the end of that period a prisoner may claim to go into association, and they are then removed to Ghent, where they work and eat in company but have separate sleeping cells. Separation, again, is not insisted upon with the sickly, or those whose minds appear weak; while all upon whom cellular imprisonment has failed may also in due course be removed to association. But for the rest the separate system is the invariable rule, and it is carried out with careful and unvarying sternness. The prisoner never leaves his cell save for chapel or exercise; at the former he is in a separate box or compartment; the latter he takes alone in a narrow yard. His life, however, is not one of absolute solitude. He is visited frequently by his warders and schoolmasters and trade instructors; chaplain, governor, and doctor also break the monotony of his life. According to the Belgian view of the case, he "lives in association with the prison staff," not with his fellow criminals. It is claimed for this system, which aims primarily at the reformation of individuals, that no evil consequences have as yet been seen to follow from the treatment. Official statistics may be searched in vain for the record of cases of suicide or of mental alienation; neither are abnormally frequent. On the other hand the Belgian authorities insist that the dread of the punishment has had a marked effect upon crime, and that there is a diminution in the number of second sentences. "Recidivists," or reconvicted prisoners, are, moreover, subjected to a more rigorous discipline.

There are three classes of prisons in Belgium;—the *maisons d'arrêt*, or prisons of detention, for accused persons undergoing examination or awaiting trial; the *maisons de sûreté*, or prisons for the infliction of short sentences; and the *maison centrales*, which correspond to the English convict prisons. Prisoners awaiting trial, and still innocent in the eyes of the law, are treated with much leniency and consideration. An arrangement peculiar to the French and Belgian prisons is the privilege of the "pistole." A prisoner on payment of a certain charge is conceded better accommodation; he has a room, not a cell, decently furnished, and may provide his own food, have books, see his friends, and do no work. Offenders of the better class, and never previously convicted, are sometimes relegated specially to the pistole by the tribunals; and the local boards of visitors have also power to transfer prisoners to this privileged class. Independent of the pistole the law provides three kinds of penalty—correctional imprisonment, seclusion, and imprisonment with hard labor. But, except the slight differences as regards privileges of letters and visits, the treatment is identical in all three categories. It is correctional for all; all prisoners are kept in seclusion; and there is no hard labor, as we understand it. Purely penal labor does not exist in the Belgian prisons. Public works are obviously impossible; and there are no tread-mills or cranks. The labor is entirely industrial; but its object is rather to reform individuals than to produce profit to the state. With strict cellular confinement the range of prison industries is generally limited to sedentary employment; but, besides, weaving, tailoring, shoemaking, book-binding, and so forth, various handicrafts are practiced. The prisoner's labor is partly let out to contractors, partly utilized by the authorities. A portion of the earnings for work done goes to the prisoners; and part of the money may be spent in the purchase of better food or tobacco, where it is permitted, from the canteen. No pains are spared to instruct the prisoners; those ignorant of any trade are regularly apprenticed and taught, the idea being to provide every one with a means of livelihood on release. The severity, not to say cruelty, of the strict rule of separation is mitigated as far as possible by the paternal solicitude of the authorities. The administrative arrangements of the Belgian prisons are nearly perfect. The buildings are spacious—the halls lofty, light, and airy; the cells are of ample dimensions, carefully ventilated, well-lighted, and well-warmed. An abundant water supply assists the sanitary services; dietaries are sufficient and well-chosen, soup with plenty of vegetables forming an especial feature in them. School instruction is available for all. There are well-supplied libraries. The hospitals are clean and spacious, fitted with every necessary, and the percentage of patients under treatment is usually small. An epidemic of ophthalmia was, however long present in the reformatory prison of St. Hubert. An independent system of visitation is supposed to protect the prisoners from ill usage; local boards composed of local functionaries exercise constant supervision and control over the prisons in their vicinity. The central administration is intelligent; and the prison service being esteemed highly honourable attracts good men to recruit its ranks. Female prisons are exclusively managed by the nuns of some religious order in the locality. Besides the prisons of punishment for adults, there are two establishments in Belgium which deal exclusively with juvenile crime. These are at St. Hubert in Luxemburg, and at Namur. The first dating from 1840, is an agricultural colony which receives all youths up to the age of fourteen; the labor is exclusively in the fields. Young criminals belonging to the towns are sent to Namur, where the work is mechanical but more sedentary. A good education both moral and practical is received at these reformatories, which are more like schools than prisons. There are also philanthropic schools for vagrants and non-criminal children. At present no societies labor to assist prisoners on release. A complete organization once existed for the purpose, but it was wholly official, and those whom it was supposed to benefit suspected and kept aloof from it. It may be added that, although there is no power in the prisoners' own hands of working out remission by steady industry and good conduct, sentences may be abbreviated on these grounds on the recommendation of the prison authorities. All sentences, too, have been shortened since the general introduction of cellular imprisonment; as the treatment was more severe, justice demanded a curtailment of the penalties. Capital punishment, although not definitely abolished, is never inflicted, and all sentenced to death pass into prison for life. But after ten years they too are transferred to Ghent for the remainder of their days.

Brazil.—The present emperor of Brazil has long taken an active interest in prison reform. He has encouraged the prison administration of his country to introduce a scheme which is in many respects the same as that in force in England. Prisoners, after sentence, are subjected to a period of close cellular confinement enduring eight months; they then pass to another prison, where cellular separation is still enforced, but the daily labor is in association and in silence. This is styled the reformatory stage; after that comes the third stage, which is reached by marks gained through industry and good conduct. In this last stage, called the testing stage, prisoners work together; they may converse, may wear their own clothes, and are under the care and supervision of the most trustworthy of their fellows. They sleep in large dormitories, not in cells, are allowed to cultivate a piece of garden ground on their own account, and a large portion of their earnings is placed to their credit and handed over to them on release.

Denmark.—The prison system in force in Denmark dates from 1840, previous to which time the arrangements were extremely unsatisfactory. In the early part of the century Danish prisons were in as deplorable condition as any in Europe; after enduring indescribable horrors, the worst malefactors passed on to hard labor in the fortresses or in the fleets. But a commission was appointed in 1840 to report, and recommended the adoption of the cellular system for all prisoners awaiting trial, and under short term sentences —those condemned to long imprisonment to be put to hard labor in association. The necessary prisons were constructed at a cost, within a quarter of a century, of two millions of pounds. There are a large number of small detention prisons, and four principal prisons for the convicted; one cellular for males at Vridsloesville, and two associated at Horsens and Viborg, one for females combined cellular and associated at Christianshavn. About 75 per cent. of the whole are sentenced to separative confinement in cells; its infliction is limited to first offenders, youths, or those sentenced to six months and upwards to three years and a half; the associated or aggregate system applies to the reconvicted, and for terms from two years to life. There is no distinctly penal labor in the prisons; the industrial prevails, and is in the hands of contractors. Prisoners in cells are constantly visited; religious and secular instruction is imparted; the dietaries are carefully calculated and the régime generally intelligent and humane.

A number of aid societies have been established at the seat of the large prisons, which assist prisoners on release who have been diligent and well conducted in confinement. Work is found, tools and subsistence given, as in England. It is interesting to note that the first aid society was formed at Copenhagen in 1841, through the exertions of Mrs. Fry. Besides the regular prisons, there are three reformatories for juveniles modelled on the French school at Mettray; they have been founded by private benevolence, but receive aid from the state. Agriculture is the principal employment of the inmates.

France.—Prisons and their management have not attracted close or continuous attention in France. Dynastic changes, wars, revolutions, and intestinal troubles may be pleaded as the excuse. A system based on the principle of individual separation as practiced in the United States was on the point of being adopted in France when the legislation to secure it was interrupted by the revolution of 1848. Under the empire the question was generally subordinated to more pressing political needs. Cellular imprisonment was, however, adopted partially, but only to a limited extent, for persons awaiting trial. Central prisons in which the prisoners lived and worked in association had been established early in the century, and their use was extended. They received all sentenced to the shorter terms. The long-term convicts went to the *bagnes*, the great convict prisons at the arsenals of Rochefort, Brest, and Toulon; and in 1851, a few years after it had been abandoned by England transportation to penal colonies was adopted by France. In 1869 Napoleon III. appointed a commission to inquire and report upon the whole question, but its labors were rudely interrupted by the Franco-German War. Three years later a fresh commission, appointed by the national assembly to discuss parliamentary reform made a most exhaustive report in 1874. It unhesitatingly recommended cellular confinement, and the principle became law the following year. This system of prison discipline then became applicable to all persons awaiting trial, to those sentenced to any term up to a year and a day, and to those for longer terms provided they asked to be kept separate and apart. It was calculated by the commission first mentioned that there were nearly eight thousand cells already in existence and available, but an additional twenty-one thousand would have to be constructed at an outlay of sixty-three millions of francs [$11,466,000] in order to meet the demands of this new system. A model cell was designed and plans for model prisons, but the expense the change would entail appears to have deterred French authorities, both the central executive and the *conseils généraux*, from promptly making it. There are not more than ten or a dozen cellular prisons in France, and two of them are in Paris—Mazas (for trial prisoners) and La Santé, but the latter is not entirely cellular. The construction of others has been contemplated, but in few cases proceeded with, and many years will probably elapse before any uniformity in penal treatment is established in France.

Prison administration is complex in France, and there are many kinds of prisons—a few of them being under the authority of the minister of the interior: (1) the *maison d'arrêt*, temporary places of durance in every arrondissement for persons charged with offences, and those sentenced to more than a year's imprisonment who are awaiting transfer to a *maison centrale;* (2) the *maison de justice*, often part and parcel of the former, but only existing in the assize court towns for the safe custody of those tried or condemned at the assizes; (3) the depôt situated on the island of Ré, for all sentenced to *travaux forcés* awaiting deportation to New Caledonia (Arabs so sentenced wait at Avignon their removal to French Guiana); (4) departmental prisons or houses of correction, for summary convictions, or those sentenced to less than a year, or, if provided with sufficient cells, those amenable to separate confinement; (5) the *maisons centrales*, or central prisons, for all sentenced to more than a year, or for men and women above sixty sentenced to *travaux forcés;* (6) *maison de force*, for women sentenced to *travaux forcés*, or both sexes condemned to seclusion; (7) prisons for those sentenced to simple detention; (8) penal settlements in Corsica, more particularly at Chiavari, Casabianca, and Castelluccio, the régime of which is the same as in the *maisons centrales;* (9) reformatory establishments for juvenile offenders; and (10) *depôts de sûreté*, for prisoners, who are travelling, at places where there are no other prisons. The total number of prisons of all classes in France, exclusive of the last, exceeds 500, and the prison population averages 50,000 daily. Besides the foregoing there are a certain number of military prisons under the war minister seated at the great garrison towns, or in Algeria; and at all the seaports there are maritime prisons for soldiers or sailors who have broken laws civil or military. The latter are under the minister of marine, who also has special charge of the penal settlements at a distance from France, including French Guiana and New Caledonia, where there are several prisons and hulks adapted for the confinement of convicts. The disciplinary treatment of all prisoners in separate confinement is much the same in France as elsewhere; the isolation while it lasts is complete and is broken only by the frequent visits of officials. The exercise is solitary, and at chapel the same rule obtains by each prisoner occupying a separate box, or by having service in the centre of the prison, to which all the cell doors, slightly opened, converge. It may be stated here that religious tolerance prevails everywhere; and prisonors not Roman Catholics may receive the ministration of clergymen of their own creed. Female prisons are mostly managed by nuns or members of the female religious orders. There is one at Doullens especially kept for Protestant female prisoners, and managed by a Protestant sisterhood. The evils of association in the congregate prisons are diminished by classification, so far as it goes. But prisoners are at least kept in categories; trial prisoners are together; those for a year are kept apart from the summary convictions, and convicts *en route* for the island of Ré from all the rest. Males and females occupy different prisons. As almost all prisons have at least a few separate cells, these are utilized either for the recidivists and those of worst character, or for any well-disposed prisoners who exhibit a real desire to amend. The diet, although coarse, is liberal. It may be supplemented by purchase made from the canteen, at which both wine and tobacco may be obtained by all who can pay for it. Each person may thus spend a certain proportion of his earnings or *pécule*, the rest being reserved for his discharge. What remains of the product of the prisoner's labor is handed over to the contractor, who also receives a grant per prisoner from the state. Labor is only obligatory upon those so sentenced; it is purely industrial; penal labor, such as treadmill or crank, does not exist in French prisons. In the smaller it is not easy to find occupation for the inmates, but in the larger many and various industries are carried on. Among the more ordinary trades the manufacture of "articles de Paris," toys, neat bonbon boxes, hosiery, and cabinet-making produce good financial returns. The labor of the prisoners in Corsican settlements has been usefully directed upon the reclamation of marshy lands, the clearing of forests, and the tilling of the less fertile districts. The agricultural results have been good as regards the cultivation of the orange, olive, and vine; mulberry trees have been planted for the silk-worm; and the wheat fields have returned rich harvests of grain, much esteemed in Italy and the south of France. Good roads and many canals have been made, to open up the interior. These Corsican prisons have long suffered from the unhealthiness of their neighborhood but the draining of the marshes, the development of irrigation and the plantation of trees have all combined to improve their sanitary conditions.

The efforts made in France, more particularly by private benevolence, to cope with juvenile delinquency have been very praiseworthy. French reformatories are of two classes—those that are punitive or correctional, and those that are simply reformatory. To the first, where the discipline is severe, are sent all youths convicted of offences committed with full knowledge of their criminality, and those relegated from the reformatories as insubordinate; to the second, children proved guilty but not responsible for their acts, or the ill-conducted whose parents cannot manage them. The first-named are public institutions maintained by the state; the latter are private, and may be supported entirely by subscriptions. There are in all thirty-eight of the former, as well as five penal colonies, and five juvenile quarters attached to various departmental prisons; of the latter there are twenty-eight. All these are for males. For females there are twenty-three private establishments and one public. The most important of the public reformatories for boys is that of La Petite Roquette in Paris, immediately opposite the convict prison of the same name, in front of which executions are carried out. Of the private institutions that of Mettray near Tours, started by the benevolent enterprise of M. de Metz, has a world-wide reputation. A very successful female reformatory is that of Darnétal near Rouen, where the women are employed in farming and field operations.

As regards the most heinous offenders, France not only clings to deportation, but is disposed to enlarge and multiply her penal settlements. In 1884 the Government had under consideration the necessity for sending out all "recidivists" to the Polynesian islands. This, however, has been hindered for the moment by the energetic protest of the Australian colonies, and, instead of the number sent to New Caledonia being increased, French Guiana will probably be more largely utilized. In the former islands most of the evils which attended the early days of transportation to Australia have been apparent. The French convicts either remain in the hands of the Government incarcerated in badly constructed prisons, where discipline and supervision are unsatisfactory or incomplete, or they pass into a state of semi-freedom to work for free settlers on their own account. There are not enough of the latter to afford much employment, and the conditions of the soil of New Caledonia are not such as to encourage the convicts to work for themselves. It is extremely improbable that the penal settlement will ever grow into a prosperous self-supporting colony, and thus the chief end of deportation remains unachieved. At present the French penal settlements beyond sea are merely badly-built indifferently-managed prisons at a long distance from home.

Germany.—There is a similarity in the prison discipline of the various units of the German empire. In the grand-duchy of *Baden* there are four kinds of prisons—district prisons, fortresses, houses of correction, and central prisons. The punishment in the two first named is simply detention or privation of liberty,—the district prisons being for persons under examination and waiting trial, or those sentenced to less than six weeks' imprisonment. Sentences above that time are endured in the central prisons. The principle of cellular imprisonment is the general rule, but it is not extended, unless at a prisoner's wish, beyond three years. For youths between twelve and eighteen the limit is six months. Prisoners unfit for solitary confinement and those who have endured three years' detention are kept together, but they are not associated during working hours. Both systems are supposed to be attended with good results in Baden. Both have their merits, but popular feeling inclines most to the cellular plan as conducing to reform while it keeps the prisoners from mutual contamination. The chief cellular prison is at Bruchsal, where there is accommodation for five hundred, but there are a certain number of separate cells attached to many other prisons. The labor in the prisons is industrial as opposed to penal; contractors are not encouraged; and in most prisons the administration itself keeps the employment of the prison in its own hands. Forty per cent. of the prisoners on admission are ignorant of any trade, but they do not leave prison without learning one. Prisoners' aid societies exist in twenty-nine out of fifty-nine districts, and they achieve good results, although their aid is not too frequently invoked.

The bulk of the prisons in *Bavaria*, mostly converted castles and convents, are on the collective system, but there are four cellular prisons—one at Nuremberg, and three other district prisons for those awaiting trial. The prisons are much the same as in Baden. There are police prisons for first arrests; district prisons mentioned above, which also take short sentences; prisons for three months' sentences and upwards, and for juveniles; and houses of correction. There are also special prisons set apart for persons convicted of theft, fraud, robbery, receiving, whose sentences exceed three months; and a system of classification exists which separates all likely by their previous character to exercise a baneful influence on their fellows. For the long-term prisoners the labor may be upon public works beyond the walls of the jail, and prisoners may demand to be so employed, or in work for which they are fit. Industry and good conduct will secure a remission of sentence. After three months of the sentence have been served there is no purely penal labor. Industrial labor is conducted by the prison authorities, who are not in favor of the employment of contractors, which is thought to jeopardize discipline. Secular education is not overlooked; there are hospitals, chapels, libraries, and the administration generally is humane. There are numerous societies to assist discharged prisoners, which, however, are said to be much hampered in action by the ignorance and prejudice of the public. One at Munich has nevertheless done great good.

There are but few prisons in *Prussia* in which isolation is exclusively carried out. But in forty-six cellular and associated imprisonment exist side by side; the total number of cells is, however, small when compared with the total population in prison. The advantage of introducing the system of "progressive stages," of passing from strict separation to labor in association, is anxiously discussed, but nothing yet has been done. Prussian prisons may be classed as—(1) those exclusively for hard labor, (2) those for imprisonment and simple detention, and (3) those of a mixed character. Hard-labor sentences may be for any term from one year to life; the labor is compulsory, without restriction, both inside and beyond the walls. The maximum of simple imprisonment or detention is for five years, during which time a prisoner is not compelled to work except in accordance with his capacity and the position he occupied in social life; nor need he work outside the prison against his will. Imprisonment in a fortress, which may be for life and the minimum of which is for one day, means simple deprivation of liberty. There is also a detention on summary conviction for vagrants and beggars limited to six weeks. These may be made to work inside or outside the prison. There is no penal labor; but much variety and enterprise exist as regards the prison industrial employments, which, in addition to the ordinary kinds, include feather-scraping, leather-dressing, turning, carving, illuminating, etc. The males also farm; the women make gloves, cigars, and tapestry, embroider, knit, weave, and spin. The work is carried on through contractors, who pay a certain sum on the amount produced. A portion of their earnings goes to the prisoners,—half of it to be expended in buying extra food, half accumulated against release. To reduce evils of association it is ordered that first sentences shall be separated from hardened offenders, but this classification is not always possible; juvenile prisoners are, however, kept apart in cells. Release, provisionally, may take place after three-fourths of the sentence has been endured with good conduct, but the license to be abroad may be revoked for a breach of law. There are many prisoners' aid societies, the best being in Rhenish Prussia and Westphalia, but the results obtained have not been very satisfactory. Employers and free workmen will not receive liberated prisoners freely, and the aid societies would effect more if they were more centralized and worked more together. Prussian prisons are on the whole well organized; the discipline is severe yet just; order reigns everywhere; secular instruction and religious ministrations are ample, and the employment of prisoners according to their capacities is carefully attended to. But many of the prisons require rebuilding or reconstruction; isolation at night should be the universal rule; and more cells are needed to ensure the separation of the trial prisoners and short sentences. Administrative centralization is much needed in Prussia.

Prison discipline has attracted close attention in the kingdom of *Saxony* since 1850, when the penitentiary at Zwickau was first opened and conducted with satisfactory results. In 1854 it was decreed that all Saxon prisons should follow the same system, which is that of treatment either solitary or associated according to individual wants; neither rule obtains exclusively, and the prisons have facilities for both. Work, education, and diet are supposed to be carefully allotted to prisoners. The prisons follow the usual classification of German prisons; there are those for severe punishment, two in number, three for less severe punishment, and two for the older offenders. Besides these there are the fortresses and the prisons of detention. The labor is purely industrial, not penal; Saxony is a very industrial country, and its prisons produce nearly every article of manufacture. Work is carried out in them partly by contractors and partly by the authorities. In the five reformatories agriculture is the principal occupation. A graduated system of remission of sentences is in force, dependent on industry and conduct.

In *Würtemberg* the cellular system was adopted for women in 1865, and a prison on that plan erected at Heilbronn, which has since been utilized exclusively for men. The bulk of the Würtemberg prisons are, however, still on the collective system; but at all prisons there are places for the isolated detention of a certain number of prisoners. The classification of prisons is much the same as in other parts of the German empire under the penal code of the empire. There is no distinction between penal and industrial labor; the latter is of the varied character followed in other German prisons, and is partly in the hands of contractors, partly in that of the administration. An aid society has existed in Würtemberg since 1831, and it has numerous ramifications through the country. It does good service in obtaining work, providing tools, and assisting emigration.

Italy.—There is a want of uniformity in the prison system of the Italian kingdom, which is not strange, having regard to the recent unification of the country. The various units which were till recently independent of each other had each its own views. Many varieties of prison discipline, therefore, still remain in force. There are some prisons in which complete isolation is the rule, others where the labor is associated with cellular separation at night. But the largest number are on the collective system. All new prisons of detention are built on the principle of isolation, and this rule is as far as possible strictly observed for all prisoners awaiting trial. This period of detention may be spent in a provincial (*carcere centrale*), district (*circondarale*), or communal (*mandamentale*) jail. Sentences are carried out according to their character in different prisons. There are prisons for those condemned to simple confinement and detention; others for "relegates;" others again for reclusion accompanied with hard labor; and twenty are *bagnios* or hard-labor prisons for those sentenced for long periods (up to life), to undergo the punishment of the *ergastolo* or *galera*. The discipline is progressive. In the ordinary prisons a gradual amelioration of condition may be secured by good conduct; in the bagnios, besides the exemption from fetters, convicts may gain the privilege of completing the last half of their sentences in one or other of the agricultural colonies. These have been established in various islands of the Tuscan archipelago, as at Pianosa and Gorgona; and an intermediate prison has been established on the island of Capraia for well-conducted prisoners in a last stage of semi-liberty. Associated convict labor has produced good results in Italy. By it all necessary prison buildings have been erected at the penal colonies and at various points on the mainland; it has also been applied to agriculture, the reclamation of land, the construction of storehouses, docks, salt works, and on the improvement of various ports. In the prisons or penitentiaries the labor is industrial, and follows the usual lines. Contractors have generally the control of this labor, receiving the results after deductions for prisoners' earnings to be spent in the usual way and with the obligation to teach trades. On the latter condition contractors are granted the exclusive right to the labor of juveniles in houses of correction; and there are a number of reformatory schools, mostly on a charitable basis, into which are drafted all juveniles, vagrants, and idlers sentenced to compulsory detention.

Mexico.—In Mexico the rule of constant separation for all prisoners has been accepted, but not yet carried out entirely. The old prisons were on the associated system; but new cellular prisons have recently been built, or are in process of construction at Jalisco, Durango, Puebla, and Mexico. These will receive trial prisoners and those sentenced. There is an "hospicio de pobres" for young children; also a special reformatory establishment for children between nine and eighteen. Political offenders are kept apart from ordinary offenders. All convicted prisoners may earn conditional release on completion of half their whole sentence. This form of release is called preparatory liberty, and for a short time preceding it they are allowed to leave the jails to run errands or seek work. The labor in Mexican prisons is industrial, not penal, and in theory at least the advantages of learning a trade in prison are fully understood. Contracts for prison labor are forbidden. A portion of the proceeds goes to the prisoners, and may be spent in purchasing food or furniture or articles of comfort. There are "protective boards" who visit and seek to improve the prisoners, and independent philanthropists are also admitted. Prisoners on release go to the protective boards, who assist in obtaining them an honest livelihood.

The Netherlands.—Here the treatment a condemned prisoner undergoes depends mainly upon the sentence awarded. The judge at his discretion may direct the imprisonment to be on the solitary or the associated system. This power as regards the first is, however, limited to half the whole term of sentence, and in 1851 it could only be applied to sentences of one year; this was extended in 1864 to two years, and in 1871 to four years,—so that now the maximum of cellular imprisonment to be inflicted is actually limited to two years. There are several prisons on the cellular plan; but in most the two kinds of imprisonment exist side by side. There are four classes of prisons: (1) the central prisons for persons sentenced to eighteen months and upwards; (2) detention prisons for less than eighteen months; (3) prisons of arrest for those sentenced to three months or less; and (4) police or central prisons for those condemned to one month and under. In the three last named are also kept prisoners awaiting trial. As regards classification nothing more is attempted where association is the rule than the separation of the most hardened and previously convicted offenders from other prisoners. Imprisonment is either simple detention or accompanied by hard labor. The latter is industrial only, never penal, and embraces a great variety of handicrafts, most of which are carried out under contractors. But work is also done on account of the state, with the advantage that it is not subject to the fluctuations of supply and demand. All prisoners, except those for short terms, are, if possible, taught a trade. The earnings go in part to the prisoners, to be expended by them in the usual way. Remissions of sentence not exceeding six months may be accorded to all originally condemned to not less than three years, and who have undergone at least half. There is a society for the moral amelioration of prisoners in the Netherlands, which has numerous ramifications, and is devoted to prison visiting and the welfare of prisoners generally. This extends to efforts to obtain employment for them on release, which are praiseworthy, and on the whole eminently successful.

Norway.—Prisons in Norway may be divided into two principal classes, the *Strafarbeidesanstalter*, or penal institutions where prisoners are compelled to labor, and the district prisons established in 1857 for detention and simple imprisonment. (1) The first may be further subdivided into fortress prisons, houses of correction, and the cellular prison or penitentiary of Christiania. This last takes the first convicted for short terms between the ages of eighteen and thirty, the fortresses the longer sentences, and the houses of correction the intermediate terms. All these prisons except that of Christiania are on the associated system, with no attempt at classification beyond the separation of the worst from the least corrupt in workshops or dormitories. The hours of labor are long—fourteen in summer and ten in winter. The labor, conducted solely by the authorities, is industrial; at Christiania cloth manufacture is a principal trade, at Akershuus it is stonecutting. Most prisoners learn a trade if they are ignorant of one on reception. No portion of the proceeds of their labor goes to the prisoners. There is no regular system of granting remissions. All the penal institutions have chaplains, schools, libraries, and hospitals. Released prisoners are, as far as possible, preserved from relapse by the care taken to provide them with work when free. There are a few aid societies, but their operations are somewhat circumscribed from want of means. (2) The district prisons, fifty-six in number, take summary convictions from four to two hundred and forty days. Imprisonment may be endured on bread and water with regulated intervals, or on the jail allowance. Prisoners in these prisons are not compelled to work, but they can have employment if they wish it. These district jails are also used for the detention of all persons apprehended and awaiting trial, and as debtors' prisons. They are mostly on the cellular plan, especially in the cases of those sentenced to solitary confinement on bread and water and those committed for trial.

Portugal is still behindhand as regards its prison administration. The jails are extremely defective in construction; the discipline is lax and the management careless. All prisons are on the associated plan; they stand mostly in the market places of the large towns, with the first-floor windows upon the public thoroughfares, so that the inmates are at liberty to talk and communicate with the passers by, whom they importune constantly for alms. Little less lamentable than the neglect of prison discipline is the practice of indefinitely postponing jail deliveries, with the inevitable consequence of frequent failures of justice. Juries often will not convict, alleging that the accused have been sufficiently punished by long detention awaiting trial.

Russia.—Prison discipline was much discussed in Russia as far back as the commencement of the present century, and in the year 1819 a society, now known as the Imperial Society, was established to watch over the administration of prisons. This society still exists, and is affiliated to the ministry of the interior. Its central committee and the provincial committees working under it select the staff of the prisons, and exercise a general surveillance over them. Various classes of prisons have existed in European Russia. As at present organized they consist of—(1) the fortresses, for grave offenders, especially the political and revolutionary,—in these the discipline is very severe; (2) the military prisons, in which the discipline is not less strict; (3) the house of detention, the ancient *ostrog* or stronghold which every town has always had for the safe keeping of prisoners charged with offences,—in these were detained also prisoners awaiting corporal punishment or deportation to a penal colony; (4) the hard-labor prisons, in which were located the labor parties or correctional corps instituted by the emperor Nicholas, organized and disciplined on a military basis; (5) the amendment prisons or houses of industry established by the empress Catherine. These are all on the associated system, and fall very far short of accepted ideas on prison management. But an entirely new cellular prison has recently been erected in St. Petersburg, which is a model of its kind. It is a house of detention for persons awaiting trial, and contains upwards of a hundred cells. All the internal arrangements of this prison are excellent; but it may be doubted whether the Russian Government will embark upon the expenditure necessary to build others of the class. The emancipation of the serfs in 1867, followed by the substitution of imprisonment for corporal punishment, added enormously to the prison population of Russia. A great increase of prison accommodation became necessary, and a commission was appointed to frame a new penitentiary system. This, as now adopted, although not entirely carried out, consists of two parts—punitive imprisonment for short sentences, and penal probationary detention as a preliminary to banishment to a colony. For the first, central prisons, associated not cellular, are being constructed at various points, and a regulated system of labor will be introduced following the lines of that in force in other European countries. For the second, at the end of the probationary period banishment, or, as it is styled in official language, enforced colonization will be the rule.

Deportation to Siberia began in 1591.[1] It was principally used for political prisoners, insurgents, religious dissenters, and conspirators. Large numbers of Poles were exiled in 1758; others again in 1830, and now, since the Nihilist movement, numbers of these implacable foes to the existing régime are regularly despatched to Siberia. The total number deported varies from 17,000 to 20,000 per annum, but this includes wives and children who may elect to accompany the exiles. The sentences are of two kinds—(1) the loss of all rights and (2) the loss of particular rights. The first includes degradation, the rupture of the marriage tie, inability to sign legal documents, to hold property, or to give a bond. The exile must wear prison dress, and have his head half-shaved. He may be flogged, and if murdered would not be much missed. After a lengthened period of probation in prison the exile becomes a colonist and may work on his own account. Those sentenced to the loss of particular rights are only compelled to live in Siberia, where they may get their living as they can. Many, however, are condemned to spend a portion of their time in confinement but without hard labor. The exiles are sent from all parts of the empire by rail or river to Ekaterinburg, and thence to Tiumen, whence they are distributed through Siberia. Those deprived of partial rights are generally located in western Siberia. Those deprived of all rights go on to eastern Siberia. The latter go by river generally to Tomsk; thence they walk to their ultimate resting place, which may be Irkutsk or Yakutsk or Tchita, or the island of Saghalien, and the journey may occupy months. Not long ago a party of convicts was despatched by sea to the last-named destination, embarking at Odessa and travelling through the Suez Canal and by the Pacific Ocean. There are several hundred prisons in Siberia. They are of three kinds: (1) the *etape*, which afford temporary lodgings for prisoners on the line of march; (2) the *prisylnie*, where the detention is often for several months during the winter or until the ice is broken up; and (3) the *ostrog*, the generic Russian name for a prison, which is the place of durance for all exiles not on their own resources. Few of the large prisons in Siberia were built for the purpose. They are converted buildings—old factories, distilleries, and so forth. They are all upon the associate principle, containing a number of large rooms to accommodate any number from twenty-five to a hundred. The great central prison near Irkutsk, called the Alexandreffsky, one of the most important in Siberia, generally holds from 1600 to 2000 prisoners all under sentence of hard labor, and awaiting transfer to the mines. Dr. Lansdell, who visited this prison in 1879, found the prisoners very short of work. Some were engaged in making cigarette papers, others in shoemaking and brickmaking. The prison is a huge stone-built building, very different from the ordinary run of Siberian prisons, which are usually built of logs caulked with moss to keep out the cold. They are surrounded by a high wooden palisade. Each prison has its hospital, chapel, generally a schoolroom, and a few workshops. The prisoners themselves are not unkindly treated. At most of the stations there are local committees to watch over the welfare of the prisoners. This is an extension of the Imperial Society of St. Petersburg already mentioned. The committees supply books and visit the prisoners. They clothe and educate the prisoners' children, and help their wives to employment. They also augment the prisoners' diet from funds obtained by subscription. The regulation rations of Siberian exiles seem very liberal. The Russian prisoner has nearly twice the amount of solid food that an English prisoner receives, and he is at liberty to add to his diet out of his own means, which the English prisoner is not. The prisoners are also supplied with ample clothing if they have none of their own, those sentenced to deprivation of all rights being obliged to wear convict dress. The discipline of the prisons is now in accordance with European ideas. Prison offences are punished by relegation to a solitary cell, a certain number of which exist at all the prisons. Diminutions of diet are also inflicted, and an obligation to wear irons if they are not already worn. All exiles wear leg-irons for a certain time. These are riveted on to the ankles, and caught by a chain which is carried suspended to a belt round the waist. The irons are worn for various periods from eighteen months to four and even eight years. Very heinous offenders or those who have escaped frequently are chained to a wheelbarrow, which they are obliged to pull about with them wherever they go. A more severe punishment when confinement and irons fail is birching with a rod, for the knout is now abolished. The rod consists of switches so small that three may be passed together into the muzzle of a musket. The punishment is described as not more severe than that inflicted at English public schools. There is another flagellator, however, called the *plete*, a whip of twisted hide, which is still retained at a few of the most distant Siberian prisons and only for the most incorrigible, on whom irons, the birch, and other punishments have had no effect. The costliness of deportation is enormous and the results it obtains doubtful. The slow colonization of this vast territory may follow eventually, but there are already great difficulties in finding employment for the mass of labor in the Government's hands. The mines of gold, silver, and coal are passing into private hands, and there are no other public works. Hence part of the Russian criminals who would have gone to Siberia are detained in the large prisons in Russia, where they are employed in manufactories or in the labors of ordinary mechanics, or any outdoor work such as making bricks, mending roads, and manufacturing salt. Nevertheless recent visitors to Russian prisons, whether in Russia proper or in the heart of Siberia, describe the prisoners as generally idle. The principle of progressive stages by which a prisoner can gain a remission of sentence or milder treatment prevails throughout. The well-conducted persons can earn wages, and may spend the money in buying an increase to their diet. The bulk of the worst convicts gravitate to the island of Saghalien, where the number in 1879 was about 2600. Half of those were kept in prison, half remained comparatively free. The discipline here is very severe. The diet is said to be scanty, and as the island is barren everything has to be imported. Fish, however, is found in large quantities. There are four large prisons at Dui, the principal post on the island, which are insufficiently heated in winter and generally overcrowded. The convicts are chiefly employed in raising coal from mines which are let to a company. Very conflicting evidence is current as regards the Siberian prisons. Prince Kropotkine, an exile, speaking with some authority, denounces them as hotbeds of vice and cruelty. Dr. Lansdell on the other hand, a reputable eyewitness, does not on the whole speak unfavorably of them. He describes them as rough, perhaps; but so are Siberian dwellings. He thinks that as compared with the English convict the Siberian is not badly off. The labor is lighter; he has more privileges: friends may see him oftener and bring him food; and he passes his time neither in the seclusion of a cell nor in unbroken silence, but among his fellows with whom he may lounge, talk, and speak. The Russian convict, however, misses those intellectual, moral, and religious influences which are abundantly showered upon the English. There are no prisoners' aid societies in Siberia, and the convict, after release, when suffered to begin life again on his own account, carries with him always the convict stain and is hindered rather than helped to begin life afresh. Dr. Lansdell sums up his opinion in these words:

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[1] [Dronke says in Pierer's Lexikon, vol: xvi., p. 402, that the first deportation by the Czar was of Samaïlow in 1688, and judicial deportations began in 1753.—AM. ED.]

> "Taken at the worst, condemnation to the mines is not so bad as it seems; and, in the case of peasant exiles willing to work, I cannot but think that many of them have a better chance of doing well in several parts of Siberia than at home in some parts of Russia. There is reason to suppose that reports of the ill-treatment of Russian prisoners have been greatly exaggerated by careless, ill-informed, or malicious writers. No doubt some years ago there were good grounds for serious complaint. It is very evident that now the political prisoner, beyond exile, and temporary confinement in the jail, is not ill-used. He is not always subjected to the ordinary discipline of the criminal convict, nor is he obliged to associate with them. A fabulous story has long been current that the worst criminals were buried alive in quicksilver mines, where they were speedily killed by the unhealthy fumes. There are no quicksilver mines in Siberia, and the principal mines, those of Nertchinsk, are now passing out of Government hands. These are mostly of silver, although other minerals and gems are found in the neighborhood. The hours of labor in the Nertchinsk mines were thirteen, and it was the same at the Kara gold mines. The convicts arrange their hours of work themselves. No definite amount of mineral was required, so they might work hard or not as they pleased. No doubt the lot of convicts in these mines was hard. Besides the laxity of discipline, the herding together of the worst characters and the deprivation of social, intellectual, and religious privileges must have made life a burden to many."

Spain, like Portugal, still lags behind. It is not to the credit of a country in which prison discipline was discussed three centuries ago that now at the close of the 19th its prison system is about the worst in Europe. Till very recently the posts of governors in the jails were sold to the highest bidder, and purchasers were suffered to recoup themselves out of the unfortunate wretches committed to their charge. The principal prison in the capital of the kingdom was nothing more than a converted slaughter-house where pigs were killed and salted, as its name, the Saladero, implied. This dark, dirty noisome den, although generally condemned, continues to serve even now. Numerous efforts to provide a more suitable prison have been made from time to time. The construction of model prisons was decreed as far back as 1847, but in 1860 nothing had been done, and a new project was brought forward. Again in 1869 a fresh scheme replaced the previous ones which were still dead letters. Seven more years elapsed, and in 1876 a new law was passed providing for the construction of a new cellular prison in Madrid with cells for a thousand prisoners. This law too hung fire, and the prison is not yet completed. The bulk of the prison population in Spain is still sent to *presidios*, or convict establishments, where general association both in the prison and at labor is the rule. The principal of these are situated at Carthagena, Valencia, where there are two prisons, Valladolid, Granada, and Burgos. There are also prisons at Alcala, Tarragona, Saragossa, and Santoña. Persons convicted of grave crimes are deported to the Balearic Islands or to the penal settlements in Africa, the principal of which are situated at Ceuta and Melilla. Throughout these establishments there is an utter absence of sanitary regulations; the diet is coarse and meagre; the discipline is brutal; the authorities are quite callous; and morality does not exist. The Spanish authorities, however, claim the credit of having abolished corporal punishment in their prisons.

Sweden.—A great impetus was given to prison reform in Sweden by the interest taken in the question by King Oscar I. in 1840. Following special legislation, thirty-eight new cellular prisons were built in the various provinces of the kingdom. These prisons have been used since for all prisoners awaiting trial, those condemned to reclusion and those sentenced to imprisonment with hard labor for two years and under. Persons sentenced to pay fines, but unable to pay, go to the cellular prisons. The isolation is continuous day and night. Besides these cellular there are a number of associated prisons for terms longer than two years and up to life. The labor in the first-named is of the usual kind—tailoring, shoemaking, and some kinds of carpentry. Trade instructors are specially appointed, so as to provide a prisoner on liberation with some employment. In the associated prisons there is more variety of work: linen and woollen cloths are manufactured, timber split up for matches, granite cut and dressed for buildings and pavements. The female prisoners weave textile fabrics, and make match boxes. A portion of the earnings is granted to prisoners, which, to a limited extent, may be spent in buying extra food. There is no purely penal labor, nor any regulated system of granting remissions for industry or good conduct. Many aid societies were formed about twenty-five years ago, but through want of success or funds their number has dwindled down to two.

Switzerland.—From the complete independence of each canton, each has its own special penal system and places of imprisonment. Hence the systems are various, and are not all equally good. The prisons of Switzerland may be divided into four groups: (1) those of the cantons of Uri, Schwyz, Unterwalden, and Valais, which are still of a patriarchal character; (2) those of Fribourg, Basel (rural), and Lucerne, which are on the associated plan and unsatisfactory from every point of view; (3) those of the cantons of St. Gall, Vaud, Geneva, and Zurich, which have prisons for associated labor and separation at night, while Soleure, Grisons, Bern, and Schaffhausen are laboring to raise their prisons to this level; (4) the penitentiaries of Lenzburg, Basel (urban), Neuchâtel, and Ticino, which are good modern prisons in which the cellular system is completely applied. The system is one of progression, the prisoner passes through several stages of isolation, employment in association, and comparative freedom; but only at Neuchâtel is there separation by day as well as night. The general principle is one of collective imprisonment: but there is an attempt at classification, according to degrees of morality, in the best prisons. Sentences may be either to imprisonment or reclusion with hard labor. The first may be from twenty-four hours to five years; the second from one year to fifteen, twenty, thirty years, or to life. An abbreviation of punishment may under all the cantonal laws be obtained, but such reduction is rarely made according to fixed rules. In most of the cantons prisoners have a share in their own labor. This labor is chiefly industrial, but there is a form of penal labor to be seen where the plan has survived of employing certain prisoners to sweep the streets, make roads or dyke the rivers. Such labor is felt to have a bad moral effect, and industrial labor is preferred. The latter is conducted by the administration itself, and not by contractors. It is thought that the state can introduce a greater variety of employments, and control the prisoner better when at labor than could free employers. Aid societies exist in most of the cantons; the first was established at St. Gall about 1845. Wherever they exist the societies protect prisoners in durance and assist prisoners on release by providing tools and employment with private persons. The only drawback in the Swiss aid societies is the want of organization and uniformity of action.

United States.—There is no uniform prison system in the United States. The variety of jurisdictions following the constant extension of territory and development of communities more or less populous perpetuates changing conditions, and the supreme Government has not concerned itself greatly with prison affairs, and has claimed no supervision or special control. The rule of local self-government has left each jurisdiction to manage its prison according to its own ideas, and hence the utmost diversity of practice still obtains. While some prisons are as good as need be, others are marked with many defects. There is a wide distinction between the best and the worst. In the country which initiated prison reform, numbers of prisons exist nowadays which fall far below the commonest requirements of a good prison system. Taken broadly the prisons of the Union may be classed into—(1) State prisons; (2) district prisons; (3) county prisons; (4) municipal or city prisons. Each State as a rule has its own State prison, but Pennsylvania and Indiana have two and New York three such prisons. The cellular system, or the rule of continuous separation, to which reference has been made already (see p. 772), was at first followed by several States, but gradually abandoned in favor of the so-called silent system, or that of labor in association under the rule of silence, with cellular separation at night. At the present time there is but one prison, the Eastern Penitentiary of Philadelphia, managed on the purely solitary plan. Of the long-sentenced convicts 96 per cent. are now confined in congregate prisons. There are about forty State prisons in all. Of the district prisons intermediate between the State and the county prisons there are but few. The county prisons are by far the most numerous. The county in the United States is the unit of political organization under the State, and, with area and population comparatively limited, is a convenient subdivision for the purposes of the criminal law. Hence it has been asserted that no one knows exactly the number of county prisons in the United States, but it has been computed at upwards of two thousand. The city or municipal prisons are also very numerous and constantly increasing. Each and every one, as in the State prisons, is managed locally by local authorities, with the inevitable result of the utmost diversity in practice, and often enough the utmost neglect of the commonest rules of prison discipline. A self-constituted body inspected a couple of hundred of these jails a few years back, and reported that they were mostly defective from a sanitary point of view, insecure, and so constructed as to compel the promiscuous association of all classes, old and young, the guilty and innocent, the novice and the hardened in crime. The sexes even were not invariably separated. Little or no employment was provided for the prisoners, and in few prisons was any effort made to compass religious or intellectual culture. An eyewitness, Dr. Wines, reporting of other jails of the same class still more recently, unhesitatingly condemned them. "Ohio, to-day," says the Ohio Board of Charity, "supports base seminaries of crime at public expense." "In our jail system lingers more barbarism than in all our other State institutions together." Yet there are a few and conspicuous exceptions to the general verdict of condemnation. The discipline and management of the district prisons at Albany, Detroit, Rochester, and Pittsburgh are excellent. The good example is gradually becoming more and more largely imitated. Where good prisons exist it will be found that their administration remains for some length of time in intelligent hands, free from the "pernicious influence of partisan politics." The chief drawback to improvement is the uncertainty no less than the complexity of the governing bodies. These are apt to be changed capriciously; and, what is worse, they are needlessly intricate and often far too numerous. They act independently, without reference to each other, and they are not too ready to benefit by example and experience. What is wanted is a supreme central authority over all the prisons of a State, if not throughout the Union. Wherever there is the nearest approach to this the results are most satisfactory.

It is not strange that under these conditions discipline should also vary greatly, or, as has been said "every variety of discipline, lack of discipline, or abuse of discipline is found." Neither the deterrent nor the reformatory agencies are properly or uniformly brought to bear. Prison punishments are still severe; although flogging is nominally abolished, it is said to be still practiced in prisons where it is forbidden; and some more ancient methods such as the yoke, the shower bath, and the iron crown have not yet entirely disappeared. There is, however, often good secular and religious instruction. The dietaries are fuller than on the opposite side of the Atlantic, meat is a more common ingredient, and Indian meal is very largely issued. The financial results obtained are not unsatisfactory: many of the State prisons are now self-supporting, and an examination of the labor returns will prove that much enterprise has been displayed in finding employment for the prisoners. There is no purely penal labor, although much of the labor performed is sufficiently severe. There may be no treadwheel or cranks, but convicts in Alabama and Texas have been employed to build railways; they have raised cotton in Mississippi, and have worked mines in Tennessee and New York, while in many States they are utilized in gardening and agriculture. A great deal of labor has been expended on quarrying and dressing stone for building, or for burning into quicklime; at Auburn there is a large manufactory of agricultural tools; Ohio employs saddlers; Massachusetts prisoners make ornamental iron work; in Michigan they tan leather; and at Dannemora, in northern New York, iron ore is quarried, smelted, forged, and wrought into nails by the prisoners. In general the labor is hired by contractors at a fixed sum per day, which varies from a few cents to as much as a dollar. The chief cause for the present inadequacy of the American prisons, over and above the faults in administration already mentioned, is probably the rapidly increased demand on their accommodation in recent years. This is due partly to the growth of population, partly also to the influx of "colored" criminals since the emancipation. In the days of slavery the slave was punished summarily by his master, but now he is arraigned and sent to prison. The result has been that the prisons were suddenly crowded before any new and improved system could be introduced.

While there are but few agencies for the assistance of discharged prisoners, considerable care is devoted in the United States to the treatment and checking of juvenile crime. Reformatories have existed since 1825, when the first was established on Randall's Island within the limits of the city of New York. Others followed; but these did not form part of the penal system of the States till 1847, when the State reform school at Westborough, Massachusetts, was established by law. They soon increased and multiplied, and now between sixteen and twenty are to be found within the principal States. There are also a number of semi-public schools. The average reformatory population is about 15,000. The results are said to be very satisfactory. The percentage of youths reformed and trained into good citizens has been placed as high as 60, 75, even 80 per cent. Parents may in some States contribute to the support of their children in reformatories, but as a rule the inmates are orphans or abandoned children or those whose parents are very poor. The best system for training and caring for juvenile offenders probably is that which obtains in Massachusetts. (A. G.)

PRISREND, **PRISDREN**, **PRISDRA**, **PISDRA**, **PISREN**, or **PISRA**, in Roumelia, the chief town of a sandjak and the seat of a Greek and a Roman Catholic archbishop, in the Turkish vilayet of Kossovo (formerly Monastir), stretches for 2 or 3 miles along the northwestern base of the Scardus or Shar-dagh, and is traversed by the rapid waters of the Resna Mitritza, which, issuing from a deep gorge a little above the town, joins the Drin (White or Albanian Drin) a few miles below. To the north-northwest of Prisrend, which lies at a height of 1577 feet above the sea, a great undulating and fertile plain extends for more than 40 miles towards Ipek. In 1865 the Roman Catholic archbishop estimated the total at 50,000 (8000 Mohammedan families, 3000 Greek, and 150 Latin). It is now about 46,000. There is a castle on the buttress of the Scardus, at the foot of which lies the Christian quarter, with a small brick-built ancient-looking Byzantine church. The old cathedral, now a mosque, is also a Byzantine building. Prisrend, doubtfully identified with Tharendus, was at one time the capital of Servia, and the district is still called Old Servia. At present the town owes much of its importance to its manufacture of arms; and it also produces glass, pottery, and saddlery.

PRIVATEER is an armed vessel belonging to a private owner, the subject of a belligerent power, commissioned by the sovereign of that power. The commission is either a commission of war or of marque and reprisals in time of peace. It was marque in this sense which was granted to aggrieved subjects of the realm of England as early as the statute 4 Hen. V. c. 7. The term "letters of marque," however, is now generally applied less strictly to the commission under which a privateer sails in time of war. The acceptance of a commission from a belligerent power by a neutral, though not piracy by the law of nations, has frequently been made so by treaty.[1] Acceptance of such a commission by a British subject is forbidden by the Foreign Enlistment Act, 1870. A vessel with a commission from each of two powers at war with one another is a pirate by the law of nations. Privateers stand in a position between that of a public ship of war and a merchant vessel. They are not entitled to the full rights which the comity of nations extends to public ships of war; *e.g.*, by the municipal regulations of most nations they may not carry the flag of a public ship of war. A capture made by a privateer may either become the property of the captor or, following the general rule of international law, the property of the state (see **PRIZE**). In Great Britain, in order to encourage privateering, the prize taken by a privateer was formerly divided between the owners and the captors, and the rights of the crown were specially excluded in numerous Prize Acts. But now, by the Naval Prize Act, 1864, a prize made by a privateer belongs to the crown in its office of Admiralty. By the United States Prize Act of 1864, the whole proceeds of a prize made by a privateer go, unless it is otherwise provided in her commission, to the captors. The sum awarded is divided, in the absence of agreement, equally between the owners and the ship's company.

Privateering is now a matter of much less importance than it formerly was, owing to the terms of Art. 1 of the Declaration of Paris, April 16, 1856, "Privateering is and remains abolished." The declaration binds only the powers who are signatories or who afterwards assented, and those only when engaged in war with one another. The United States, Mexico, Uruguay, and Spain have not acceded to it, and thus it would not hold in case of a war between the United States and any other power, whether the latter were bound by the Declaration or not. By the constitution of the United States, Congress has power to grant letters of marque and reprisal. Congress, by an Act of March 3, 1863, authorized the issue of letters of marque by the president, but they were never in fact issued either by the United States or Confederate Government.

In the Franco-Prussian war of 1870, Prussia, in spite of the Declaration of Paris, took a course very little removed from privateering in the creation of a volunteer fleet.

PRIVET (*Ligustrum*), the vernacular name[2] of a genus of *Oleaceæ*. There are several species, all of them shrubs or low trees with evergreen or nearly evergreen opposite entire leaves, and dense cymes of small white tubular four-parted flowers, enclosing two stamens and succeeded by small, globular, usually black berries, each with a single pendulous seed. The best-known species is the common European privet, which makes good hedges in cases where no great powers of resistance to the inroads of cattle, etc., are required. *L. ovalifolium* thrives by the seaside and even in towns, and is thus a valuable all but evergreen shrub. *L. lucidum* is taller and handsomer. There are several other species, mostly natives of China and Japan, some of which when attacked by a species of scale-insect (*Coccus*) yield a waxy substance.

PRIVILEGE, in law, is an immunity or exemption conferred by special grant in derogation of common right. The term is derived from *privilegium*, a law specially passed in favor of or against a particular person. In Roman law the latter sense was the more common; in modern law the word bears only the former sense. Privilege in English law is either *personal* or *real*,—that is to say, it is granted to a person, as a peer, or to a place, as a university. The most important instances at present existing in England are the privilege of parliament (see **PARLIAMENT**), the privilege which protects certain communications from being regarded as libellous (see **LIBEL**), and certain privileges enjoyed by the clergy and others, by which they are to some extent exempt from public duties, such as serving on juries. Privileged copyholds are those held by the custom of the manor and not by the will of the lord. There are certain debts in England, Scotland, and the United States which are said to be privileged, that is, such debts as the executor may pay before all others—for example, funeral expenses or servants' wages. In English law the term "preferred" rather than "privileged" is generally applied to such debts. There are certain deeds and summonses which are privileged in Scotch law, the former because they require less solemnity than ordinary deeds, the latter because the ordinary *induciæ* are shortened in their case (see Watson, *Law Dict.*, *s.v.* "Privilege").

In the United States the term privilege is of considerable political importance. By Art. IV. § 2 of the constitution, "the citizens of each State shall be entitled to all privileges and immunities of citizens in the several States." By Art. XIV. § 1 of the amendments to the constitution (enacted July 28, 1868), "no State shall make or enforce any law which shall abridge the privileges or immunities of citizens of the United States." It will be noticed that Art. IV. applies to citizens of the States, Art. XIV. to citizens of the United States. "The intention of this clause (Art. IV.) was to confer on the citizens of each State, if one may so say, a general citizenship, and to communicate all the privileges and immunities which the citizens of the same State would have been entitled to under the like circumstances" (Story,

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[1] Instances will be found in Phillimore, *International Law*, vol. i. pt. iii. ch. xx.; Twiss, *Law of Nations*, vol. ii. ch. x.

[2] Another form of the name, *primprivet*, *primprint*, or *print*, like *ligustrum* itself, used at one time to be applied to the primrose.

Constitution of the United States, § 1806). The clauses have several times been the subject of judicial decision in the supreme court. Their practical effect may be thus illustrated. With regard to Art. IV., it was held that a State license tax discriminating against commodities the production of other States was void as abridging the privileges and immunities of the citizens of such other States (Ward *v.* State of Maryland, 12 Wallace's *Reports*, 418). With regard to Art. XIV. 1, it was held that its main purpose was to protect from the hostile legislation of the States the privileges and immunities of citizens of the United States, looking more especially to the then recent admission of negroes to political rights. Accordingly it was held that a grant of exclusive right or privilege of maintaining slaughter-houses for twenty-one years, imposing at the same time the duty of providing ample conveniences, was not unconstitutional, as it was only a police regulation for the health of the people (The Slaughter-House Cases, 16 Wallace, 36). The same has been held of a refusal by a State to grant to a woman a license to practice law (Bradwell *v.* The State, 16 Wallace, 130), of a State law confining the right of suffrage to males (Minor *v.* Happersett, 21 Wallace, 162), and of a State law regulating the sale of intoxicating liquors (Bartemeyer *v.* Iowa, 18 Wallace, 129). Suits to redress the deprivation of privilege secured by the constitution of the United States must be brought in a United States court. It is a crime to conspire to prevent the free exercise and enjoyment of any privilege, or to conspire to deprive any person of equal privileges and immunities, or under color of law to subject any inhabitant of a State or Territory to the deprivation of any privileges or immunities (*Revised Statutes of the United States*, §§ 5507, 5510, 5519).

PRIVY COUNCIL. In England the king almost of necessity has been at all times guided by a council. The council, as it existed in the Norman period under the name of *curia regis* (a branch of the larger *commune concilium regni*), exercised judicial, legislative, and administrative functions. It contained the germs of the courts of law and equity, the Houses of Parliament, and the privy council. The Courts of King's Bench and Common Pleas were gradually separated from it and became only courts of first instance, subject to appeal to the king's council. From the time of Edward I. the *concilium ordinarium*, the ordinary or standing council of the king, superseded the *curia regis*. It exercised high judicial functions as the ultimate court of appeal, as the adviser of suitors on petition what court to choose for redress, and as the resort of those who failed to obtain justice in the ordinary course. It was also the supreme administrative body, and as such issued ordinances on matters of a local or temporary nature, with not infrequent usurpations at a later period of jurisdiction belonging more properly to the common law courts or to parliament. The council "consisted of the chief ministers, the chancellor, treasurer, lord steward, lord admiral, lord marshall, the keeper of the privy seal, the chamberlain, treasurer, and comptroller of the household, the chancellor of the exchequer, the master of the wardrobe; and of the judges, king's serjeant, and attorney-general, the master of the rolls, and justices in eyre, who who at that time were not the same as the judges at Westminster" (Hallam, *Middle Ages*, vol. iii. p. 205). The growing power of the ordinary council (it does not seem to have been called the privy council until after the reign of Henry VI.) led to many complaints on the part of the Commons, some of which found their expression in statutes. The most worthy of notice is 25 Edw. III. st. 5, c. 4, characterized by Hallam as probably the most extensively beneficial enactment in the whole body of our laws. Among other provisions it prohibited arbitrary imprisonment and the determination of pleas of freehold before the council. The power of the council expanded or contracted according to the vigor of the king. Its authority was finally reduced by the Long Parliament in 1640 by means of 16 Car. I. c. 10. Assumption of jurisdiction over freeholds was still a grievance, for the Act specially declared that the king's council has no jurisdiction over any man's land, goods, or chattels. From the beginning of Edward III.'s reign the council and the House of Lords were often blended into one assembly, called the *magnum concilium* or great council. As it met only when summoned by writ and not daily, like the ordinary council, it could scarcely have exerted as much authority as the latter. It is therefore not surprising to find it soon split permanently into its two component parts, each retaining both judicial and legislative authority. The privy council still exercises authority of both kinds, though not as completely as the House of Lords. The political importance of the privy council has almost entirely disappeared since the duties of government have been assumed by the cabinet. Its modern legislative jurisdiction is of a subordinate character. Its position as a court of appeal from the foreign possessions of the crown is a strictly logical one. It was always the court for redress where no other redress could be obtained. For the sake of convenience this jurisdiction in cases of what is now called equity was exercised by the chancellor, originally the president of the ordinary council when it sat as a court of justice. But in cases for which equity made no provision, as being out of the bounds of the realm, the privy council still exercises to the full one of the most ancient parts of its jurisdiction. Appeals lay from foreign possessions by virtue of the prerogative, but are now generally regulated by statute. The jurisdiction of the High Court of Delegates over ecclesiastical and admiralty cases was transferred to the privy council in 1832. The council lost its probate appeal jurisdiction in 1857, its admiralty jurisdiction in appeals from England in 1875, from Ireland in 1877.

At the present day members of the privy council become so at the will of the crown, but it is understood that persons in certain positions have an *ex officio* claim to be nominated. The council consists of princes of the royal family or of some of the great officers of state, such as the principal members of the Government, the archbishops and the bishop of London, the judges of the House of Lords, the judicial committee, and the court of appeal, diplomatists of high rank, etc. Members of the privy council have the title of "right honorable" and social precedence next after knights of the Garter. Ireland has its own privy council. Scotland has had none of its own since 6 Anne c. 40, which provided for one privy council for Great Britain. The modern jurisdiction of the privy council may be divided into two branches, administrative and judicial.

Administrative.—This jurisdiction chiefly depends upon statutory authority, which practically makes of the privy council a subordinate legislature. It is exercised either by the whole council or by committees to which matters are referred by the crown in council. Examples of the latter are the board of trade, the committee of council on education, the local government board (see PUBLIC HEALTH), the universities committee, with temporary powers under the Universities Act, 1877, and the committee of council for the consideration of charters of incorporation under the Municipal Corporations Act, 1882. Cases affecting the constitutional rights of the Channel Islands are referred to a committee for the affairs of Jersey and Guernsey. The committees report to the crown in council, and their report is adopted and enforced by an order in council, published in the *Gazette*. Among other Acts conferring administrative powers upon the privy council are the Pharmacy Act, 1852, as amended by 31 & 32 Vict. c. 121, the Medical Act, 1858, the Foreign Enlistment Act, 1870, the Destructive Insects Act, 1877, the Contagious Diseases (Animals) Act, 1878, the Dentists Act, 1878, the Veterinary Surgeons Act, 1881.

Judicial.—Up to 1833 the judicial authority of the privy council was exercised by judicial committees appointed from time to time for the hearing of appeals referred to them by the crown in council. In 1833 the judicial committee of the privy council was established as a permanent court by 3 & 4 Will. IV. c. 41. Under this and later Acts the judicial committee now consists of the lord president, the lord chancellor, and other persons who fill or have filled high judicial offices (all unpaid), of two retired Indian or colonial judges who receive an allowance for attending the sittings of the committee, and of paid members, now two in number, appointed under 34 & 35 Vict. c. 91. The Appellate Jurisdiction Act, 1876, provides for what is in effect the union of the House of Lords and of the privy council in their judicial capacities by the lords of appeal in ordinary gradually becoming judges of both courts. After the death or resignation of the present paid members these two high judicial bodies will be practically combined, and a near approach will be made to the mediæval *magnum concilium* in an ultimate court of appeal from the whole of the British dominions.

In proceedings under the Church Discipline Act archbishops and bishops who are members of the privy council are members of the judicial committee, 3 & 4 Vict. c. 86. In proceedings under the Public Worship Act, 1874, archbishops and bishops attend as assessors according to rules made by order in council, 39 & 40 Vict. c. 59 § 14. The jurisdiction of the judicial committee is either original or appellate. The original jurisdiction is the less important, and consists of certain powers conferred by the Copyright, Patent, Endowed Schools, and other Acts. The power most frequently exercised is that of extending the term of patents. The appellate jurisdiction is entirely regulated by statute, with the exception of the rarely occurring appeal from orders made by the lord chancellor of Great Britain or of Ireland in exercise of powers conferred by royal sign manual for the custody of idiots and lunatics. Appeals lie from the Arches Court of Canterbury, from a vice-admiralty court abroad, and from the Channel Islands, the Isle of Man, India, and the colonies. Appeals are either of right or by leave. Appeals lie as of right when the value of the matter at issue is of a certain amount (the amount varying according to the appeal rules of the different foreign possessions), and in a few other cases. Appeals lie at the discretion of the judicial committee, on leave being obtained by petition for special leave to appeal. The proceedings in all cases alike, whether original or appellate, are by petition (see PETITION). The petition is addressed to the crown in council in the first instance.

See, in addition to the writers on constitutional history, Sir Harris Nicolas, *Proceedings and Ordinances of the Privy Council of England*; Dicey, *The Privy Council*; Macpherson, *Practice of the Judicial Committee of the Privy Council*.

(J. W†.)

PRIZE, or **PRIZE OF WAR**, denotes the ship or goods of an enemy, or *in transitu* to an enemy, captured at sea. Goods captured on land are not prize, but booty of war. To be good prize the capture must be on the high seas or in the territorial waters of one of the belligerents, and must be by an armed vessel duly commissioned by the sovereign of the captor. A capture made in neutral waters is a violation of neutrality, and may be restored at the discretion of the neutral power. Most nations have municipal regulations upon the subject. Thus prize captured in breach of the neutrality of Great Britain may be restored by the High Court of Justice (Admiralty Division) under the powers of the Foreign Enlistment Act, 1870, 33 & 34 Vict. c. 90, § 14. Capture may be actual or constructive. Constructive or joint captors are those who have assisted the actual captors by conveying encouragement to them or intimidation to the enemy. All public ships of war within signalling distance are usually held entitled to share in the proceeds of the capture. This rule is incorporated in the United States code of prize law, the Act of Congress of June 30, 1864. It is not all enemy's property that is good prize. The conflicting interests of neutrals have led to modifications of the general belligerent right of seizing enemy's property wherever found, a right which had become established as part of the general maritime law as early as the *Consolato del Mare* (see vol. vi. p. 282, and SEA LAWS). By the rules laid in the *Consolato* neutral vessels or neutral goods were to be restored to the owners without compensation for the loss of time and other inconveniences attending capture. This may be said to have been the general law of the sea down to 1856. At the same time it is to be noticed that two doctrines inconsistent with the original rule had met with the sanction of certain nations, *viz.*, (1) the French doctrine of hostile infection, by which neutral property on an enemy's ship or a neutral ship carrying enemy's property was a good prize: (2) the Dutch doctrine, by which the character of the ship alone was regarded—free ship made free goods, enemy ship enemy goods (see Twiss, *Law of Nations*, vol. ii. ch. v.). In 1856 the Declaration of Paris adopted an intermediate system. To this Declaration most nations have acceded (see PRIVATEER). By article 2 of the Declaration, "the neutral flag covers enemy's goods, with the exception of contraband of war." By article 3, "neutral goods, with the exception of contraband of war, are not liable to capture under an enemy's flag." Contraband of war, speaking generally, includes all articles, such as provisions and munitions of war, likely to add to the military or naval resources of the enemy (see CONTRABAND). After the capture has been made, the next proceeding is the determination of its legality. It is now an understood rule of international law that the question of prize or no prize must be determined by a qualified prize court (see below). Captors should send their capture to a convenient port, if possible a port of their own nation or an allied power, for adjudication. They may forfeit their rights by misconduct in this respect. The property in the prize vests in the sovereign, in accordance with the old maxim of law *Parta bello cedunt reipublicæ.* This right attaches both in cases of capture and recapture, subject in the latter case to what is called the *jus postliminii*, that is, the right of the owner of property recaptured from the enemy to have it returned—formerly if the recapture has taken place before the property had been taken within the enemy's territory (*infra præsidia*), at present if less than twenty-four hours has elapsed between the capture and recapture. The right of the recaptors to salvage on recapture is regulated by the municipal law of different nations. By English law one-eighth of the value is the sum usually awarded, but this may be increased to one-fourth under special circumstances. The right does not exist at all if the vessel has been fitted out as a vessel of war by the enemy, 27 & 28 Vict. c. 25, § 40. One-eighth is awarded for recapture from pirates, 13 & 14 Vict. c. 26, § 5. In the United States, by the Prize Act of June 30, 1864, salvage on recapture is allowed according to the circumstances of the case. There is no sum fixed as in England. Although the prize vests in the sovereign, it has been held in England that the captors have an insurable interest in the prize immediately after capture and before condemnation on the ground that under the Prize Act the captors have a certain expectation of profit upon the safe arrival of the prize in port, and that they are liable to condemnation in damages and costs if the capture be unjustifiable. By the general maritime law a prize may be released upon ransom; but it has been the general policy of European nations to discountenance ransom as less beneficial to the state than the detention of a prize. Thus an Act of 1782, and subsequent Acts, avoided ransom bills given by British subjects, and subjected a commander giving one to an enemy to penalties, unless in either case the circumstances were such as to justify the giving or taking of the bill. The Naval Prize Act, 1864, is less strict in its terms. It enacts that the queen in council may from time to time in relation to any war make such orders as are expedient as to contracts for the ransoming of a ship or goods; contravention of the orders makes the contract void and renders the offender liable to a penalty not exceeding £500 [$2430], 27 & 28 Vict. c. 25, § 45. By the Naval Discipline Act, 1866, a commanding officer making an unlawful agreement for ransom is liable to be dismissed from the service, 29 & 30 Vict. c. 109, § 41. The United States have never prohibited ransom bills. The rights of the sovereign to prize may be waived, as was formerly done by the crown of Great Britain in the case of privateers (see PRIVATEER).

Many statutes dealing with prize have been enacted at different times in England. The first general Prize Act was 6 Anne c. 13. The Act that now regulates prize is the Naval Prize Act, 1864, already referred to. Various offences in relation to prize are dealt with by the Naval Prize Act and the Naval Discipline Act. Such are false swearing in a prize cause or appeal, taking money, etc., out of a ship before condemnation, ill-using persons on board the prize, etc., or breaking bulk with a view to embezzlement. Prize is subject to the usual customs regulations. The United States Prize Act is the Act of June 30, 1864, just seven days later in date than the British Prize Act. The two Acts are similar in character, but the United States Act is more full and definite than the British, as it deals with some matters which in Great Britain are left to the discretion of the executive.

Prize Court.—This is a court sitting by the commission of the sovereign of the captor for the determination of prize causes. A capture does not become good prize until condemnation by a prize court. As a general rule the court must be commissioned by the sovereign, must sit in the country of the captor, and must be in possession of the prize. In the case of allied powers, it is usually agreed (as it was between Great Britain and France in 1854) that the decision shall be made by a court of the country to which the officer in command belongs. A prize court may sit in the territory of an ally, though this is irregular; but it is a violation of neutrality to constitute a prize court within the limits of a neutral power. A prize may, however, in case of necessity be brought into a neutral port and sold there under the decree of a prize court, subject to objection on the part of the neutral Government. The sentence of a prize court is, where the jurisdiction is well-founded, a judgment *in rem* and entitled to universal respect. In the British dominions the prize courts are such courts as the crown or parliament invests with authority in prize matters. In practice these are the High Court of Justice (Admiralty Division) and the Vice-Admiralty Courts abroad. By the Naval Prize Act, 1864, the High Court of Admiralty of England (now represented by the Admiralty Division) has jurisdiction as a prize court throughout the British dominions. It is to be noticed that this jurisdiction is entirely derivative; the court has no original prize jurisdiction as it has original instance jurisdiction. The prize jurisdiction of Scotch courts was vested in the High Court of Admiralty of England by 6 Geo. IV. c. 120, § 57. In the United States (in accordance with Art. III. § 2 of the constitution, "The judicial power shall extend to . . . . . . all cases of admiralty and maritime jurisdiction") the prize courts are the district courts, the State courts having no jurisdiction. The procedure of a prize court is simple in its character. In Great Britain and the United States standing interrogatories are administered to the captors. The case is heard upon the depositions of the witnesses in answer to the interrogatories, and upon the ship's papers, which it is the duty of the captor to forward to a port of his country for deposit in the court. The flag is regarded as *prima facie* evidence of the nationality of a captured vessel. The pleadings are not technical. A libel is filed, followed by a monition to parties interested. If the cause be not prosecuted, the court will issue a monition to the captors to proceed. A prize court has power to order matters incidental to the cause, such as unlivery and appraisement and sale. It also distributes prize money in some cases (see below). The procedure of prize courts in the British dominions may be regulated by order in council under the powers of the Naval Prize Act, 1864; in the United States it depends upon the Prize Act of June 30, 1864. An appeal lies in England from the Admiralty Division to the Court of Appeal and thence to the House of Lords, from the Vice-Admiralty Courts abroad to the Judicial Committee of the Privy Council. In the United States it lies to the supreme court where the matter in dispute exceeds 2000 dollars, or involves a question of general importance. In addition to prize proper, prize courts have had jurisdiction in some analogous matters conferred on them by statute. Thus a prize court in the British dominions has jurisdiction over (1) enemy's property captured in a conjunct expedition of land and naval forces, 2 and 3 Will. IV c. 53, § 30, or captured on land by a naval or naval and military force acting either alone or with allied forces, 27 & 28 Vict. c. 25, §§ 34, 35; (2) petitions of right where the subject-matter of a petition arises out of the exercise of any belligerent right by the crown, or would be cognizable in a prize court if the same were a matter in dispute between private persons, § 52. Questions of booty of war may be referred to the Admiralty Division as a prize court, 3 & 4 Vict. c. 65, § 22. The United States prize courts have by the Act of 1854 jurisdiction over property captured in an insurrection.[1]

Prize Money.—The term prize money is used in a wider sense than the term prize. It extends to any reward granted by the state for the capture of enemy's property whether by land or sea. (1) The Act consolidating the right to and distribution of army prize money is the Army Prize Act, 1832, 2 & 3 Will. IV. c. 53. The right and interest of troops to prize money and bounty money is at the discretion of the crown, and is to be distributed in such proportions as the crown may direct. It is to be noticed that capture by
troops of an enemy's ship in a road, river,
of the enemy gives a right to prize mon
though it is not prize proper, not having
sea by an armed ship. Deserters are not
money. Shares not claimed within six ye
A list of persons entitled is transmitted to
the treasurer of which distributes the mon
persons or their assignees, or to the re
according to the rules laid down in the Ac
may be assigned subject to certain conditio
of officers the assignment must express t
money actually paid for the assignment; in
commissioned officers or seamen the assi
valid where there is no regimental agen
expeditions of land and naval forces, the s
forces is to be paid to the treasurer of C
By 27 & 28 Vict. c. 36, § 3, prize money no
may be paid without probate or letters of
By 39 Vict. c. 14, the accounts are to be la
ment. In the United States provision was
Acts of Congress that officers and soldiers
in certain wars should be entitled to warr
lands as a reward for their services. (2) F
prize money where the captor at sea is not
war, see PRIVATEER. Where the captor
of war of Great Britain, the officers and
such interest in the proceeds of prize as the
time to time grant them. This interest i
feiture for misconduct in relation to the pr
c. 25, §§ 36, 55. In the United States, by t
1864, the whole proceeds go to the captor
is of superior or equal force, one-half to the
half to the United States where the prize is
The prize money accruing to the United S
of the fund for pensions. Besides a share o
bounty is generally given. By the Naval
this is at the rate of £5 for each person on b
ship, if a ship of war, 27 & 28 Vict. c. 25, § 42.
States Act of 1864 the rate is 200 dollars if
superior or equal force, 100 if of inferior
tribution of prize money and prize bounty i
is regulated by the Naval Agency and D
1864, 27 & 28 Vict. c. 24. The money is di
the direction of the lords of the Admiralt
tions specified in a royal proclamation or o
The proportions are graduated according t
xvii. p. 307). Assignment of a share by a
seaman or a non-commissioned officer of ma
is void unless in accordance with orders i
forfeited and unclaimed shares, and a per
cent. out of the proceeds and grants, are ca
count of the naval prize cash balance.
Division has the sole right of determinin
distribution or investment. In the Un
distribution is regulated by the Act of 1864.
tion is by the district court; it is a judici
Great Britain, the act of a Government de
proportions too are fixed by statute—not
Britain, to the discretion of the executive.
ing officer of a fleet or squadron has one-tw
to him, of a division one-fiftieth, a fle
hundredth, the commander of a single
of the amount awarded to the vessel; the
proportion to their pay. Prize money is
treasury of the United States to be distribu
the decree of the court. Ransom money,
and proceeds of condemned property are
prize money. Assignments of prize money
by the commanding officer and the paymas
certain cases where money is granted to
crew of vessels making captures which are
strict sense of the word. Under this head
the salvage on recapture already mentio
cases provided for in the following enact
23 Car. II. c. 11, § 10, 2 per cent. of the va
defended may be awarded to those wounde
sentatives of those slain in the defense of
against pirates. By the Customs Act, 1876,
36, §§ 210–216, rewards may be granted t
customs out of the penalties for goods seize
Trade Act, 1873, 36 & 37 Vict. c. 88, §§ 11,
£5 [$24.30] per slave or of £4 [$19.44] per
the officers and crew of one of Her Maje
capture of a slave ship. Where the capture
of war, the bounty is one-third of the v
seized, and a bounty of £5 [$24.30] for eac
Act of Congress of March 3, 1819, a bounty
given for each slave captured, and the p
demned slave ships are divided between t
and the captors, half to each.

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[1] For the procedure of prize courts see Story, *On Prize Courts*; Phillimore, *International Law*, vol. iii. pt. xi.; Lushington, *Manual of Naval Prize Law.*

PROBABILITY.

THE mathematical theory of probability is a science which aims at reducing to calculation, where possible, the amount of credence due to propositions or statements, or to the occurrence of events, future or past, more especially as contingent or dependent upon other propositions or events the probability of which is known.

Any statement or (supposed) fact commands a certain amount of credence, varying from zero, which means conviction of its falsity, to absolute certainty, denoted by unity. An even chance, or the probability of an event which is as likely as not to happen, is represented by the fraction $\frac{1}{2}$. It is to be observed that $\frac{1}{2}$ will be the probability of an event about which we have no knowledge whatever, because if we can see that it is more likely to happen than not, or less likely than not, we must be in possession of some information respecting it. In has been proposed to form a sort of thermometrical scale, to which to refer the strength of the conviction we have in any given case. Thus if the twenty-six letters of the alphabet have been shaken together in a bag, and one letter be drawn, we feel a very feeble expectation that A has been the one taken. If two letters be drawn, we have still very little confidence that A is one of them; if three be drawn, it is somewhat stronger; and so on, till at last, if twenty-six be drawn, we are certain of the event, that is, of A having been taken.

Probability, which necessarily implies uncertainty, is a consequence of our ignorance. To an omniscient Being there can be none. Why, for instance, if we throw up a shilling, are we uncertain whether it will turn up head or tail? Because the shilling passes, in the interval, through a series of states which our knowledge is unable to predict or to follow. If we knew the exact position and state of motion of the coin as it leaves our hand, the exact value of the final impulse it receives, the laws of its motion as affected by the resistance of the air and gravity, and finally the nature of the ground at the exact spot where it falls, and the laws regulating the collision between the two substances, we could predict as certainly the result of the toss as we can which letter of the alphabet will be drawn after twenty-five have been taken and examined.

The probability, or amount of conviction accorded to any fact or statement, is thus essentially subjective and varies with the degree of knowledge of the mind to which the fact is presented (it is often indeed also influenced by passion and prejudice, which act powerfully in warping the judgment),—so that, as Laplace observes, it is affected partly by our ignorance partly by our knowledge. Thus, if the question were put, Is lead heavier than silver? some persons would think it is, but would not be surprised if they were wrong; others would say it is lighter; while to a worker in metals probability would be superseded by certainty. Again, to take Laplace's illustration, there are three urns A, B, C, one of which contains black balls, the other two white balls; a ball is drawn from the urn C, and we want to know the probability that it shall be black. If we do not know which of the urns contains the black balls, there is only one favorable chance out of three, and the probability is said to be $\frac{1}{3}$. But if a person knows that the urn A contains white balls, to him the uncertainty is confined to the urns B and C, and therefore the probability of the same event is $\frac{1}{2}$. Finally to one who had found that A and B both contained white balls, the probability is converted into certainty.

In common language, an event is usually said to be likely or probable if it is more likely to happen than not, or when, in mathematical language, its probability exceeds $\frac{1}{2}$; and it is said to be improbable or unlikely when its probability is less than $\frac{1}{2}$. Not that this sense is always adhered to; for, in such a phrase as "It is likely to thunder to-day," we do not mean that it is more likely than not, but that in our opinion the chance of thunder is greater than usual; again, "Such a horse is likely to win the Derby," simply means that he has the best chance, though according to the betting that chance may be only $\frac{1}{5}$. Such unsteady and elliptical employment of words has of course to be abandoned and replaced by strict definition, at least mentally, when they are made the subjects of mathematical analysis. *Certainty*, or absolute conviction, also, as generally understood, is different from the mathematical sense of the word certainty. It is very difficult and often impossible, as is pointed out in the celebrated *Grammar of Assent*, to draw out the grounds on which the human mind in each case yields that conviction, or assent, which according to Newman, admits of no degrees, and either is entire or is not at all.[1] If, when walking on the beach, we find the letters "Constantinople" traced on the sand, we should feel, not a strong impression, but absolute certainty, that they were characters not drawn at random, but by one acquainted with the word so spelt. Again, we are certain of our own death as a future event; we are certain, too, that Great Britain is an island; yet in all such cases it would be very difficult, even for a practiced intellect, to present in logical form the evidence, which nevertheless has compelled the mind in each instance to concede the point.[2] Mathematical certainty, which means that the contrary proposition is inconceivable, is thus different, though not perhaps as regards the force of the mental conviction, from moral or practical certainty. It is questionable whether the former kind of certainty is not entirely hypothetical, and whether it is ever attainable in any of the affairs or events of the real world around us. The truth of no conclusion can rise above that of the premises, of no theorem above that of the data. That two and two make four is an incontrovertible truth; but before applying even it to a concrete instance we have to be assured that there were really two in each constituent group; and we can hardly have mathematical certainty of this, as the strange freaks of memory, the tricks of conjurors, etc., have often made apparent.

There is no more remarkable feature in the mathematical theory of probability than the manner in which it has been found to harmonize with, and justify, the conclusions to which mankind have been led, not by reasoning, but by instinct and experience, both of the individual and of the race. At the same time it has corrected, extended, and invested them with a definiteness and precision of which these crude, though sound, appreciations of common sense were till then devoid. Even in cases where the theoretical result appears to differ from the common-sense view, it often happens that the latter may, though perhaps unknown to the mind itself, have taken account of circumstances in the case omitted in the data of the theoretical problem. Thus, it may be that a person accords a lower degree of credence to a fact attested by two or more independent witnesses than theory warrants,—the reason being that he has unconsciously recognized the possibility of collusion, which had not been presented among the data. Again, it appears from the rules for the credibility of testimony that the probability of a fact may be *diminished* by being attested by a new witness, viz., in the case where his credibility is less than $\frac{1}{2}$. This is certainly at variance with our natural impression, which is that our previous conviction of any fact is clearly not weakened, however little it be intensified, by any fresh evidence, however suspicious, as to its truth. But on reflection we see that it is a practical absurdity to suppose the credibility of any witness less than $\frac{1}{2}$—that is, that he speaks falsehood oftener than truth—for all men tell the truth probably nine times out of ten, and only deviate from it when their passions or interests are concerned. Even where his interests are at stake, no man has any preference for a lie, as such, above the truth; so that his testimony to a fact will at worst leave the antecedent probability exactly what it was.

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[1] "There is a sort of *leap* which most men make from a high probability to absolute assurance . . . analogous to the sudden consilience, or springing into one, of the two images seen by binocular vision, when gradually brought within a certain proximity."—Sir J. Herschel, in *Edin. Review*, July, 1850.

[2] Archbishop Whately's *jeu d'esprit*, *Historic Doubts respecting Napoleon Bonaparte*, is a good illustration of the difficulties there may be in *proving* a conclusion the certainty of which is absolute.

A celebrated instance of the confirmation and completion by theory of the ordinary view is afforded by what is known as James Bernoulli's theorem. If we know the odds in favor of an event to be three to two, as for instance that of drawing a white ball from a bag containing three white and two black, we should certainly judge that if we make five trials we are more likely to draw white three times and black twice than any other combination. Still, however, we should feel that this was very uncertain; instead of three white, we might draw white 0, 1, 2, 4, or 5 times. But if we make say one thousand trials, we should feel confident that, although the numbers of white and black might not be in the proportion of three to two, they would be very nearly in that proportion. And the more the trials are multiplied the more closely would this proportion be found to obtain. This is the principle upon which we are continually judging of the possibility of events from what is observed in a certain number of cases.[1] Thus if, out of ten particular infants, six are found to live to the age of twenty, we judge, but with a very low amount of conviction, that nearly six-tenths of the whole number born live to twenty. But if, out of 1,000,000 cases, we find that 600,000 live to be twenty, we should feel certain that the same proportion would be found to hold almost exactly were it possible to test the whole number of cases, say in England during the 19th century. In fact we may say, considering how seldom we know *a priori* the probability of any event, that the knowledge we have of such probability in any case is entirely derived from this principle, viz., that the proportion which holds in a large number of trials will be found to hold in the total number, even when this may be infinite,—the deviation or error being less and less as the trials are multiplied.

Such no doubt is the verdict of the common sense of mankind, and it is not easy to say upon what considerations it is based, if it be not the effect of the unconscious habit which all men acquire of weighing chances and probabilities, in the state of ignorance and uncertainty in which human life is. It is now extremely interesting to see the results of the unerring methods of mathematical analysis when applied to the same problem. It is a very difficult one, and James Bernoulli tells us he reflected upon it for twenty years. His methods, extended by De Moivre and Laplace, fully confirm the conclusions of rough common sense; but they have done much more. They enable us to estimate exactly how far we can rely on the proportion of cases in a large number of trials, truly representing the proportion out of the total number—that is, the real probability of the event. Thus he proves that if, as in the case above mentioned, the real probability of an event is $\frac{3}{5}$, the odds are 1000 to 1 that, in 25,550 trials, the event shall occur not more than 15,841 times and not less than 14,819 times,—that is, that the deviation from 15,330, or $\frac{3}{5}$ of the whole, shall not exceed $\frac{1}{50}$ of the whole number of trials.

The history of the theory of probability, from the celebrated question as to the equitable division of the stakes between two players on their game being interrupted, proposed to Pascal by the Chevalier de Méré in 1654, embracing, as it does, contributions from almost all the great names of Europe during the period, down to Laplace and Poisson, is elaborately and admirably given by Mr. Todhunter in his *History* of the subject, now a classical work. It was not indeed to be anticipated that a new science which took its rise in games of chance, and which had long to encounter an obloquy, hardly yet extinct, due to the prevailing idea that its only end was to facilitate and encourage the calculations of gamblers, could ever have attained its present status—that its aid should be called for in every department of natural science, both to assist in discovery, which it has repeatedly done (even in pure mathematics), to minimize the unavoidable errors of observation, and to detect the presence of causes as revealed by observed events. Nor are commercial and other practical interests of life less indebted to it:[2] wherever the future has to be forecasted, risk to be provided against, or the true lessons to be deduced from statistics, it corrects for us the rough conjectures of common sense, and decides which course is really, according to the lights of which we are in possession, the wisest for us to pursue. It is *sui generis* and unique as an application of mathematics, the only one, apparently, lying quite outside the field of physical science. De Moivre has remarked that, "some of the problems about chance having a great appearance of simplicity, the mind is easily drawn into a belief that their solution may be attained by the mere strength of natural good sense"; and it is with surprise we find that they involve in many cases the most subtle and difficult mathematical questions. It has been found to tax to the utmost the resources of analysis and the powers of invention of those who have had to deal with the new cases and combinations which it has presented. Great, however, as are the strictly mathematical difficulties, they cannot be said to be the principal. Especially in the practical applications, to detach the problem from its surroundings *in rerum natura*, discarding what is non-essential, rightly to estimate the extent of our knowledge respecting it, neither tacitly assuming as known what is not known, nor tacitly overlooking some datum, perhaps from its very obviousness, to make sure that events we are taking as independent are not really connected, or probably so,—such are the preliminaries necessary before the question is put in the scientific form to which calculation can be applied, and failing which the result of the mathematician will be but an *ignoratio elenchi*—a correct answer, but to a different question.

From its earliest beginnings, a notable feature in our subject has been the strange and insidious manner in which errors creep in—often misleading the most acute minds, as in the case of D'Alembert—and the difficulty of detecting them, even when one is assured of their presence by the evident incorrectness of the result. This is probably in many cases occasioned by the poverty of language obliging us to use one term in the same context for different things—thus introducing the fallacy of ambiguous middle; *e. g.*, the same word "probability" referring to the same event may sometimes mean its probability *before* a certain occurrence, sometimes *after*; thus the chance of a horse winning the Derby is different after the Two Thousand from what it was before. Again, it may mean the probability of the event according to one source of information, as distinguished from its probability taking everything into account; for instance, an astronomer thinks he can notice in a newly-discovered planet a rotation from east to west; the probability that this is the case is of course that of his observations in like cases turning out correct, if we had no other source of information; but the actual probability is less, because we know that at least the vast majority of the planets and satellites revolve from west to east. It is easy to see that such employment of terms in the same context must prove a fruitful source of fallacies, and yet, without wearisome repetitions, it cannot always be avoided. But, apart from mere logical errors, the main stumbling-block is no doubt the uncertainty as to the limits of our knowledge in each case, or—though this may seem a contradiction in terms—the difficulty of knowing what we do know; and we certainly err as often in forgetting or ignoring what we do know, as in assuming what we do not. It is a not uncommon popular delusion to suppose that if a coin has turned up head, say five times running, or the red has won five times at roulette, the same event is likely to occur a sixth time; and it arises from overlooking (perhaps from the imagination being struck by the singularity of the occurrence) the *a priori* knowledge we possess, that the chance at any trial is an even one (supposing all perfectly fair); the mind thus unconsciously regards the event simply as one that has recurred five times, and therefore judges, correctly, that it is very likely to occur once more. Thus if we are given a bag containing a number of balls, and we proceed to draw them one by one, and the first five drawn are white, the odds are 6 to 1 that the next will be white—the slight information afforded by the five trials being thus of great importance and strongly influencing the probabilities of the future, when it is all we have to guide us, but absolutely valueless and without influence on the future when we have *a priori* certain information. The lightest air will move a ship which is adrift, but has simply no effect on one securely moored.

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[1] So it is said, "the tree is known by its fruits"; "practice is better than theory"; and the universal sense of mankind judges that the safest test of any new invention, system, or institution is to see how it works. So little are we able by *a priori* speculations to forecast the thousand obstacles and disturbing influences which manifest themselves when any new cause or agent is introduced as a factor in the world's affairs.

[2] Men were surprised to hear that not only births, deaths, and marriages, but the decisions of tribunals, the results of popular elections, the influence of punishments in checking crime, the comparative values of medical remedies, the probable limits of error in numerical results in every department of physical inquiry, the detection of causes, physical, social and moral, nay, even the weight of evidence and the validity of logical argument, might come to be surveyed with the lynx-eyed scrutiny of a dispassionate analysis.—*Sir J. Herschel.*

It is not to be supposed that the results arrived at when the calculus of probabilities is applied to most practical questions are anything more than approximations; but the same may be said of almost all such applications of abstract science. Partly from ignorance of the real state of the case, partly from the extreme intricacy of the calculations requisite if all the conditions which we do or might know are introduced, we are obliged to substitute in fact, for the actual problem, a simpler one approximately representing it. Thus, in mechanical questions, assumptions such as that the centre of gravity of an actual sphere is at its centre, that the friction of the rails on a railway is constant at different spots or at different times, or that in the rolling of a heavy body no depression is produced by its weight in the supporting substance, are instances of the convenient fictions which simplify the real question, while they prevent us accepting the result as more than something near the truth. So in probability, the chance of life of an individual is taken from the general tables (unless reasons to the contrary are very palpable), although, if his past history, his mode of life, the longevity of his family, etc., were duly weighed, the general value ought to be modified in his case; again, in attempting to estimate the value of the verdict of a jury, whether unanimous or by a majority, each man is supposed to give his honest opinion—feeling and prejudice, or pressure from his fellow-jurors, being left out of the account. Again, the value of an *expectation* to an individual is taken to be measured by the sum divided by his present fortune, though it is clearly affected by other circumstances, as the number of his family, the nature of his business, etc. An event has been found to occur on an average once a year during a long period; it is not difficult to show that the chance of its happening in a particular year is $1 - e^{-1}$, or 2 to 1 nearly. But, on examining the record, we observe it has never failed to occur during three years running. This fact increases the above chance, but to introduce it into the calculation at once renders the question a very difficult one. Even in games of chance we are obliged to judge of the relative skill of two players by the result of a few games; now one may not have been in his usual health, etc., or may have designedly not played his best; when he did win he may have done so by superior play, or rather by good luck; again, even in so simple a case as pitch and toss, the coin may, in the concrete, not be quite symmetrical, and the odds of head or tail not quite even.

Not much has been added to our subject since the close of Laplace's career. The history of science records more than one parallel to this abatement of activity. When such a genius has departed, the field of his labors seems exhausted for the time and little left to be gleaned by his successors. It is to be regretted that so little remains to us of the inner working of such gifted minds and of the clue by which each of their discoveries was reached. The didactic and synthetic form in which these are presented to the world retains but faint traces of the skilful inductions, the keen and delicate perception of fitness and analogy, and the power of imagination—though such a term may possibly excite a smile when applied to such dry subjects—which have doubtless guided such a master as Laplace or Newton in shaping out each great design—only the minor details of which have remained over, to be supplied by the less cunning hand of commentator and disciple.

We proceed to enumerate the principal divisions of the theory of probability and its applications. Under each we will endeavor to give at least one or two of the more remarkable and suggestive questions which belong to it—especially such as admit of simplification or improvement in the received solutions; in such an article as the present we are debarred from attempting even an outline of the whole. We will suppose the general fundamental principles to be already known to the reader, as they are to be now found in several elementary works, such as Todhunter's *Algebra*, Whitworth's *Choice and Chance*, etc.

Many of the most important results are given under the apparently trifling form of the chances in drawing balls from an urn, etc., or seem to relate to games of chance, as dice or cards, but are in reality of far wider application—this form being adopted as the most definite and lucid manner of presenting the chances of events occurring under circumstances which may be assimilated, more or less closely, to such cases.

I. DETERMINATION OF THE PROBABILITIES OF COMPOUND EVENTS, WHEN THE PROBABILITIES OF THE SIMPLE EVENTS ON WHICH THEY DEPEND ARE KNOWN.

1. Under this head come a very large and diversified range of questions; a very few of the most important are all that we can give. One great class relates to the fulfilment of given conditions in repeated trials as to the same event, knowing the probability of what will happen in each trial.

2. Let there be an event which must turn out in one of two ways, W and B (as in drawing a ball from an urn containing white and black balls only); let the respective probabilities for each trial be p,q; so that $p+q=1$. Let two trials be made: the four possible cases which may arise are

WW, WB, BW, BB.

The probability of the first is p^2, of the second pq, of the third pq, of the fourth q^2. Thus the probability of a white and a black ball being drawn *in an assigned order* is pq; but that of a white and a black in any order is $2pq$.

Suppose now n trials to be made. The probability of W every time is p^n; that of B once and W $(n-1)$ times in an assigned order is $p^{n-1}q$, but if the order is indifferent it is $np^{n-1}q$; that of B occurring twice only is $p^{n-2}q^2$ if the order is given, but $\frac{n(n-1)}{2}p^{n-2}q^2$ in any order; and so on. We have then this result: in the binominal expansion

$$(p+q)^n=1=p^n+np^{n-1}q+\frac{n(n-1)}{\underline{|2}}p^{n-2}q^2+\frac{n(n-1)(n-2)}{\underline{|3}}p^{n-3}q^3+\ldots\ldots\quad(1),$$

the terms in their order give the probabilities of the event W happening n times; of W $(n-1)$ times and B once; of W $(n-2)$ times and B twice; and so on,—the sum of the whole giving 1, that is, certainty.

3. As an example, let A and B be two players whose respective chances of winning one game are p and q; to find the probability of A winning m games before B wins n games, the play terminating when either of these events has occurred.

The chance of A winning the first m games is p^m. The chance of his winning in the first $m+1$ games is $mp^{m-1}q \cdot p=mp^mq$; for he must have won $m-1$ games out of the first m, and then win the $(m+1)$th; otherwise we should be including the first case. Again, the chance of A winning in the first $m+2$ games is, in like manner, $\frac{(m+1)m}{2}p^{m-1}q^2p=\frac{(m+1)m}{2}p^mq^2$; and so on. Now the match must be decided at latest by the $(m+n-1)$th game; for, if A fails to win m games by that time, B must have won n. Hence the chance of A winning the match is

$$p^m\left\{1+mq+\frac{m(m+1)}{\underline{|2}}q^2+\ldots\frac{m(m+1)\ldots(m+n-2)}{\underline{|n-1}}q^{n-1}\right\}.$$

Thus, if A's skill be double that of B, the chance that A wins four games before B wins two is $\frac{112}{243}$. That of B winning is $\frac{131}{243}$.

If A and B agree to leave off playing before the match is decided, the stakes ought clearly to be divided between them in proportion to their respective probabilities of winning, as given above,—putting for m and n the numbers of games required to be won, at any given point of the match, by A and B respectively.

This was one of the questions proposed to Pascal by the Chevalier de Méré in the year 1654.

4. In the expansion (1) it may be asked which combination of the events W, B is most likely to occur in the n trials. As the ratio of the 2d term to the 1st is $n\frac{q}{p}$, of the 3d to the 2d $\frac{n-1}{2}\frac{q}{p}$, and of the $(r+1)$th to the rth $\frac{n-r+1}{r}\frac{q}{p}$, so long as this ratio continues to increase the terms will increase. The condition, therefore, for the rth term to be the greatest is

$$\frac{n-r+1}{r}<\frac{p}{q};\text{ or } r>(n+1)q;$$

that is, r is the next integer above $(n+1)q$.

We conclude that if r is the next integer below $(n+1)q$ the $(r+1)$th term is the greatest—that is, it is most likely that the event W occurs $n-r$ times and B r times. If $(n+1)q$ should be an integer (r), B is as likely to occur r as $r+1$ times; and either is more probable than any other number. Thus in twelve throws of a die, the ace is more likely to turn up twice than any other number; while in eleven throws it is as likely to turn up once only as twice.

It is important to remark that, if the number of trials n be very large, we may treat qn and pn as whole numbers, and conclude that the event W is more likely to happen pn times and B qn times than in any other proportion.

5. Among the many questions which relate to the occurrence of different combinations in successive trials as to the same event, one is as to the chances for a succession, or run, of the same result several times.

Let us consider the very simple case—In n throws of a coin, what is the chance that head occurs (at least) twice running?

This will be an instance of the aid afforded by the calculus of finite differences in questions on probability. Let u_r = the number of cases of r throws of a coin in which head turns up twice running, the whole number of cases being of course 2^r. Now if we consider the value of u_{n+3}, it includes $2u_{n+2}$, because the $(n+3)$th throw may turn up two ways; but it includes also those cases when head turns up in the last two throws, tail in the preceding one, and no run of two heads occurs in the n preceding ones. The number of these cases is 2^n-u_n. We have therefore the equation

$$u_{n+3}=2u_{n+2}+2^n-u_n\quad.\ .\ .\ .\ .\quad(2).$$

If E be an operator such that $Eu_r=u_{r+1}$, equation (2) is

$$(E^3-2E^2+1)u_n=2^n;$$

or,

$$(E-1)(E^2-E-1)u_n=2^n;$$

so that, if we put α, β for the roots of the equation $E^2-E-1=0$,

$$u_n=2^n+A+B\alpha^n+C\beta^n\quad.\ .\ .\ .\quad(3),$$

since $u_n=2^n$ is a particular solution of (2),—A, B, C being three undetermined constants.

Now in two throws there is one case where head turns up twice, and in three throws there are three cases; hence we have

$$u_1=0=2+A+B\alpha+C\beta$$
$$u_2=1=4+A+B\alpha^2+C\beta^2$$
$$u_3=3=8+A+B\alpha^3+C\beta^3;$$

and, remembering that $\alpha^2=\alpha+1$, $\beta^2=\beta+1$, we shall easily find from these

$$A=0,\ B=\frac{\alpha^2}{\beta-\alpha},\ C=\frac{\beta^2}{\alpha-\beta};$$

so that

$$u_n=2^n-\frac{\alpha^{n+2}-\beta^{n+2}}{\alpha-\beta}\quad.\ .\ .\ .\ .\ .\quad(4).$$

Now

$$\alpha=\frac{1+\sqrt{5}}{2},\ \beta=\frac{1-\sqrt{5}}{2};$$

expanding by the binomial theorem and reducing,

$$u_n=2^n-\frac{n+2}{2^{n+1}}\left\{1+\frac{(n+1)n}{\underline{|3}}5+\frac{(n+1)n(n-1)(n-2)}{\underline{|5}}5^2+\ldots\right\}\ldots(5);$$

dividing by the total number of cases 2^n, we have for the probability of head turning up at least twice running in n throws

$$p_n=1-\frac{n+2}{2^{2n+1}}\left\{1+\frac{(n+1)n5}{\underline{|3}}+\frac{(n+1)n(n-1)(n-2)}{\underline{|5}}5^2+\ldots\right\}\ldots(6).$$

Another method of obtaining the same result is to consider the number of cases in which head never occurs twice running; let u_n be this number, then 2^n-u_n must be the number of cases when head occurs at least twice successively. Consider the value of u_{n+2}; if the last or $(n+2)$th throw be tail, u_{n+2} includes all the cases (u_{n+1}) of the $n+1$ preceding throws which gave no succession of heads; and if the last be head the last but one must be tail, and these two may be preceded by any one of the u_n favorable cases for the first n throws. Consequently

$$u_{n+2}=u_{n+1}+u_n.$$

If α, β, as before are the roots of the quadratic $E^2-E-1=0$, this equation gives

$$u_n=A\alpha^n+B\beta^n.$$

Here A and B are easily found from the conditions $u_1=2$, $u_2=3$; viz.,

$$A=\frac{\alpha^2}{\alpha-\beta},\ B=\frac{\beta^2}{\beta-\alpha},$$

whence

$$u_n=\frac{n+2}{2^{n+1}}\left\{1+\frac{(n+1)n}{1.2.3}5+\text{etc.}\right\}$$

as in eq. (5). The probability that head never turns up twice running is found by dividing this by 2^n, the whole number of cases. This probability of course becomes smaller and smaller as the number of trials (n) is increased.

6. Let us consider the chance of a run of three heads or tails during n throws,—that of a run of two heads or tails being evidently $\frac{2^n-2}{2^n}=1-\frac{1}{2^{n-1}}$, as there are but two cases out of the 2^n which are alternately head and tail.

Let u_r be the number of cases, during r throws, which give at least one succession of three heads or three tails. Consider the value of u_{n+3}; it includes $2u_{n+2}$, as the last throw may be head or tail; but, besides these, every case of the first n throws which contains no run of three gives rise to one new case of the $n+3$ having a run of three; thus, if the nth throw be head, the last four may be HTTT, or THHH if the nth be tail. Hence

$$u_{n+3}=2u_{n+2}+2^n-u_n,$$

the same equation of differences as (2.) Its solution is equation (3), in which, if we determine the constants by the conditions $u_1=0$, $u_2=0$, $u_3=2$, and divide by 2^n, we find for the probability of a run of three of either event during n trials

$$=\frac{u_n}{2^n}=1-\frac{n+1}{2^{2n-1}}\left\{1+\frac{n(n-1)}{\underline{|3}}5+\frac{n(n-1)(n-2)(n-3)}{\underline{|5}}5^2+\right\}(7.)$$

Comparing this result with (6) we find that *the chance of a run of two heads in* n *trials is equal to the chance of a run of three, of either heads or tails, in* n + 1 *trials.*

7. If an event may turn out on each trial in $a+b$ ways, of which a are favorable and b unfavorable (thus a card may be drawn from a pack in fifty-two ways, twelve of which give court cards), and if we consider the probability that during n trials there shall occur a run of at least p favorable results, it is not difficult to see that (u_r denoting the number of ways this may occur in r trials)

$$u_{n+p+1} = (a+b)u_{n+p} + ba^p\{(a+b)^n - u_n\},$$

as u_{n+p+1} includes, besides $(a+b)u_{n+p}$, those cases in which the last p trials are favorable, the one before unfavorable, and the n preceding containing no such run as stated.

We will not enter on Laplace's solution of this equation, or rather of one equivalent to it, especially as the result is not a simple one (see Todhunter, p. 185).

8. Let the probability of an event happening in one trial be p, that of its failing q; we have seen (art. 4) that, if a large number N of trials be made, the event is most likely to happen pN times and fail qN times. The chance of this occurring, is however, extremely small, though greater than that in favor of any other proportion. We propose now to examine the probability that the proportion of successes shall not deviate from its most probable value by more than a given limit—that is, in fact, *to find the probability that in* N *trials the number of times in which the event happens shall lie between the two limits* pN ± r.

Let $m = p\mathrm{N}$, $n = q\mathrm{N}$, which are taken to be integers. The probability of the event happening m times is the greatest term T of the expansion (1), viz.,

$$\mathrm{T} = \frac{\underline{|\mathrm{N}}}{\underline{|m}\,\underline{|n}}p^mq^n.$$

The calculation of this would be impracticable when N, m, n are large numbers, but Stirling's theorem gives us

$$1.\,2.\,3\,\ldots\,x = x^{x+\frac{1}{2}}e^{-x}\sqrt{2\pi},$$

very nearly when x is large; and by substituting in the preceding value of T, and reducing, we easily find

$$\mathrm{T} = \frac{1}{\sqrt{2\pi pq\mathrm{N}}} \quad \ldots\ldots\ldots (8).$$

Now the terms of the expansion (1) on either side of T are

$$\ldots\ldots \frac{n(n-1)}{(m+1)(m+2)}\frac{p^2}{q^2}\mathrm{T} + \frac{n}{m+1}\frac{p}{q}\mathrm{T} + \mathrm{T} + \frac{m}{n+1}\frac{q}{p}\mathrm{T} + \frac{m(m-1)}{(n+1)(n+2)}\frac{q^2}{p^2}\mathrm{T} + \quad \ldots\ldots (9).$$

But if x is much greater than a,

$$x - a = xe^{-\frac{a}{x}} \text{ nearly,}$$

so that

$$n(n-1)(n-2)\ldots(s \text{ terms}) = n^se^{-\frac{1+2+\ldots(s-1)}{n}} = n^se^{-\frac{s(s-1)}{2n}};$$

also $$(m+1)(m+2)\ \ldots\ (s \text{ terms}) = m^se^{\frac{(s+1)}{2m}}.$$

Hence the sth term before T in (9) is

$$\left(\frac{n}{m}\right)^s e^{-\frac{s(s-1)}{2n}}e^{-\frac{s(s+1)}{2m}}\left(\frac{p}{q}\right)^s\mathrm{T}, \text{ or } e^{-\frac{\mathrm{N}s^2}{2mn}+\frac{m-n}{2mn}s}\,\mathrm{T}.$$

The sth term after T is

$$e^{-\frac{\mathrm{N}s^2}{2mn}-\frac{m-n}{2mn}s}\,\mathrm{T}.$$

Now the probability that the event shall happen a number of times comprised between $m + r$ and $m - r$ is the sum of the terms in (9) from the rth term before T to the rth term after T. (N. B., though r may be large, it is supposed small as compared with N, m, or n.)

Now the sth term before T + the sth term after T = $2e^{-\frac{\mathrm{N}s^2}{2mn}}\mathrm{T}$, since $e^x + e^{-x} = 2$, when $x = \frac{m-n}{2mn}s$ is small. Taking then each term before T with the corresponding term after T, and putting for shortness

$$a^2 = \frac{\mathrm{N}}{2mn} = \frac{1}{2pq\mathrm{N}} \quad \ldots\ldots (10).$$

we have for the required probability

$$p_r = 2\left(\tfrac{1}{2}\mathrm{T} + \mathrm{T}e^{-a^2} + \mathrm{T}e^{-2^2a^2} + \mathrm{T}e^{-3^2a^2} + \ldots\,\mathrm{T}e^{-r^2a^2}\right).$$

If we now consider the curve whose equation is

$$y = \mathrm{T}e^{-x^2},$$

and take a series of its ordinates corresponding to $x = 0$, a, $2a$, $3a$ . . . . ra, where a is very small, and if A be its area from $x = 0$ to $x = ra$, then

$$\frac{\mathrm{A}}{a} = \tfrac{1}{2}(\text{first} + \text{last ordinates}) + \text{sum of intermediate ordinates}$$

$$\therefore p_r = \frac{2}{a}\mathrm{A} + \text{last ordinate},$$

$$= \frac{2}{a}\,\mathrm{T}\int_0^{ra} e^{-x^2}dx + \mathrm{T}e^{-r^2a^2}$$

or $$p_r = \frac{2}{\sqrt{\pi}}\int_0^{ra} e^{-x^2}dx + \frac{1}{\sqrt{2pq\mathrm{N}\pi}}e^{-r^2a^2} \quad \ldots (11).$$

9. We refer to the integral calculus for the methods of computing the celebrated integral $\int e^{-x^2}dx$, and will give here a short table of its values.

Table of the Values of the Integral $\mathrm{I} = \frac{2}{\sqrt{\pi}}\int_0^{r} e^{-x^2}dx.$

r	I	r	I	r	I	r	I
0.00	0.00000	.2	.22270	1.3	.93401	2.4	.99931
.01	.01128	.3	.32863	1.4	.95229	2.5	.99959
.02	.02256	.4	.42839	1.5	.96611	2.6	.99976
.03	.03384	.5	.52050	1.6	.97635	2.7	.99987
.04	.04511	.6	.60386	1.7	.98379	2.8	.99992
.05	.05637	.7	.67780	1.8	.98909	2.9	.99996
.06	.06762	.8	.74210	1.9	.99279	3.0	.99998
.07	.07886	.9	.79691	2.0	.99532	∞	1.00000
.08	.09008	1.0	.84270	2.1	.99702		
.09	.10128	1.1	.88020	2.2	.99814		
.1	.11246	1.2	.91031	2.3	.99886		

If the value of I is 0.5, or ½, $r = .4769$.

10. The second term in formula (11) expresses the probability that the number of occurrences of the event shall be exactly $m + r$ or $m - r$, or more correctly the mean of these two probabilities. It may be neglected when the number of trials N is very great and the deviation r not a very small number.

We see from the foregoing table that when

$$ra = \frac{r}{\sqrt{2pq\mathrm{N}}} = 3$$

it becomes practically a certainty that the number of occurrences will fall between the limits $m \pm r$.

Thus, suppose a shilling is tossed 200 times in succession; here $p = q = \frac{1}{2}$ and $a = \frac{1}{\sqrt{2pq\mathrm{N}}} = \frac{1}{10}$. If therefore $r = 30$, it may be called a certainty that head will turn up more than 70 and less than 130 times.

In the same case suppose we wish to find the limits $m \pm r$ such that it is an even chance that the number of heads shall fall between them, if the second term of (11) be neglected, we see from the table that

$$ra = \frac{1}{10}r = .48, \therefore r = 4.8;$$

so that the probability that the number of heads shall fall between 95 and 105 is

$$p_5 = .52 + \frac{1}{10\sqrt{\pi}}e^{-\frac{1}{4}} = .57 \text{ nearly,}$$

rather more than an even chance.

11. Neglecting the second term of (11), we see that p_r depends solely on the value of ra, or that of $\frac{r}{\sqrt{\mathrm{N}}}$; so that if the number of trials N be increased, the value of r, to give the same probability, *increases as the square root of N*; thus, if in N trials it is practically certain (when $ra = 3$) that the number of occurrences lies between $p\mathrm{N} \pm r$, then if the number of trials be doubled, it will be certain that the occurrences will lie between $2p\mathrm{N} \pm r\sqrt{2}$.

In all cases, if N be given, r can be determined, so that there is a probability amounting to certainty that *the ratio of the number of occurrences to the whole number of cases shall* lie between the limits

$$p \pm \frac{r}{\mathrm{N}}.$$

Now if N be increased $r \propto \sqrt{\mathrm{N}}$; so that these limits are

$$p \pm \frac{\mathrm{C}}{\sqrt{\mathrm{N}}},$$

C being a constant. Hence *it is always possible to increase the number of trials till it becomes a certainty that the proportion of occurrences of the event will differ from* p, *its probability*

a single trial, by a quantity less than any assignable. This is the celebrated theorem given by James Bernoulli in the *Ars Conjectandi*. (See Todhunter's *History*, p. 71.)

12. We will give here a graphical representation (Fig. 1), taken from M. Quetelet's *Lettres sur la Théorie des Probabilités*, of the facilities of the different numbers of successes which may occur in 1000 trials as to any event which is equally likely to happen as not in each trial—as in 1000 tosses of a coin, or 1000 drawings from an urn containing one white and one black ball, replacing the ball each time—or again in drawing 1000 balls together from an urn containing a great number of black and white in equal proportion.

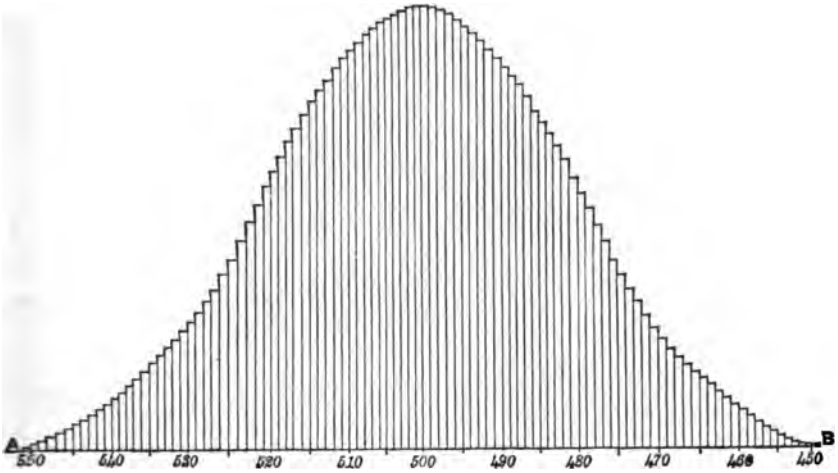


FIG. 1.

As $p = q = \frac{1}{2}$, we find from formula (8) that the chance of exactly half the entire number drawn, viz., 500, being white is

$$T = \frac{1}{\sqrt{500\pi}} = .02523;$$

and the chance for any number $500 \pm s$ is found by multiplying T by $e^{-\frac{s^2}{500}}$.

If then we take the central ordinate to represent T on any scale, and arrange along the horizontal line AB the different numbers of white balls which may occur, and erect opposite each number an ordinate representing the probability of that number, we have a graphical diagram of the relative possibilities of all possible proportions of black and white in the result.

We see from it that all values of the number of white balls drawn less than 450, or greater than 550, may be considered impossible, the probabilities for them being excessively small.

The probability of the number of white balls falling between any two assigned limits, as 490 and 520, is found by measuring the area of the figure comprised between the two ordinates opposite those numbers, and dividing the result by the total area.

II. PROBABILITY OF FUTURE EVENTS DEDUCED FROM EXPERIENCE.

13. In our ignorance of the causes which influence future events, the cases are rare in which we know *a priori* the chance, or "facility," of the occurrence of any given event, as we do, for instance, that of a coin turning up head when tossed. In other cases we have to judge of the chances of it happening from experience alone. We could not say what is the chance that snow will fall in the month of March next from our knowledge of meteorology, but have to go back to the recorded facts. In walking down a certain street at 5 o'clock on three different days, I have twice met a certain individual, and wish to estimate from these data the likelihood of again meeting him under the same circumstances—in ignorance of the real state of things, viz., that he lives in that street, and returns from his business at that hour. Such is nearly the position in which we stand as to the probabilities of the future in the majority of cases.

We have to judge then, from certain recorded facts of the probability of the causes which have occasioned them, and thence to deduce the probabilities of future events occurring under the operation of the same causes. The term "cause" is not here used in its metaphysical sense, but as simply equivalent to "antecedent state of things."

Let us suppose two urns, A containing two white balls, B containing one white and one black ball, and that a person not knowing which is which has drawn a white ball from one, to find the probability that this is the urn A. This is in fact to find, supposing a great number of such drawings to be made, what proportion of them have come from the urn A. If a great number N of drawings are made indiscriminately from both urns, $\frac{1}{2}$ N come from the urn A and are all white, $\frac{1}{4}$ N white come from the urn B, and $\frac{1}{4}$ N black. The drawing actually made is either one of the $\frac{1}{2}$ N white from A, or of the $\frac{1}{4}$ N white from B. As it is equally likely to have been any one of these, the chance that it came from A is $\frac{1}{2}$ N ÷ $\frac{3}{4}$ N, or $\frac{2}{3}$.

Suppose there had been two urns A and three urns B, and a white ball has been drawn from one of the five; as in a great number N of drawings $\frac{2}{5}$ N come from A and are white, $\frac{3}{5}$ N from B and $\frac{1}{2}$ of them are white, the chance that it came from one of the urns A is

$$\tfrac{2}{5} \div (\tfrac{2}{5} + \tfrac{1}{2} \cdot \tfrac{3}{5}) = \tfrac{4}{7}.$$

In general suppose an event to have occurred which must have been preceded by one of several *causes*, and let the antecedent probabilities of the causes be

$$P_1, P_2, P_3 \ . \ . \ .$$

and let p_1 be the probability that when the first cause exists the event will follow, p_2 the same probability when the second cause exists, and so on, to find *after the event* has occurred, the probabilities of the several causes or hypotheses.

Let a great number N of trials be made; out of these the number in which the first cause exists is P_1N, and out of this number the cases in which the event follows are p_1P_1N; in like manner the cases in which the second cause exists and the event follows are p_2P_2N; and so on. As the event has happened, the actual case is one out of the number

$$(p_1P_1 + p_2P_2 + p_3P_3 + \text{etc.})N,$$

and as the number in which the first cause was present is p_1P_1N the *a posteriori* probability of that cause is

$$\pi_1 = \frac{p_1P_1}{p_1P_1 + p_2P_2 + p_3P_3 + \text{etc.}} \quad . \quad (12).$$

So likewise for the other causes,—the sum of these *a posteriori* probabilities being

$$\pi_1 + \pi_2 + \pi_3 + \ . \ . \ . \ . = 1.$$

Supposing the event to have occurred as above, we now see how the probability as to the future, viz., whether the event will happen or fail in a fresh trial, is affected by it. If the first cause exists, the chance that it will happen is p_1; hence the chance of its happening from the first cause is $p_1\pi_1$; so likewise for the second, third, etc. Hence the probability of succeeding on a second trial is

$$p_1\pi_1 + p_2\pi_2 + p_3\pi_3 + \ . \ . \ (13).$$

14. To give a simple example: suppose an urn to contain three balls which are white or black; one is drawn and found to be white. It is replaced in the urn and a fresh drawing made; find the chance that the ball drawn is white. There are three hypotheses, which are taken to be equally probable *a priori*, viz., the urn contains three white, two white, or one white—that of none white being now impossible. The probability after the event of the first is by (12).

$$\frac{\frac{1}{3}}{\frac{1}{3} + \frac{2}{3} \cdot \frac{1}{3} + \frac{1}{3} \cdot \frac{1}{3}} = \tfrac{1}{2};$$

that of the second is $\frac{1}{3}$, that of the third $\frac{1}{6}$.

Hence the chance of the new drawing giving a white ball is

$$\tfrac{1}{2} + \tfrac{2}{3} \cdot \tfrac{1}{3} + \tfrac{1}{3} \cdot \tfrac{1}{6} = \tfrac{7}{9}.$$

15. The calculations required in the application of formulas (12) and (13) are often tedious, and such questions may often be solved in a simpler manner. Let us consider the following:

An urn contains n black or white balls. A ball is drawn and replaced; if this has been done r times, and in every case a white ball has appeared, to find the chance that the $(r+1)$th drawing will give a white ball.

If s drawings are made successively from an urn containing n balls, always replacing the ball drawn, the number of different ways this may be done is clearly n^s.

If there be $n+1$ such urns, one with 0 white balls, one with one white, one with 2 white, etc., the last with n white, the whole number of ways in which r drawings can be made from any one of them is $(n+1)n^r$.

Now the number of ways in which r drawings, *all white*, can be made from the first is 0, from the second 1^r, from the third 2^r, from the fourth 3^r, and so on; so that the whole number of ways in which r drawings of a white ball can be made from the $n+1$ urns is

$$1^r + 2^r + 3^r + \ldots n^r.$$

Hence *the chance that if* r *drawings are made from an urn containing* n *black or white balls all shall be white is*

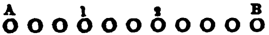
$$p^r = \frac{1^r + 2^r + 3^r + \ldots n^r}{(n+1)n^r},$$

for all we know of the contents of such an urn is that they are equally likely to be those of any one of the $n+1$ urns above.

If now a great number N of trials of r drawings be made from such urns, the number of cases where all are white is p_r N. If $r+1$ drawings are made the number of cases where all are white is p_{r+1}N; that is, out of the p_r N cases where the first r drawings are white there are p_{r+1}N where the $(r+1)$th is also white; so that the probability sought for in the question is

$$\varpi = \frac{p_{r+1}}{p_r} = \frac{1}{n} \frac{1^{r+1} + 2^{r+1} + 3^{r+1} + \ldots n^{r+1}}{1^r + 2^r + 3^r + \ldots n^r}.$$

16. Let us consider the same question *when the ball is not replaced*. First suppose the n balls arranged in a row from A to B as below, the white on the left, the black on the right, the arrow marking the point of separation, which point is unknown (as it would be to a blind man), and is equally likely to be in any of its $n+1$ possible positions.



Now if two balls, 1 and 2, are selected at random, the chance that both are white is the chance of the arrow falling in the division 2B of the row. But this chance is the same as that of a third ball 3 (different from 1 and 2), chosen at random, falling in 2B—which chance is ⅓, because it is equally probable that 1, 2, or 3 shall be the last in order. It is easy to see that these chances are the same if we reflect that, the ball 3 being equally likely to fall in A1, 12, or 2B, the number of possible positions for the arrow in each division always exceeds by 1 the number of positions for 3; therefore as 3 is equally likely to fall in any of the three divisions, so is the arrow.

The chance that two balls drawn at random shall both be white is thus ⅓; in the same way that for three balls is ¼, and so on. Hence the chance that r balls drawn shall all be white is

$$p_r = \frac{1}{r+1};$$

the same chance for $r+1$ balls is

$$p_{r+1} = \frac{1}{r+2};$$

thus, as in a large number N of trials the number of cases where the first r drawn are white is p_rN, and the number where the first $r+1$ are white is p_{r+1}N, we have the result:

If r balls are drawn and all prove to be white, the chance that the next drawn shall also be white is

$$\varpi = \frac{p_{r+1}}{p_r} = \frac{r+1}{r+2}.$$

This result is thus independent of n the whole number of balls. This result applies to repeated trials as to any event, provided we have really no *a priori* knowledge as to the chance of success or failure on one trial, so that all values for this chance are equally likely before the trial or trials. Thus, if we see a stranger hit a mark four times running, the chance he does so again is ⅚; or, if a person, knowing nothing of the water where he is fishing, draws up a fish each time in four casts of his line, the same is the chance of his succeeding a fifth time.[1]

In cases where we know, or rather think we know, the facility as to a single trial, if the result of a number of trials gives a large difference in the proportion of successes to failures from what we should anticipate, this will afford an appreciable presumption that our assumption as to the facility was erroneous, as indeed common sense indicates. If a coin turns up head twenty times running, we should say the two faces are probably not alike, or that it was not thrown fairly. We shall see later on, when we come to treat of the combination of separate probabilities as to the same event, the method of dealing with such cases (see art. 3[illegible]).

We will give another example which may be easily solved by means of (12), or by the simpler process below.

There are n horses in a race, about which I have no knowledge except that one of the horses A is black; as to the result of the race I have only the information that a black horse has certainly won: to find the chance that this was A—supposing the proportion of black among race-horses in general to be p; *i. e.*, the probability that any given horse is black is p.

Suppose a large number N of trials made as to such a case. A wins in $\frac{1}{n}$N of these. Another horse B wins in $\frac{1}{n}$N; out of these B is black in $\frac{1}{n}$Np. Likewise for C; and so on. Hence the actual case which has occurred is one out of the number

$$\frac{1}{n}\text{N} + \frac{n-1}{n}\text{N}p;$$

and, as of these the cases in which A wins are $\frac{1}{n}$N, the required chance that A has won is

$$\frac{1}{1+(n-1)p}.$$

17. We now proceed to consider the important theorem of Bayes (see Todhunter, p. 294; Laplace, *Théorie Analytique des Prob.*, chap. 6), the object of which is to deduce from the experience of a given number of trials, as to an event which must happen or fail on each trial, the information thus afforded as to the real facility of the event in any one trial, which facility is identical with the proportion of successes out of an infinite number of trials, were it possible to make them.

Thus we find in the Carlisle Table of Mortality that of 5642 persons aged thirty 1245 died before reaching fifty; it becomes then a question how far we can rely on the real facility of the event, that is, the proportion of mankind aged thirty who die before fifty not differing from the ratio $\frac{1245}{5642}$ by more than given limits of excess or defect. Again it may be asked, if 5642 (or any other number of) fresh trials be made, what is the probability that the number of deaths shall not differ from 1245 by more than a given deviation?

The question is equivalent to the following: An urn contains a very great number of black and white balls, the proportion of each being unknown; if, on drawing $m+n$ balls, m are found white and n black, to find the probability that the proportion of the numbers in the urn of each colour lies between given limits.

The question will not be altered if we suppose all the balls ranged in a line AB (Fig. 2), the white ones on the left, the black on the right, the point X where they meet being unknown and all positions for it in AB being *a priori* equally probable. The $m+n$ points having been chosen at random in AB, m are found to fall on AX, n on XB. That is, all we know of X is that it is the $(m+1)$th in order beginning from A of $m+n+1$ points chosen at random in AB. If we put AB $=1$, AX $=x$, the number of cases when the point X falls on the element dx, is measured by

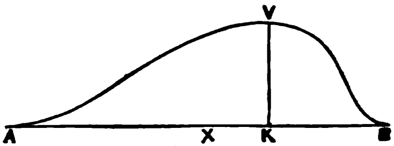


FIG. 2.

$$\frac{\lfloor m+n}{\lfloor m\,\lfloor n}\, x^m(1-x)^n dx,$$

since for a specified set of m points, out of the $m+n$, falling on AX, the measure would be $x^m(1-x)^n dx$, and the number of such sets is $\frac{\lfloor m+n}{\lfloor m\,\lfloor n}$. Now the whole number of cases is given by integrating this differential from 1 to 0; and the number in which X falls between given distances α, β from A is found by integrating from β to α. Hence the probability

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[1] It may be asked why the above reasoning does not apply to the case of the chance of a coin which has turned up head r times doing so once more. The reason is that the antecedent probabilities of the different hypotheses are not equal. Thus, let a shilling have turned up head once; to find the chance of its doing so a second time. In formula (12) three hypotheses may be made as to a double: throw 1° two heads, 2° a head and tail, 3° two tails; but the probabilities of these are respectively ¼, ½, ¼; therefore by (12) the probability of the 1st after the event is ¼ ÷ (¼ + ½ . ½) = ½; that of the second is also ½; and by (13) the probability of succeeding on a second trial is

$$\tfrac{1}{2} + \tfrac{1}{2} . 0 = \tfrac{1}{2},$$

because, if hypothesis 2° is the true one, the second trial must fail.

hat the ratio of the white balls in the urn to the whole number ies between any two given limits α, β is

$$p=\frac{\int_{\alpha}^{\beta}x^m(1-x)^n dx}{\int_0^1 x^m(1-x)^n dx}\quad .\ .\ .\ .\ .\ (14).$$

The *curve of frequency* for the point X after the event—that s, the ordinate of which at any point of AB is proportional o the frequency or density of the positions of X in the mmediate vicinity of that point—is

$$y=x^m(1-x)^n;$$

he maximum ordinate KV occurs at a point K, dividing B in the ratio $m:n$,—the ratio of the total numbers of hite and black balls being thus more likely to be that of he numbers of each actually drawn than any other.

Let us suppose, for instance, that three white and two lack have been drawn; to find the chance that the proporion of white balls is between ⅖ and ⅘ of the whole; that is, hat it differs by less than ± ⅕ from ⅗, its most natural alue.

$$p=\frac{\int_{\frac{2}{5}}^{\frac{4}{5}}x^3(1-x)^2dx}{\int_0^1 x^3(1-x)^2dx}=\frac{2256}{5^5}=\frac{18}{25}\text{ nearly.}$$

18. An event has happened m times and failed n times in $+n$ trials. To find the probability that in $p+q$ further ials it shall happen p times and fail q times,—that is, that $+q$ more points being taken at random in AB, p shall fall AX and q in XB. The whole number of cases is measured y

$$AB)^{p+q}\frac{|\underline{m+n}}{|\underline{m}\,|\underline{n}}\int_0^1 x^m(1-x)^n dx=\frac{|\underline{m+n}}{|\underline{m}\,|\underline{n}}\int_0^1 x^m(1-x)^n dx.$$

The number of favorable cases, when any *particular set* of points, out of the $p+q$ additional trials, falls in AX, is easured by

$$\frac{|\underline{m+n}}{|\underline{m}\,|\underline{n}}\int_0^1 x^{m+p}(1-x)^{n+q}dx,$$

ecause, the number of cases as to the $m+n$ points being, hen X falls on the element dx,

$$\frac{|\underline{m+n}}{|\underline{m}\,|\underline{n}}x^m(1-x)^n dx,$$

ch of these affords $x^p(1-x)^q$ cases where p new points fall AX, and q on XB.

Now, the number of different sets of p points being

$$\frac{|\underline{p+q}}{|\underline{p}\,|\underline{q}},$$

e required probability is

$$\varpi=\frac{|\underline{p+q}}{|\underline{p}\,|\underline{q}}\frac{\int_0^1 x^{m+p}(1-x)^{n+q}dx}{\int_0^1 x^m(1-x)^n dx}\quad .\ .\ .\ (15);$$

, by means of the known values of these definite integrals,

$$\varpi=\frac{|\underline{p+q}}{|\underline{p}\,|\underline{q}}\cdot\frac{|\underline{m+p}\,|\underline{n+q}}{|\underline{m}\,|\underline{n}}\cdot\frac{|\underline{m+n+1}}{|\underline{m+n+p+q+1}}\quad .\ .\ (16).$$

For instance, the chance that in one more trial the event all happen is $\frac{m+1}{m+n+2}$. This is easy to verify, as the line B has been divided into $m+n+2$ sections by the $m+n+1$ ints taken on it (including X). Now if one more trial is ade, *i.e.*, one more point taken at random, it is equally ely to fall in any section; and $m+1$ sections are favorable.

19. When the number of trials $m+n$ in art. 17 is large, probability is considerable that the facility of the event a single trial will not differ from its most natural value, ., $\frac{m}{m+n}$ by more than a very small deviation. To make is apparent, we shall have to modify the formula (14), ich gives for the chance that this facility lies between limits α and β (by substituting for the denominator its own value),

$$p=\frac{|\underline{m+n+1}}{|\underline{m}\,|\underline{n}}\int_{\alpha}^{\beta}x^m(1-x)^n dx\quad .\ .\ .\ .(17).$$

To find now the probability that the facility lies between the limits $\beta=\frac{m}{m+n}+\delta$, and $\alpha=\frac{m}{m+n}-\delta$, where δ is small. Put for x, $\frac{m}{m+n}+x$; and (17) becomes

$$p=\frac{|\underline{m+n+1}}{|\underline{m}\,|\underline{n}}\int_{-\delta}^{\delta}\left(\frac{m}{m+n}+x\right)^m\left(\frac{n}{m+n}-x\right)^n dx.$$

Now if x is small, and we put $u=(a+x)^m$,

$$\log u=m\log a+m\frac{x}{a}-\frac{mx^2}{2a^2}$$

$$\therefore u=a^m e^{\frac{mx}{a}-\frac{mx^2}{2a^2}}$$

correct as far as the square of x. Hence the two factors under the sign of integration become

$$\frac{m^m}{(m+n)^m}e^{(m+nx)-\frac{(m+n)^2}{2m}x^2},\text{ and }\frac{n^n}{(m+n)^n}e^{-(m+n)x-\frac{(m+n)^2}{2n}x^2};$$

so that

$$p=\frac{|\underline{m+n+1}}{|\underline{m}\,|\underline{n}}\frac{m^m n^n}{(m+n)^{m+n}}\int_{-\delta}^{\delta}e^{-\frac{(m+n)^3}{2mn}x^2}dx\quad .\ .\ (18).$$

Now, since by Stirling's theorem $\underline{m}=m^{m+\frac{1}{2}}e^{-m}\sqrt{2\pi}$, the constant coefficient here becomes

$$\frac{(m+n+1)(m+n)^{m+n+\frac{1}{2}}e^{-m-n}\sqrt{2\pi}}{m^m.n^n.\,e^{-m-n}2\pi\sqrt{mn}}\frac{m^m n^n}{(m+n)^{m+n}}=\frac{(m+n)^{\frac{3}{2}}}{\sqrt{2mn\pi}},$$

taking $m+n+1=m+n$. Now if we substitute in (18)

$$t=x\frac{(m+n)^{\frac{3}{2}}}{\sqrt{2mn}}\quad .\ .\ .\ .\ .\ .\ .\ (19),$$

$$p=\frac{1}{\sqrt{\pi}}\int_{-\lambda}^{\lambda}e^{-t^2}dt,$$

where

$$\lambda+\delta\frac{(m+n)^{\frac{3}{2}}}{\sqrt{2mn}}\quad .\ .\ .\ .\ .\ .\ .\ (20),$$

or finally

$$p=\frac{2}{\sqrt{\pi}}\int_0^{\lambda}e^{-t^2}dt,\quad .\ .\ .\ .\ .\ .\ .\ .\ .\ (21),$$

for the approximate value of the probability that the real facility of the event lies between the limits $\frac{m}{m+n}\pm\delta$.

Thus, if out of 10,000 trials, the event has happened 5000 times, the probability that, out of an infinite number, the number of successes shall lie between $\frac{1}{2}\pm\frac{1}{200}$, or between $\frac{101}{200}$ and $\frac{99}{200}$, of the whole, will be

$$p=.678=\tfrac{2}{3}\text{ nearly,}$$

for we find from (20) $\lambda=\frac{10^6}{\frac{1}{2}10^4\sqrt{2}}\cdot\frac{1}{200}=.7$ nearly; and, referring to the table in art. 9, we find the above value for the integral (21).

We must refer to the sixth chapter of Laplace for the investigation of how far the number of successes in a given number of fresh trials may be expected to deviate from the natural proportion, viz., that of the observed cases—as also for several closely allied questions, with important applications to statistics.

III. On Expectation.

20. The value of a given chance of obtaining a given sum of money is the chance multiplied by that sum; for in a great number of trials this would give the sum actually realized. The same may be said as to loss. Thus if it is 2 to 1 that a horse will win a race, it is considered a fair wager to lay £10 [$48.60] to £20 [$97.20] on the result; for the value of the expected gain is ⅔ of 10, and that of the expected loss ⅓ of 20, which are equal. Thus, if the probabilities for and against an event are p, q, and I arrange in any way to gain a sum a if it happens and lose a sum b if it fails, then if $pa=qb$ I shall neither gain nor lose in the long run; but if the ratio $a:b$ be less than this, my expectation of loss exceeds that of gain; or, in other words, I must lose in the long run.

The above definition is what is called the *mathematical expectation;* but it clearly is not a proper measure of the advantage or loss to the individual; for a poor man would undoubtedly prefer £500 [$2430] down to the chance of £1000 [$4860] if a certain coin turns up head. The importance of a sum of money to an individual, or its *moral value*, as it has been called, depends on many circumstances which it is impossible to take into account; but, roughly and generally, there is no doubt that Daniel Bernoulli's hypothesis, viz., that this importance is measured by *the sum divided by the fortune of the individual*[1]—is a true and natural one. Thus, generally speaking, £5 [$24.30] is the same to a man with £1000 [$4860] as £50 [$243] to one with £10,000 [$48,600]; and it may be observed that this principle is very generally acted on in taxation, etc.

21. To estimate, according to this hypothesis, the advantage or moral value of his whole fortune to the individual, or his *moral fortune*, as Laplace calls it, in contradistinction to his *physical fortune*, let x=his *physical* fortune, y=his *moral* fortune, then, if the former receive an increment dx, we have, from Daniel Bernoulli's principle,

$$dy=k\frac{dx}{x};$$

$$\therefore\ y=k\log\frac{x}{h}\quad\ldots\ldots\ldots\quad(22),$$

k, h being two constants. x and y are always positive, and $x > h$; for every man must possess some fortune or its equivalent, in order to live.

22. To estimate now the value of a *moral expectation*. Suppose a person whose fortune is a to have the chance p of obtaining a sum α, q of obtaining β, r of obtaining γ, etc., and let

$$p+q+r+\ldots=1,$$

only one of the events being possible. Now his moral expectation from the first chance—that is, the increment of his moral fortune into the chance—is

$$pk\left\{\log\frac{a+\alpha}{h}-\log\frac{a}{h}\right\}=pk\log(a+\alpha)-pk\log a.$$

Hence his whole moral expectation is[2]

$E=kp\log(a+\alpha)+kq\log(a+\beta)+kr\log(a+\gamma)+\ldots-k\log a$; and, if Y stands for his moral fortune including this expectation, that is $k\log\frac{a}{h}+E$, we have

$$Y=kp\log(a+\alpha)+kq\ g(a+\beta)+\ldots-k\log h\quad.\ .\ .\quad(23).$$

Let X be the physical fortune corresponding to this moral one, by (22)

$$Y=k\log X-k\log h.$$

Hence $\quad X=(a+\alpha)^p(a+\beta)^q(a+\gamma)^r\quad\ldots\ldots\quad(24);$

and $X-a$ will be the actual or physical increase of fortune which is of the same value to him as his expectation, and which he may reasonably accept in lieu of it.

The mathematical value of the same expectation is

$$p\alpha+q\beta+r\gamma+\quad\ldots\ldots\quad(25).$$

23. Several results follow from (24). Thus, if the sums α, β, γ . . . are very small, it is easy to see that the moral expectation concides with the mathematical, for

$$X=a^{+p+q+\cdot\cdot}\left(1+\frac{\alpha}{a}\right)^p\left(1+\frac{\beta}{a}\right)^q\cdot\cdot=a^{+1}\left(1+p\frac{\alpha}{a}+q\frac{\beta}{a}+\cdot\cdot\right);$$

$$\therefore X=a+p\alpha+q\beta+\ldots$$

24. We may show also that it is disadvantageous to play at even a fair game of chance (unless the stakes are very small, in which case the last article applies). Thus, suppose a man whose fortune is a plays at a game where his chance of winning a sum α is p, and his chance of losing a sum β is $q=1-p$. If the game is fair,

$$p\alpha=q\beta$$

Now by (24) the physical fortune which is equivalent to his prospects after the game is

$$X=(a+\alpha)^p(a-\beta)^q$$

or $$X=(a+\alpha)^{\frac{\beta}{\alpha+\beta}}(a-\beta)^{\frac{\alpha}{\alpha+\beta}}.$$

Now the geometrical mean of r quantities is less than the arithmetical,[3] so that if there are β quantities $a+\alpha$, and α quantities $a-\beta$,

$$\left\{(a+\alpha)^{\beta}(a-\beta)^{\alpha}\right\}^{\frac{1}{\alpha+\beta}}<\frac{\beta(a+\alpha)+\alpha(a-\beta)}{\alpha+\beta},$$

or $$X<a,$$

so that he must expect morally to lose by the game.

25. The advantage of *insurance* against risks may be seen by the following instance. A merchant, whose fortune is represented by 1, will realize a sum ϵ if a certain vessel arrives safely. Let the probability of this be p. To make up exactly for the risk run by the insurance company, he should pay them a sum

$$(1-p)\epsilon.$$

If he does, his moral fortune becomes by (22)

$$k\log\frac{1+p\epsilon}{h};$$

while, if he does not insure, it will be (23).

$$kp\log\frac{1+\epsilon}{h}.$$

Now the first of these exceeds the second, so that he gains by insuring on these terms; because

$$\log(1+p\epsilon)>p\log(1+\epsilon),$$

that is $$(1+p\epsilon)^{\frac{1}{p}}>1+\epsilon;$$

for, putting $p=\frac{m}{m+n}$,

$$\left(\frac{m(1+\epsilon)+n}{m+n}\right)^{m+n}>(1+\epsilon)^m,$$

because (see note art. 24), if $m(1+\epsilon)+n$ is divided into $m+n$ equal parts, their product is greater than that of m parts each equal to $1+\epsilon$ and n parts each equal to 1.

The merchant will still gain by paying, over and above what covers the risk of the company, a sum α, at most, which satisfies

$$\log(1-\alpha+p\epsilon)=p\log(1+\epsilon);$$
$$\therefore\alpha=1+p\epsilon-(1+\epsilon)^p.$$

By paying any sum not exceeding this value, he still gains, while the insurance office also makes a profit, which is really a certainty when it has a large business; so that, as Laplace remarks, this example explains how such an office renders a real service to the public, while making a profit for itself. In this it differs from a gambling establishment, in which case the public must lose, in any sense of the term.

It may be shown that it is better to expose one's fortune in separate sums to risks independent of each other than to expose the whole to the same danger.[4] Suppose a merchant having a fortune a, has besides a sum ϵ which he must receive if a ship arrives in safety. By (24) the value in money of his present fortune is

$$X=(a+\epsilon)^p a^q,$$

where p = chance of the ship arriving, and $q=1-p$.

Now suppose he risks the same sum in two equal portions in two ships. We cannot apply (23), as the events are not mutually exclusive; but we see that, if both ships arrive, the chance of this being p^2, he realizes the whole sum ϵ; if one only arrives, the chance being $2pq$, he receives $\frac{1}{2}\epsilon$; if both are lost, the chance being q^2, he loses all. Thus (24) his is now worth a sum.

$$X'=(a+\epsilon)^{p^2}(a+\tfrac{1}{2}\epsilon)^{2pq}a^{q^2}.$$

Now this sum is greater than the former; for

$$(a+\epsilon)^{p^2-p}.(a+\tfrac{1}{2}\epsilon)^{2pq}.a^{q^2-q}>1,$$

that is, $$(a+\epsilon)^{-pq}(a+\tfrac{1}{2}\epsilon)^{2pq}a^{-pq}>1;$$

for $$\frac{(a+\frac{1}{2}\epsilon)^2}{a(a+\epsilon)}>1,$$

as is obviously true.

Now suppose he risks the sum ϵ in *three* separate ventures. His fortune will be

$$X''=(a+\epsilon)^{p^3}.(a+\tfrac{2}{3}\epsilon)^{3p^2q}.(a+\tfrac{1}{3}\epsilon)^{3pq^2}a^{q^3};$$

---

[1] This rule must be understood to hold only when the sum is very small, or rather infinitesimal, strictly speaking. It would lead to absurdities if it were used for large increments (though Buffon has done so; see Todhunter, p. 345). Thus, to a man possessing £100, it is of the same importance to receive a gift of £100 as two separate gifts of £50; but this rule would give as the measure of the importance of the first $\frac{100}{100}=1$: while in the other case, it would give $\frac{50}{100}+\frac{50}{150}=\frac{5}{6}$. The real measure of the importance of an increment when not small is a matter for calculation, as shown in the text.

[2] It is important to remark that we should be wrong in thus adding the expectations if the events were not mutually exclusive. For the mathematical expectations it is not so.

[3] A very simple proof of this principle is as follows.—let a number N be divided into r parts a, b, c, etc.; if any two of these, as a, b, are unequal, since

$$\left(\frac{a+b}{2}\right)^2>ab,$$

it follows that the product $abcd\ldots$ is increased by substituting $\frac{a+b}{2}$, $\frac{a+b}{2}$, for a and b. Hence as long as any two are unequal we can divide N differently so as to obtain a greater product, and therefore when the parts are all equal the product is greatest, or

$$\left(\frac{a+b+c+\ldots}{r}\right)^r>abc\ldots$$

[4] The familiar expression not to "put all one's eggs in the same basket" shows us how general common sense has recognized this principle.

and we have to show that this is worth more than when there were two. If we put a outside each bracket, and put $\delta = \frac{\epsilon}{3a}$ we have to prove

$$(1+3\delta)^{p^3}(1+2\delta)^{3p^2q}.(1+\delta)^{3pq^2} > (1+3\delta)^{p^2}.(1+\tfrac{3}{2}\delta)^{2pq};$$

or $$(1+3\delta)^{p^2-p}.(1+2\delta)^{3pq}(1+\delta)^{3q^2} > (1+\tfrac{3}{2}\delta)^{2q};$$

or, since $p^2 - p = -pq$,

$$(1+3\delta)^{-p}(1+2\delta)^{3p}(1+\delta)^{3q} > (1+\tfrac{3}{2}\delta)^2,$$

or $$\left\{\frac{(1+2\delta)^3}{(1+3\delta)(1+\delta)^3}\right\}^p(1+\delta)^3 > (1+\tfrac{3}{2}\delta)^2;$$

now $$(1+2\delta)^3 < (1+\delta)^3(1+3\delta);$$

hence the fraction in the brackets is always less than its pth power as $p<1$; and we can now show that

$$\frac{(1+2\delta)^3}{(1+3\delta)(1+\delta)^3}(1+\delta)^3 > (1+\tfrac{3}{2}\delta)^2,$$

that is, $$(1+2\delta)^3 > (1+3\delta)(1+\tfrac{3}{2}\delta)^2,$$

or $$1+6\delta+12\delta^2+8\delta^3 > 1+6\delta+\tfrac{45}{4}\delta^2+\tfrac{27}{4}\delta^3.$$

Laplace shows (ch. x.) that the gain continues to increase by sub-division of the risk; it could no doubt be shown by ordinary algebra. He shows further that the moral advantage tends to become equal to the mathematical. This may be done more easily thus:

The expression is, when ϵ is divided into r equal parts.

$$X = (a+\epsilon)^{p^r}\left(a+\epsilon-\frac{\epsilon}{r}\right)^{rp^{r-1}q}\left(a+\epsilon-\frac{2\epsilon}{r}\right)^{\frac{r(r-1)}{2}p^{r-2}q^2}$$

and we have to find the limit towards which this tends as r becomes infinitely great.

Put $s = a + \epsilon$;

$$X = s^{p^r}\left(s-\frac{\epsilon}{r}\right)^{rp^{r-1}q}\left(s-2\frac{\epsilon}{r}\right)^{\frac{r(r-1)}{2}p^{r-2}q^2}\cdots\left(s-(r-1)\frac{\epsilon}{r}\right)^{rq^{r-1}p}\left(s-\epsilon\right)^{q^r}$$

Now in the binomial expansion

$$1 = p^r + rp^{r-1}q + \frac{r(r-1)}{1.2}p^{r-2}q^2 + .$$

he greatest term is the $(qr+1)$th, viz.,

$$T = \frac{r(r-1)\ldots(rp+1)}{1.2.3\ldots rq}p^{rp}q^{rq}$$

The factor in X corresponding to this is

$$\left(s - rq\frac{\epsilon}{r}\right)^T = U,^T$$

f we put $U = s - q\epsilon$.

Let us now express the binomial series before and after T thus:

$$1 = \ldots + T_3 + T_2 + T_1 + T + t_1 + t_2 + t_3 + \ldots$$

nd we have

$$X = \ldots\left(U+2\frac{\epsilon}{r}\right)^{T_2}\left(U+\frac{\epsilon}{r}\right)^{T_1}U^T\left(U-\frac{\epsilon}{r}\right)^{t_1}\left(U-2\frac{\epsilon}{r}\right)^{t_2}\ldots$$

The factors towards the beginning and end may be all aken as 1, because the terms of the binomial increase apidly in value from either end when $r=\infty$, and we shall ave the true limit for X by taking an indefinitely great umber of factors on either side of U, which number, however, may be infinitely less than r.

As the sth factors before and after U may be expressed hus (s being always very small compared to r)—

$$\left(Ue^{s\frac{\epsilon}{rU}}\right)^{T_s}, \left(Ue^{-s\frac{\epsilon}{rU}}\right)^{t_s},$$

nd as $\ldots T_2+T_1+T+t_1+t_2\ldots=1$, we have

$$X = Ue^{\frac{\epsilon}{rU}(\ldots 2T_2+T_1-t_1-2t_2-\ldots)}$$

Now we have seen in art. 8 that

$$T_s = Te^{-\frac{s^2}{2pqr}+\frac{p-q}{2pqr}s}, \quad t_s = Te^{-\frac{s^2}{2pqr}-\frac{p-q}{2pqr}s}$$

Hence $$T_s - t_s = Te^{-\frac{s^2}{2pqr}}\frac{p-q}{pqr}s;$$

$$\therefore sT_s - st_s = \frac{p-q}{pq}T.\frac{s^2}{r}e^{-\frac{s^2}{2pqr}}.$$

Hence the exponent of e above becomes

$$\frac{\epsilon}{rU}.\frac{p-q}{pq}T.\sum_{s=0}^{s=s_1}\frac{s^2}{r}e^{-\frac{s^2}{2pqr}},$$

s_1 being the extreme limit for s.

If we put $x = \frac{s}{\sqrt{r}}$, and $x^2e^{-\frac{x^2}{2pq}} = \phi(x)$

he above sum is

$$\phi(0)+\phi\left(\frac{1}{r^{\frac{1}{2}}}\right)+\phi\left(\frac{2}{r^{\frac{1}{2}}}\right)+\ldots\phi\left(\frac{s_1}{r^{\frac{1}{2}}}\right) = r^{\frac{1}{2}}\int_0^{\frac{s_1}{r^{\frac{1}{2}}}}\phi(x)dx.$$

Now it is easy to prove that

$$\int_0^{\infty} x^2e^{-\frac{x^2}{K}}dx \text{ is finite;}$$

and much more is it so when the superior limit is finite.

Hence the exponent of e becomes

$$\frac{\epsilon}{rU}\frac{p-q}{pq}T.r^{\frac{1}{2}}.K = \frac{\epsilon}{U}.\frac{p-q}{pq}.TKr^{-\frac{1}{2}},$$

where K is finite; so that the exponent becomes infinitesimal when $r=\infty$.

The limit therefore towards which X tends is

$$X = U = s - q\epsilon = a + p\epsilon,$$

that is, the mathematical value of the fortune.

The very important applications of probabilities to annuities and insurance are to be found in the articles on those subjects, to which therefore we refer the reader.

IV. PROBABILITY OF TESTIMONY.

26. We have here to treat of the probability of events attested by several witnesses of known credibility, or which have several different probabilities in their favor, derived from different independent sources of information of any kind, of known values.[1]

A witness may fail in two ways—he may be intentionally dishonest, or he may be mistaken; his evidence may be false, either because he wishes to deceive, or because he is deceived himself. However, we will not here take separate account of these two sources of error, but simply consider the probability of the truth of a statement made by a witness, which will be a true measure of the value of his evidence. To estimate this probability in any given case is not an easy matter; but if we could examine a large number of statements made by a certain person, and find in how many of them he was right, the ratio of these numbers would give the probability that any statement of his, taken at random, whether past or future, is a true one.

27. Suppose a witness, whose credibility is p, states that a fact occurred or did not occur, or that an event turned out in one way, when only two ways are possible. If nothing was known *a priori* as to the probability of the fact, or if its real facility was ½, it is clear that the probability that it did occur is p. For if a great number N of trials were made (either really as to the event, if its facility is known to be ½, as in tossing a coin; or as to it and other cases resembling it as to our ignorance of the real facility, if such is the state of things) in ½N the event happens, and out of these the witness asserts in ½pN cases that it did happen. Now, out of the whole number, he asserts in ½N cases that it happened, as there is no reason for his affirming oftener than he denies (or, it may be said, he affirms in ½pN cases where it did happen, and in ½$(1-p)$N cases where it did not). Hence, dividing the whole number of cases when it happens and he affirms it by the whole number of cases where he affirms it, we find ½pN ÷ ½N $= p$.

We have entered at length on the proof of what is almost self-evident (perhaps indeed included in the definition) in this case, because the same method will succeed in other cases which are not so easily to be discerned.

28. Let us now consider the same question when the *a priori* probability of the fact or event is known. Suppose a bag contains n balls, one white and the rest black, and the same witness says he has seen the white ball drawn; what is the chance that it was drawn?

A great number N of trials being made, the number in which the white ball is drawn is $\frac{1}{n}$N, and out of these he states it in $n^{-1}p$N cases. Out of the remaining $(1-n^{-1})$ N cases where a black ball was drawn, he says (untruly) that in $(1-p)(1-n^{-1})$ N cases it was white.

Now dividing the number of favorable cases, viz, those where he says it is white and it is so, by the whole number of cases, viz., those where he says it is white, we have for the probability required

$$\varpi = \frac{n^{-1}p}{n^{-1}p+(1-n^{-1})(1-p)} = \frac{p}{n-1-(n-2)p} \quad . \quad . \quad . \quad (26).$$

---

[1] The question now before us is quite different from that of the chance of an event happening or having happened which may happen in different ways, in which case we add the separate probabilities. Thus if there are but two horses in a race, of equal merit and belonging to one owner, his chance of winning is ½ + ½ = 1. But suppose I only know that one of the two is his, and, besides, some one whose credibility is ½ tells me he has won the race; here I have two separate probabilities of ½ each for the same event; but it would clearly be wrong to add them toget

This holds for any event whose *a priori* probability is n^{-1}.

If n be very large, this probability will be very small, unless p is nearly $=1$; and, indeed, if we go back to the common sense view, it is clear we should hesitate to believe a man who said he had drawn the white ball from a bag containing 10,000 balls, all but it being black. It may be observed that if $n=2$, $\varpi=p$, as in art. 27.

We have thus a scientific explanation of the universal tendency rather to reject the evidence of a witness than to accept the truth of a fact attested by him, when it is in itself of an extraordinary or very improbable nature.

29. Two independent witnesses, A and B, both state a fact, or that an event turned out in a particular way (only two ways being possible), to find the probability of the truth of the statement.

Supposing nothing is known *a priori* as to the event in question let a great number N of trials be made as to such events; the number of successes will be $\frac{1}{2}$N; out of these the witness A affirms the success in $\frac{1}{2}p$N cases; out of these the witness B affirms it, too, in $\frac{1}{2}pp'$N cases.[1] Out of the $\frac{1}{2}$N failures A affirms a success in $\frac{1}{2}(1-p)$N cases; and out of these B also affirms one in $\frac{1}{2}(1-p)(1-p')$N cases. Hence, dividing the favorable cases by the whole number the probability sought is

$$\varpi=\frac{pp'}{pp'+(1-p)(1-p')} \quad . \quad . \quad . \quad . \quad (27),$$

where p, p' are the credibilities of the two witnesses.

This very important result also holds if p be the probability of the event derived from any source, and p' the credibility of one witness, as in art. 28; or if p and p' be any independent probabilities, derived from any sources, as to one event.

30. We give another method of establishing the formula (27). Referring to art. 13, the observed event is the concurrent evidence of A and B that a statement is true. There are two *hypotheses*—that it is true or false. Antecedent to B's evidence the probabilities of these hypotheses are p and $1-p$ (art. 27), as A has said that it is true. The observed event now is that B says the same. On the first hypothesis, the probability that he will say this is p'; on the second it is $1-p'$. Hence by formula (12) the probability *a posteriori* of the first hypothesis, viz., that the joint statement is true, is, as before

$$\frac{pp'}{pp'+(1-p)(1-p')}.$$

31. If a third witness, whose credibility is p'', concurs with the two former, we shall have to combine p'' with ϖ in formula (27); hence the probability ϖ' of the statement when made by three witnesses is

$$\varpi'=\frac{\varpi p''}{\varpi p''+(1-\varpi)(1-p'')}=\frac{pp'p''}{pp'p''+(1-p)(1-p')(1-p'')} \quad . \quad . \quad (28);$$

and so on for any number.

As an example, let us find how many witnesses to a fact, the odds against which are 1,000,000,000,000 to 1, would be required to make it an even chance that the fact did occur, supposing the credibility of each witness to be $p=\frac{9}{10}$

Let x be the number.

$$\frac{1}{2}=\frac{10^{-12}p^x}{10^{-12}p^x+(1-10^{-12})(1-p)^x}=\frac{p^x}{p^x+10^{12}(1-p)^x};$$

$$\therefore 2=1+\frac{10^{12}}{9^x}$$

$$\therefore x=\frac{12}{\log 9}=12.6;$$

so that thirteen such witnesses would render the chance more than an even one.

32. Let us now consider an event which may turn out in more than two ways, and let each way be equally probable *a priori*, and suppose a witness whose credibility is p states that it turned out in a certain way; what is the chance that it did so?

Thus if a die has been thrown, and he states that ace turned up; or if tickets in a lottery are numbered 1, 2, 3, etc., and he states that 1 was drawn; to find the chance that he is right.

Take the case of the die, and suppose a great number N of throws. In $\frac{1}{6}$N the ace turns up, and he says so in $\frac{1}{6}p$N cases. In $\frac{1}{6}$N the two turns up, and he is wrong in $\frac{1}{6}(1-p)$N cases out of these; but he says ace is only $\frac{1}{5}$ of these, as there is no reason why he should give it more or less often than any of the five wrong numbers. In the same way for the other throws; so that the whole number of cases where he says ace turned up is

$$\tfrac{1}{6}p\text{N}+\tfrac{1}{5}\cdot\tfrac{5}{6}(1-p)\text{N}=\tfrac{1}{6}\text{N};$$

and, the number, out of these, when it actually turned up being $\frac{1}{6}p$N, we find *the chance it did turn up is p, the credibility of the witness.* In any such case, this result will hold. We might indeed safely have argued that when the die is thrown a great number of times, any witness, whatever his veracity, will quote each face as often as any other, as there is no reason for one to turn up oftener than another, nor for him to affirm, rightly or wrongly, one rather than another; so that he will say ace in $\frac{1}{6}$N of the throws, while he says ace in $\frac{1}{6}p$N out of the $\frac{1}{6}$N cases where it does turn up.

This result compared with art. 28 affords an apparent paradox. If a large number of tickets are marked 1,0,0,0, 0,0, ... and a witness states that 1 has been drawn from the bag, we see from art. 28 that the chance he is right is very small; whereas if the tickets were marked 1,2,3,4,5,6 . . . . and he states that 1 has been drawn, the chance he is right is p, his own credibility. However, we must remember that in the first case he is limited to two statements, 1 and 0, and he makes the first, which is very improbable in itself; whereas in the other case, the assertion he makes is in itself as probable as any other he can make—*e. g.*, that 2 was the ticket drawn—and therefore our expectation of its truth depends on his own credibility only.

33. Suppose now that *two* witnesses A, B both assert that the event has turned out in a certain way,—there being, as in art. 32, n equally probable ways.

Both, for instance, say that in a lottery numbered 1,2,3, 4,5 . . . . No. 1 has been drawn. A large number N of drawings being made, 1 is drawn in n^{-1}N cases; out of these A says 1 in $n^{-1}p$ N cases, and out of these B also says 1 in $n^{-1}pp'$N. No. 2 is drawn in n^{-1}N cases; here A is wrong in $n^{-1}(1-p)$N, but says 1 in only $(n-1)^{-1}n^{-1}(1-p)$N; and B will also say 1 in $(1-p')(n-1)^{-1}$ of these; that is, both agree that 1 has been drawn in

$$(n-1)^{-2}n^{-1}(1-p)(1-p')\text{N}$$

cases. So likewise if No. 3 has been drawn, and so on; hence, when No. 1 has not been drawn, they both say that it has in

$$n^{-1}(n-1)^{-1}(1-p)(1-p')\text{N}$$

cases. Hence the number of cases where they are right divided by the whole number of cases where they make the statement, that is, the probability that No. 1 has been drawn, is

$$\varpi=\frac{pp'}{pp'+(n-1)^{-1}(1-p)(1-p')} \quad . \quad . \quad . \quad . \quad (29).$$

If n be a large number the chance that they have named the ticket drawn is nearly certainty. Thus, if two independent witnesses both select the same man out of a large number, as the one they have seen commit a crime, the presumption is very strong against him. Of course, for the case to come under the above formula, it is supposed that some one of the number must be guilty.

34. In the same case, when the event may turn out in n ways not equally probable, as in a race between n horses A, B, C . . . . whose chances of winning are a, b, c . . . ., so that $a+b+c+\ldots=1$, if one witness whose credibility is p states that A has won, it is easily shown by the same reasoning as in art. 33 that the probability A has really won is

$$\varpi=\frac{ap}{ap+(1-a)(n-1)^{-1}(1-p)} \quad . \quad . \quad . \quad . \quad (30);$$

and if two witnesses say so, it is

$$\varpi=\frac{app'}{app'+(1-a)(n-1)^{-2}(1-p)(1-p')} \quad . \quad . \quad . \quad (31).$$

It is easily shown in formula (30) that if $p>n^{-1}$ the probability ϖ is increased by the testimony, beyond a, its antecedent value. Thus, suppose there are ten horses in a race, and that one of them, A, has a chance $\frac{1}{3}$ of winning, and that just after the race I learn that a black horse has won, black being A's color; now, if I know that $\frac{1}{3}$ of racehorses in general are black, this gives me a new chance $\frac{1}{3}$ (see art. 16) that A has won. Therefore from (30) the chance of the event is now $\frac{2}{15}=\frac{2}{3}$.

35. To illustrate the effect of *discordant* testimony. In art. 29 let A have asserted that the fact occurred, and let B deny it. It is easy to see that $1-p'$ is to be put for p', so that the probability that it did occur is

$$\varpi=\frac{p(1-p')}{p(1-p')+p'(1-p)} \quad . \quad . \quad . \quad . \quad . \quad (32);$$

if there had been an *a priori* probability a in favor of the fact this would have been

$$\varpi=\frac{ap(1-p')}{ap(1-p')+p'(1-a)(1-p)} \quad . \quad . \quad . \quad . \quad (33).$$

---

[1] Here we are assuming the independence of the witnesses. If B, for instance, were disposed to follow A's statements or to dissent from them, he would affirm the success here in more or less than $\frac{1}{2}pp'$N cases.

Thus if the credit of both witnesses were the same, $p = p'$, and we find from (33) $\varpi = a$, so that the evidence has not altered the likelihood of the event.

36. Where the event may turn out in n equally probable ways as in art. 33, and the witness A asserts one to have occurred, say the ticket marked 1 to have been drawn, while the witness B asserts another, say the ticket marked 2; to find the chance that No. 1 was drawn.

By the same reasoning as in art. 33 we find for the chance

$$\varpi = \frac{p(1-p')}{p(1-p') + (n-1)^{-1}(1-p)(n-2+p')} \quad . \; . \; . \; (34).$$

This result will also follow if we consider B's evidence as testimony *in favor* of No. 1 of the value $(1-p')(n-1)^{-1}$.

When the number of tickets n is very great, (34) gives

$$\varpi = \frac{p - pp'}{1 - pp'}.$$

37. As remarked in art. 26, the methods we have given for determining the probability of testimony apply to cases where the evidence is derived from other sources. Thus, suppose it has been found that a certain symptom (A) indicates the presence of a certain disease in three cases out of four, there is a probability $\frac{3}{4}$ that any patient exhibiting the symptom has the disease. This, however, must be considered in conjunction with the *a priori* probability of the presence of the disease, if we wish to know the value of the evidence deduced from the symptom being observed. For instance, if we knew that $\frac{3}{4}$ of the whole population had the disease, the evidence would have no value, and the credibility of the symptom *per se* would be $\frac{1}{2}$, telling us nothing either way. For if a be the *a priori* probability, ϖ that after the evidence, p the credibility of the evidence, we have found

$$\varpi = \frac{ap}{ap + (1-a)(1-p)};$$

so that, if $\varpi = a$, $p = \frac{1}{2}$.

If ϖ and a are given, the credibility p of the evidence is deduced from this equation, viz.,

$$p = \frac{(1-a)\varpi}{a + \varpi - 2a\varpi}.$$

38. Suppose now the probability of the disease when the symptom A occurs is ϖ (that is, it is observed that the disease exists in ϖN cases out of a large number N where the symptom is found), and likewise the same probability when another *independent* symptom B occurs is ϖ'. What is the probability of the disease where both symptoms occur?

Let a be the *a priori* probability of the disease in all the cases; then the value of the evidence of B is, as explained above,

$$p' = \frac{(1-a)\varpi'}{a + \varpi' - 2a\varpi'};$$

and this has to be combined with ϖ, which is the probability of the disease after A is observed. We find the probability (Π) required to be

$$\Pi = \frac{\varpi p'}{\varpi p' + (1-\varpi)(1-p)};$$

$$\text{whence} \quad \Pi = \frac{(1-a)\,\varpi\,\varpi'}{(1-a)\varpi\,\varpi' + a(1-\varpi')(1-\varpi')} \quad . \; . \; . \; . \; (35).^{1}$$

Thus, if the *a priori* probability of the disease in all the patients was $\frac{1}{10}$, and 3 out of 4 have the disease where A is observed, and also 3 out of 4 where *B* is observed, the chance is $\frac{81}{82}$ that the disease exists when both symptoms are present.

This question illustrates the exceeding delicacy and care required in reasoning on probabilities. If we had combined the two given probabilities in the usual way without considering the *a priori* value (as would be correct if this were quite unknown, or $= \frac{1}{2}$) we should have had

$$\Pi = \frac{\varpi\varpi'}{\varpi\varpi' + (1-\varpi)(1-\varpi')}.$$

The fallacy of so doing will appear if we consider a large population, and a very uncommon disease, and that the latter is observed to exist in $\frac{1}{2}$ the cases where the symptom A occurs, and also in $\frac{1}{2}$ for the symptom B; this formula would give $\frac{1}{2}$ for the chance when both are present. This is clearly absurd; for, both the disease and the symptoms being by hypothesis extremely rare, and the symptoms being independent, that is, having no connection with each other, it is next to impossible that any one individual of the $\frac{1}{2}$N(A)—calling N(A) the number who have the symptom A—who have *not* the disease should also be comprised in the $\frac{1}{2}$N(B) who have not the disease, because this $\frac{1}{2}$N(A), $\frac{1}{2}$N(B) are very small numbers (relatively) taken indiscriminately from the whole population who are free from the disease. It is different for the $\frac{1}{2}$N(A), $\frac{1}{2}$N(B) cases who have the disease; these cases all come out of the very small number N(D) who have the disease; therefore several individuals will be probably common to both; hence, if both symptoms coexist, it is highly probable that the case is one of the disease.

We find from (35) the true probability to be in the present case

$$\Pi = 1 - a,$$

so that, if only 1 in 1000 have the disease, the chance is 999 to 1, instead of an even one.

39. If a coin thrown m times has turned up head every time, the chance derived from this experience alone that the real facility for head exceeds $\frac{1}{2}$ is, by formula (14),

$$\varpi = \frac{\int_{\frac{1}{2}}^{1} x^m dx}{\int_{0}^{1} x^m dx} = 1 - \frac{1}{2^{m+1}}.$$

But there is here a very strong *a priori* presumption that the facility is $\frac{1}{2}$; suppose then that there is a very small *a priori* probability (p) that either in the coin itself or the way it is thrown there is something more favorable to head than to tail; after the new evidence the probability of this will be

$$\frac{p\varpi}{p\varpi + (1-p)(1-\varpi)} = \frac{(2^{m+1}-1)p}{(2^{m+1}-2)p + 1}.$$

Thus if there is an *a priori* probability $\frac{1}{1000}$, and if the coin has turned up head 5 times and never tail, the probability that the facility for head exceeds that for tail becomes

$$\frac{63}{62 + 1000} = \frac{60}{1000} \text{ nearly}.$$

40. From art. 19 we see that if a large number of trials $m + n$ be made as to any event, m being favorable, it may be considered certain that the real facility differs from $m/(m+n)$ by a very small fraction at most. If then our *a priori* idea as to the facility gives it outside the limits derived from formula (21), the evidence from experience will overrule our *a priori* presumption. Thus, if a shilling thrown up 1000 times gives head 560 times and tail 440, the evidence thus afforded that the throws were not fair is so much stronger than any antecedent conviction we could have to the contrary that we may conclude with certainty that, from some cause or other, head is more likely than tail.

41. Closely allied to the subject of our present section are the applications of the theory of probabilities to the verdicts of juries, the decisions of courts, and the results of elections. Our limits, however, will hardly allow of even a sketch of the methods given by Condorcet, Laplace, and Poisson, as it is not possible to render them intelligible within a short compass. We must therefore refer the reader to Todhunter's *History*, as well as the original works of these writers, especially to Poisson's *Recherches sur la Probabilité des Jugements*.

42. We will consider here one remarkable question given by Laplace, because the mathematical difficulty may be solved in a simpler way than by deducing it as a case of a general problem given in his chap. ii., or than Todhunter's method (see his p. 545), which depends on Lejeune Dirichlet's theorem in multiple integrals.

An event (suppose the death of a certain person) must have proceeded from one of n causes A, B, C, etc., and a tribunal has to pronounce on which is the most probable.

Let each member of the tribunal arrange the causes in the order of their probability according to his judgment, after weighing the evidence. To compare the presumption thus afforded by any one judge in favor of a specified cause with that afforded by the other judges, we must assign a value to the probability of the cause derived solely from its being, say, the rth on his list. As he is supposed to be unable to pronounce any closer to the truth than to say (suppose) H is more likely than D, D more likely than L, etc., the probability of any cause will be the average value of all those which that probability can have, given simply that it alwa

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[1] Or thus: let N = whole population and n, n' the numbers who show the symptoms A and B respectively, all these numbers being large. Now aN = whole number who have the disease; ϖn, $\varpi' n'$ the numbers out of n, n' who have it. Now ϖn, $\varpi' n'$ are both comprised in aN; and out of $\varpi' n'$, the number also included in ϖn is the same fraction of ϖn that $\varpi' n'$ is of aN; that is, the number who have both symptoms *and* the disease is

$$\varpi n \frac{\varpi' n'}{a\text{N}}$$

and those who have both symptoms and have *not* the disease is

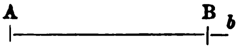
$$(1-\varpi)n \frac{(1-\varpi')n'}{(1-a)\text{N}};$$

so that, if both symptoms are present, the odds that it is a case of the disease are as

$$\frac{\varpi\varpi'}{a} : \frac{(1-\varpi)(1-\varpi')}{1-a}.$$

occupies the same place on the list of the probabilities arranged in order of magnitude. As the sum of the n probabilities is always 1, the question reduces to this—

Any whole (such as the number 1) is divided at random into n parts, and the parts are arranged in the order of their magnitude—least, second, third, . . . greatest; this is repeated for the same whole a great number of times; required the mean value of the least, of the second, etc., parts, up to that of the greatest.



Let the whole in question be represented by a line AB$=a$, and let it be divided at random into n parts by taking $n-1$ points indiscriminately on it. Let the required mean values be

$$\lambda_1 a\,,\ \lambda_2 a\,,\ \lambda_3 a\ \ldots .\ \lambda_n a\,,$$

where $\lambda_1, \lambda_2, \lambda_3$ . . . must be constant fractions. As a great number of positions is taken in AB for each of the n points, we may take a as representing that number; and the whole number N of cases will be

$$\mathrm{N} = a^{n-1}.$$

The sum of the *least* parts, in every case, will be

$$\mathrm{S}_1 = \mathrm{N}\lambda_1 a = \lambda_1 a^n .$$

Let a small increment, B$b = \delta a$, be added on to the line AB at the end B; the increase in this sum is $\delta \mathrm{S}_1 = n\lambda_1 a^{n-1}\delta a$.

But, in dividing the new line Ab, either the $n-1$ points all fall on AB as before, or $n-2$ fall on AB and 1 on Bb (the cases where two or more fall on Bb are so few we may neglect them). If all fall on AB, the least part is always the same as before except when it is the last, at the end B of the line, and then it is greater than before by δa; as it falls last in n^{-1} of the whole number of trials, the increase in S_1 is $n^{-1}a^{n-1}\delta a$. But if one point of division falls on Bb, the number of new cases introduced is $(n-1)a^{n-2}\delta a$; but, the least part being now an infinitesimal, the sum S_1 is not affected; we have therefore

$$\delta \mathrm{S}_1 = n\lambda_1 a^{n-1}\delta a = n^{-1}a^{n-1}\delta a\,;$$
$$\therefore \lambda_1 = n^{-2}.$$

To find λ_2, reasoning exactly in the same way, we find that where one point falls on Bb and $n-2$ on AB, as the least part is infinitesimal, the *second least* part is the *least* of the $n-1$ parts made by the $n-2$ points; consequently, if we put λ'_1 for the value of λ_1 when there are $n-1$ parts only, instead of n,

$$\delta \mathrm{S}_2 = n\lambda_2 a^{n-1}\delta a = n^{-1}\,a^{n-1}\delta a + (n-1)a^{n-2}\lambda'_1 a\delta a\,,$$
$$\therefore n\lambda_2 = n^{-1} + (n-1)\lambda'_1\,;\ \text{but}\ \lambda'_1 = (n-1)^{-2};$$
$$\therefore n\lambda_2 = n^{-1} + (n-1)^{-1}.$$

In the same way we can show generally that

$$n\lambda_r = n^{-1} + (n-1)\lambda'_{r-1}\,;$$

and thus the required mean value of the rth part is

$$\lambda_r a = an^{-1}\left\{n^{-1} + (n-1)^{-1} + (n-2)^{-1} + \ldots (n-r+1)^{-1}\right\} \ldots (36).$$

Thus each judge implicitly assigns the probabilities

$$\frac{1}{n^2},\ \frac{1}{n}\left(\frac{1}{n}+\frac{1}{n-1}\right),\ \frac{1}{n}\left(\frac{1}{n}+\frac{1}{n-1}+\frac{1}{n-2}\right),\ \ldots .$$

to the causes as they stand on his list, beginning from the lowest.

Laplace now says we should add the numbers thus found on the different lists for the cause A, also for B, etc.; and that cause which has the greatest sum is the most probable. This doubtless seemed self-evident to him, but ordinary minds will hardly be convinced of its correctness without proof. Let the lists of two of the judges be, beginning from the lowest,

B , H , R , K , A . . . .
C , K , D , H , B . . . .
Probabilities λ_1 , λ_2 , λ_3 , λ_4 , λ_5 . . . .

As the opinions of all the judges are supposed of equal weight, the cause H here is as likely as the cause K; but the probability that H *or* K was the cause is[1]

$$\lambda_2 + \lambda_4 .$$

Hence prob. (H) + prob. (K) = 2 prob. (H) = $\lambda_2 + \lambda_4$;

$$\therefore \text{prob. (H)} = \tfrac{1}{2}(\lambda_2 + \lambda_4);$$

that is, the probability of any cause is the mean of its probabilities on the two lists, the circumstance being clearly immaterial whether the same cause K is found opposite to it or not. The same follows for 3 or more lists.

43. Laplace applies the same method to elections. Suppose there are n candidates for an office; each elector is t arrange them in what he believes to be the order of merit; and we have first to find the numerical value of the merit he thus implicitly attributes to each candidate. Fixing some limit a as the maximum of merit, n arbitrary values less than a are taken and then arranged in order of magnitude—least, second, third, ... greatest; to find the mean value of each.

Take a line AB $= a$, and set off n arbitrary lengths AX, AY, AZ . . . . beginning at A; that is, n points are taken at random in AB. Now the mean values of AX, XY, YZ, . . . are all equal; for if a new point P be taken at random, it is equally likely to be 1st, 2d, 3d, etc., in order beginning from A, because out of $n+1$ points the chance of an assigned one being 1st is $(n+1)^{-1}$; of its being 2d $(n+1)^{-1}$; and so on. But the chance of P being 1st is equal to the mean value of AX divided by AB; of its being 2d M(XY) ÷ AB; and so on. Hence the mean value of AX is AB $(n+1)^{-1}$; that of AY is 2AB $(n+1)^{-1}$; and so on. Thus the mean merit assigned to the several candidates is

$$a(n+1)^{-1},\ 2a(n+1)^{-1},\ 3a(n+1)^{-1}\ \ldots .\ na(n+1)^{-1}.$$

Thus the relative merits may be estimated by writing under the names of the candidates the numbers 1, 2, 3, ... n. The same being done by each elector, the probability will be in favor of the candidate who has the greatest sum.

Practically it is to be feared that this plan would not succeed, though certainly the most rational and logical one if the conditions are fulfilled—because as Laplace observes not only are electors swayed by many considerations independent of the merit of the candidates, but they would often place low down in their list any candidate whom they judged a formidable competitor to the one they preferred, thus giving an unfair advantage to candidates of mediocre merit.

There are, however, many cases where such objections would not apply, and therefore where Laplace's method would be certainly the most rational. Thus, suppose a jury or committee or board of examiners have to decide on the relative merit of a number of prize essays, designs for building, etc.; each member should place them in what he judges to be the order of merit, beginning with the worst, and write over them the numbers 1, 2, 3, 4, etc.; then the relative merit of each essay, etc., would be represented by the sum of the numbers against it in each list. No doubt there would be cases where a juror would observe a great difference in merit between one essay and the one below it, which difference would not be adequately rendered by an excess of one in the number. But even then, as such superiority could not fail to be recognized by the other members of the tribunal, it is not likely that any injustice would result.

44. An *argument* advanced in support of a proposition differs from the case of testimony in that, if the argument is bad, the previous probability of the conclusion is unaffected. Let p be the *a priori* probability of the proposition, q the chance that the argument is correct; then in a large number N of cases, in qN the argument is good, and therefore the proposition is true; and out of the remaining $(1-q)$N, where the argument is bad, there are $p\ (1-q)$N cases where the proposition is nevertheless true. Hence the probability of the conclusion is

$$p + q - pq.$$

Hence any argument, however weak, adds something to the force of preceding arguments.

V. On Mean Values and the Theory of Errors.

45. The idea of a mean or average among many different magnitudes of the same kind is one continually employed and of great value. It gives us in one result, easily presented to the mind and easily remembered, a general idea of a number of quantities which perhaps we have never seen or observed, and we can thus convey the same idea to others without giving a long list of the quantities themselves. We could scarcely form any clear conception as to the duration of human life, unless by taking the average,—that is, finding the length of life each individual would have if the whole sum of the years attained by each were equally divided among the entire population. How, again, could we so easily form an idea of the climate of Rome or Nice by learning the mean of the temperatures of each day in the year, or a series of years? Here, again, it will be an important addition to the information to find also the mean summer temperature and the mean in winter, as we thus learn

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[1] This is the same as if there was only one judge. If both presented all the causes in the same order the probabilities are the same as if there were one; if now one judge transposes two causes he does not alter the chance that one or other of them is true; and again this chance solely depends on the positions of the two causes in the lists, and is the same whatever the arrangements as to the remaining causes.

what extremes of heat and cold are to be expected. We may even go further and inquire the diurnal variation in the temperature in summer or in winter; and for this we should know the average of a number of particular cases.

It may be said that the whole value of statistics depends on the doctrine of averages. The price of wheat and of other commodities, the increase or decrease of a particular crime, the age of marriages both for men and women, the amount of rain at a given locality, the advance of education, the distribution of wealth, the spread of disease, and numberless other subjects for inquiry—are instances where we often see hasty and misleading conclusions drawn from one or two particular cases which happen to make an impression, but where the philosophical method bids us to observe the results in a large number, and then to present them as summed up and represented by the average or mean.

46. There is another application of averages of a different nature from the foregoing. Different estimates of the same thing are given by several independent authorities: thus the precise moment of an earthquake is differently stated by correspondents in the papers; different heights are given for a mountain by travellers; or suppose I have myself measured the height of a building a number of times, never obtaining exactly the same result. In all such cases (if we have no reason to attach greater weight to one result than to another) our common sense tells us that the average of all the estimates is more likely to be the truth than any other value. In these cases, as M. Quetelet remarks, there is this important distinction from the preceding, that the mean value represents a thing actually existing; whereas in the others it merely serves to give a kind of general idea of a number of individuals essentially different, though of the same kind. Thus if I take the mean of the heights of 200 houses in a long street, it does not stand for any real entity, but is a mere ideal height, representing as nearly as possible those of the individual houses, whereas, in taking 200 measurements of the same house, their mean is intended to give, and will very nearly give, the actual height of that house.

47. So far it is obvious how to proceed in such cases; but it becomes a most important question in the theory of probabilities, to determine how far we can rely on the mean value of the different observations, giving us the true magnitude we seek,—or rather, as we never can expect it to give exactly that value, to ascertain with what probability we may expect the error not to exceed any assigned limit. Such is the inquiry on which we are about to enter.

This investigation is of the more importance, because we find what is really the same problem present itself again under circumstances different from what we have been considering. In the measurement of any whole by means of repeated partial measurements—as, for instance, in measuring a distance by means of a chain—the error in the result is the sum of all the partial errors (with their proper signs) incurred at each successive application of the chain. If we would know, then, the amount of confidence we may have in the accuracy of the result, we must determine, as well as we can, the probability of the error—that is, the sum of all the partial errors—not exceeding assigned limits; and to this end, we have in the first place to try to determine the law of facility, or frequency, of different values of this sum. The problem only differs from the preceding in that here we seek for the facility of the sum of the errors; in the former, of the nth part of that sum.

In both these cases, we may reasonably and naturally suppose that the error incurred in each observation, or each measurement, follows the same law as to the frequency of its different possible values and as to its limits, as each is made by the same observer, under the same circumstances, though what that law is may be unknown to us. But there is another class of cases where the same problem presents itself. An astronomical observation is made (say) of the zenith distance of a star at a particular instant; the error in this determination is a complex one, caused by an error in the time, an error in the refraction, errors of the instrument, personal error of the observer, and others. The error of the observation is in fact the sum of the partial errors arising from these different sources; now these evidently cannot be taken each to follow the same law, so that we have here a more general problem of the same species, viz., to combine a number of partial errors, each having its own law of facility and limits.

There is every reason to suppose that the error incurred in any single observation or measurement of any kind is generally due to the operation of a large number of independent sources of error; if we adopt this hypothesis, we have the same problem to solve in order to arrive at the law of facility of any single error.

48. We will consider the question as put by Poisson (*Recherches*, p. 254; see Todhunter, *History*, p. 561), and will adopt a method which greatly shortens the way to the result.

Let x be the error arising from the combination or superposition of a large number of errors $\epsilon_1, \epsilon_2, \epsilon_3$ .... each of which by itself is supposed very small, then

$$x = \epsilon_1 + \epsilon_2 + \epsilon_3 + \;\ldots\ldots \qquad (37).$$

Each partial error is capable of a number, large or small, of values, all small in themselves; and this number may be quite different for each error $\epsilon_1, \epsilon_2, \epsilon_3$ ..... There may be more positive than negative, or less, for each.[1] If n_1, n_2, n_3 .... be the numbers of values of the several errors, the number of different values of the compound error x will be

$$n_1 n_2 n_3 \ldots$$

We will suppose it, however, to take an indefinite number of values N, some multiple of the above, so that the n_1, n_2, n_3 .... different values are repeated, but all equally often, so as to leave the relative facility of the different values unaltered. We will suppose the same number N of values in every case, whether more or fewer of the partial errors $\epsilon_1, \epsilon_2, \epsilon_3$ .... are included or not.

Let the *frequency* of an error of magnitude x be called y, and let the equation expressing the frequency be

$$y = f(x) \;\ldots\ldots\ldots \qquad (38)$$

i.e., ydx = number of values of x between x and $x + dx$. The whole number of values is

$$\mathrm{N} = \int_{\mu'}^{\mu} f(x)dx,$$

where μ, μ' are the sums of the higher and lower limits of all the partial errors.

If now a new partial error ϵ be included with the others, let it have n particular values e, e', e'' ..... ; if it had but the one value e, then to every value x of the old compound error would correspond one x' of the new, such that $x + e = x'$; and the number of values of the new from x' to $x' + dx'$ is the same as of the old from x to $x + dx$—that is, $f(x)dx$, or $f(x' - e)dx'$. Now the next value e' gives, besides these, the number $f(x' - e')dx'$, and so on. Thus the whole number of values of the new compound error between x' and $x' + dx'$ is

$$\left\{ f(x' - e) + f(x' - e') + f(x' - e'') + \ldots\ldots \right\} dx' .$$

Hence the equation of frequency for the new error is (dropping the accent, and dividing by n—that is, reducing the total number of values from Nn to N, the same as before)

$$y = n^{-1} \left\{ f(x - e) + f(x - e') + f(x - e'') + \;\ldots \right\} \;.\;. \quad (39).$$

Hence

$$y = f(x) - \frac{e + e' + e'' + \ldots}{n} f'(x) + \tfrac{1}{2} \frac{e^2 + e'^2 + e''^2 + \ldots}{n} f''(x),$$

neglecting higher powers of e, e' ....

Hence *if a new partial error* ϵ, *whose mean value* $= a$, *and whose mean square is* λ, *be superposed on the compound error* (38) *resulting from the combination of a large number of partial errors, the equation of frequency for resulting error is*

$$y = f(x) - af'(x) + \tfrac{1}{2}\lambda f''(x) = (1 - a\mathrm{D} + \tfrac{1}{2}\lambda \mathrm{D}^2)f(x) \,. \quad (40)$$

It thus appears that each of the small errors only enters the result by its mean value a, and mean square λ.

If a second error were superposed, we should thus have

$$y = (1 - a_1\mathrm{D} + \tfrac{1}{2}\lambda_1\mathrm{D}^2)(1 - a\mathrm{D} + \tfrac{1}{2}\lambda\mathrm{D}^2)f(x)\,;$$

$$\therefore y = \left\{ 1 - (a + a_1)\mathrm{D} + (\tfrac{1}{2}(\lambda + \lambda_1) + aa_1)\mathrm{D}^2 \right\} f(x)\,;$$

as λ is a lower infinitesimal than a, we retain no other terms.

$$\therefore y = \left\{ 1 - (a + a_1)\mathrm{D} + \frac{\lambda + \lambda' - a^2 - a_1^2 + (a + a_1)^2}{2}\mathrm{D}^2 \right\} f(x).$$

Thus any two errors enter the result in terms of $a + a_1$ and $\lambda + \lambda' - a^2 - a_1^2$; as this holds for any two, it is easy to see that all the partial errors in (37) enter the equation of frequency (38) only in terms of m and $h - i$; putting

$$\left.\begin{aligned} m &= a_1 + a_2 + a_3 + \ldots = \text{sum of mean errors,} \\ h &= \lambda_1 + \lambda_2 + \lambda_3 + \ldots = \text{sum of mean squares of errors,} \\ i &= a_1^2 + a_2^2 + a_3^2 + \ldots = \text{sum of squares of mean errors,} \end{aligned}\right\} (41).$$

Thus, $\qquad y = f(x) \equiv \mathrm{F}(x, m, h - i).$

Let m receive an increment δm; this is equivalent to superposing a new error whose mean value is δm, and mean square infinitely smaller (*e.g.*, let its values be all +, or indeed we may take it to have but the single value δm);

$$\therefore \delta y = \frac{dy}{dm}\delta m = -\frac{dy}{dx}\delta m, \text{ by (40)};$$

$$\therefore \frac{dy}{dm} = -\frac{dy}{dx}.$$

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[1] An error may have all its values positive, or all negative. In estimating the instant when a star crosses the meridian we may err in excess or defect, but in estimating that when it emerges from behind the moon, we can only err in excess. We have heard this instance given by Clerk Maxwell.

Hence y is a function of $x-m$; so our equation must be of the form

$$y = F(x-m, h-i) \quad . \quad . \quad . \quad . \quad . \quad . \quad (42).$$

Let h receive an increment δh; or conceive a new error whose mean value $a=0$, and whose mean square $=\delta h$; we have (40)

$$\frac{dy}{dh}\delta h = \frac{1}{2}\frac{d^2y}{dx^2}\delta h\,.$$

Hence

$$\frac{d^2y}{dx^2} = 2\frac{dy}{dh} \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (43).$$

Let us now suppose in (37) that all the values of every error are increased in the ratio r: all the values of x are increased in the same ratio; consequently there are the same number of values of x from rx to $r(x+dx)$ as there were before from x to $x+dx$. This gives

$$F(x-m\,.\,h-i)dx = F(rx-rm\,,\,r^2(h-i))rdx\,,$$

for m is increased in the ratio r, and h and i in the ratio r^2.

Let us write for shortness

$$\xi = x-m,\ \eta = h-i,$$

so that

$$y = F(\xi\,,\,\eta) \quad . \quad . \quad . \quad . \quad . \quad . \quad (44);$$

we have

$$r^{-1}F(\xi\,,\,\eta) \equiv F(r\xi\,,\,r^2\eta).$$

Let $r = 1+\omega$, where ω is infinitesimal;

$$(1-\omega)y = F(\xi+\omega\xi\,,\,\eta+2\omega\eta)\,;$$

$$\therefore y-\omega y = y+\omega\xi\frac{dy}{d\xi}+2\omega\eta\frac{dy}{d\eta}\,;$$

$$\therefore \xi\frac{dy}{d\xi}+2\eta\frac{dy}{d\eta}+y=0 \quad . \quad . \quad . \quad . \quad . \quad (45).$$

This equation, and

$$\frac{d^2y}{d\xi^2} = 2\frac{dy}{d\eta} \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (46),$$

identical with (43), contain the solution of the problem.

Thus, (45) gives by integration

$$y = \eta\psi^{-\frac{1}{2}}(\xi^2\eta^{-1}) \quad . \quad . \quad . \quad . \quad . \quad . \quad (47.)$$

Again, combining (45) and (46),

$$\eta\frac{d^2y}{d\xi^2}+\xi\frac{dy}{d\xi}+y=0\,,$$

or

$$\frac{d}{d\xi}\left(\eta\frac{dy}{d\xi}+\xi y\right)=0\,;$$

$$\therefore \eta\frac{dy}{d\xi}+\xi y=\chi(\eta).$$

Substitute for y the value (47); and we find

$$2\xi\eta^{-\frac{1}{2}}\psi'(\xi^2\eta^{-1})+\xi\eta^{-\frac{1}{2}}\psi(\xi^2\eta^{-1})=\chi(\eta)\,;$$

that is, a function of $\xi\eta^{-\frac{1}{2}}$ identical with a function of η. This cannot be, unless both sides are constant. Hence $\eta\frac{dy}{d\xi}+\xi y=c$. Now $c=0$, for $\frac{dy}{d\xi}$ vanishes with ξ, by (47); and, y being always finite, the left hand number vanishes with ξ;

$$\therefore 2\psi'(\xi^2\eta^{-1})+\psi(\xi^2\eta^{-1})=0.$$

$$\therefore \psi(\xi^2\eta^{-1}) = Ce^{-\frac{1}{2}\xi^2 2\eta^{-1}}.$$

Substituting in (47) and restoring the values of ξ, η, we find the form of the function (42) to be

$$y = C(h-i)^{-\frac{1}{2}}e^{-\frac{(x-m)^2}{2(h-i)}} \quad . \quad . \quad . \quad . \quad . \quad (48).$$

C is a constant depending on the number N.

The probability of the error x falling between x and $x+dx$ is found by dividing ydx by the whole area of the curve (48); *i.e.*,

$$p = \left\{2\pi(h-i)\right\}^{-\frac{1}{2}}e^{-\frac{(x-m)^2}{2(h-i)}}dx \quad . \quad . \quad . \quad . \quad (49).$$

49. If, instead of eq. (37), we had put

$$x = \gamma_1\epsilon_1+\gamma_2\epsilon_2+\gamma_3\epsilon_3+\ldots \quad . \quad . \quad . \quad . \quad (50),$$

here $\gamma_1, \gamma_2, \gamma_3 \ldots$ are any numerical factors, the formula (49) gives the probability for x, provided h, i, m are taken to be

$$\left.\begin{aligned} m &= \gamma_1 a_1+\gamma_2 a_2+\gamma_3 a_3+\ \ldots \\ h &= \gamma_1^2\lambda_1+\gamma_2^2\lambda_2+\gamma_3^2\lambda_3+\ \ldots \\ i &= \gamma_1^2 a_1^2+\gamma_2^2 a_2^2+\gamma_3^2 a_3^2+\ldots \end{aligned}\right\} \quad . \quad . \quad . \quad (51),$$

instead of the values in (41).

50. If we take the integral of eq. (49), between any two limits, μ, ν, it gives us the probability that the sum x of the errors lies between μ and ν—that is, *that the mean of all the errors lies between* μr^{-1} *and* νr^{-1}, if r is the number of the partial errors in (37).

The most likely value of x (that is, for which the frequency is greatest) is of course $x=m$, and the chance that x does not differ from m by more than $\pm\delta$ is

$$\varpi = \frac{1}{\sqrt{2\pi(h-i)}}\int_{m-\delta}^{m+\delta}e^{-\frac{(x-m)^2}{2(h-i)}}dx\,.$$

in this put $(x-m)\left\{2(h-i)\right\}^{-\frac{1}{2}}=t\,;\ \therefore dx=dt\sqrt{2(h-i)}\,.$ The limits $m\pm\delta$ for x become $\pm\delta\left\{2(h-i)\right\}^{-\frac{1}{2}}$ for t; hence, putting

$$\tau = \delta\left\{2(h-i)\right\}^{-\frac{1}{2}}\,,$$

and remembering that $\int_{-\tau}^{\tau}e^{-t^2}dt = 2\int_0^{\tau}e^{-t^2}dt\,,$

we find

$$\varpi = \frac{2}{\sqrt{\pi}}\int_0^{\tau}e^{-t^2}dt \quad . \quad . \quad . \quad . \quad . \quad . \quad (52)$$

is the probability that the sum x of the errors in (37) *lies between the limits* $m\pm\tau\sqrt{2(h-i)}$; ϖ is also the probability that the mean of all the errors, xr^{-1}, lies between the limits

$$nr^{-1}\pm\tau r^{-1}\sqrt{2(h-i)}\,.$$

51. The important result (48), which is the key to the whole theory of errors, contains several particular cases which Laplace gives in his fourth chapter. We may first make one or two remarks on it.

(1) $h-i$ is always positive; for in (41)

$$\lambda_1 > a_1^2,\ \lambda_2 > a_2^2, \text{ etc.},$$

because the mean of the squares of n numbers is always greater than the square of the mean.[1]

(2) To find the mean value $M(x)$ of the sum x, and the mean value of its square $M(x^2)$, we have

$$M(x) = \frac{\int xydx}{\int ydx}\,;\ M(x^2) = \frac{\int x^2ydx}{\int ydx}\,,$$

the limits being $\pm\infty$. Hence

$$M(x) = m\,;$$
$$M(x^2) = m^2+h-i.$$

The first is obvious from the fact that to every value $m+s$ for x there corresponds another $m-s$. Both results also easily follow from common algebra: the case is that of a sum, x,

$$x = \epsilon_1+\epsilon_2+\epsilon_3+, \text{ etc.},$$

where each quantity $\epsilon_1, \epsilon_2, \epsilon_3 \ldots\ldots$ goes through an indedendent series of values; and it is easily proved that

$$M(x) = M(\epsilon_1)+M(\epsilon_2)+M(\epsilon_3)+\ .\ .\ .\ = \Sigma M\epsilon_1\,;$$

$$\begin{aligned} M(x^2) &= M(\epsilon_1^2)+M(\epsilon_2^2)+M(\epsilon_3^2)+\ .\ .\ .\ +2\Sigma\left\{M(\epsilon_1)M(\epsilon_2)\right\} \\ &= (\Sigma M\epsilon_1)^2-\Sigma(M\epsilon_1)^2+\Sigma M(\epsilon_1^2)\,. \end{aligned}$$

52. One particular case of the general problem in art. 48 is when the errors $\epsilon_1, \epsilon_2, \epsilon_3 \ldots\ldots$ in (37) all follow exactly the same law; as, for instance, if $\epsilon_1, \epsilon_2, \epsilon_3 \ldots\ldots$ are the errors committed in observing the same magnitude, under exactly the same circumstances, a great number of times; and we are asked to find the chance that the sum of the errors, or that their arithmetical mean, shall fall between given limits. Here the law of facility for each error is of course the same, though we may not know what it is.

We have then from (41)

$$m = ra_1,\ h = r\lambda_1,\ i = ra_1^2,$$

so that in eq. (52),

$$\varpi = \frac{2}{\sqrt{\pi}}\int_0^{\tau}e^{-t^2}dt \quad (53).$$

is the probability that the mean of all the errors shall lie between $a_1\pm\tau\sqrt{2r^{-1}(\lambda_1-a_1^2)}$

a_1 here is the mean of all the possible values of the error in this particular observation, which are of course infinite in number; and (53) shows us, what is evident beforehand, that the more the number r of observations is increased the narrower do the limits for the mean error become for a given probability ϖ; so that if, suppose, we take $\tau=3$, and $r=x$, we have very nearly $\varpi=1$, and it becomes practically certain that the mean of the actual observations will differ from a_1 by an infinitesimal deviation.

53. What we have found hitherto woul be of very little practical use, because the constants involved suppose the amounts of the errors known, and therefore the true value known of the quantity which is observed or measured. It is, however, precisely this true value which we usually do not know and are trying to find. Let us now suppose a large number r of measurements, which we will call

$$a_1a_2a_3\ \ldots\ a_r,$$

made of a magnitude whose true but unknown value is A.

The (unknown) errors of the observations will be

$$e_1 = a_1-A,\quad e_2 = a_2-A,\quad e_3 = a_3-A\ \ldots\,;$$

$$\therefore r^{-1}(e_1+e_2+\ \ldots\ e_r) = r^{-1}(a_1+a_2+\ \ldots\ a_r)-A\,;$$

or

$$M(e_1) = M(a_1)-A\,;$$

---

[1] This may be very easily proved by reasoning precisely analogous to that employed in the note on article 24.

or the mean of the errors is the error committed in taking the mean of the observations as the value of A.

Hence (53) ϖ is the probability *that the error committed in taking the mean of the observations as the truth shall lie between*

$$a_1 \pm \tau\sqrt{2r^{-1}(\lambda_1 - a_1^2)}\,.$$

Here a_1 is the true mean of the errors of an infinite number of observations, λ_1 the mean of their squares. As we have no means of determining a_1 (except that it is nearly equal to the mean of the errors we are dealing with, which would give us no result), we have to limit the generality of the question by assuming that the law of error of the observation gives positive and negative errors with equal facility; if so $a_1 = 0$, and we have the probability ϖ that the error lies between

$$\pm\tau\sqrt{2r^{-1}\lambda_1}.$$

Here λ_1, which is the mean of the squares of all possible values of the error of the observation, will be at least very nearly the mean square of the actual values of the errors, if r is large;

$$\therefore \lambda_1 = r^{-1}(e_1^2 + e_2^2 + \ldots e_r^2);$$

$$\therefore \lambda_1 = r^{-1}\left\{(a_1 - A)^2 + (a_2 - A)^2 + \ldots (a_r - A)^2\right\};$$

or
$$\begin{aligned}\lambda_1 &= M(a_1^2) - 2AM(a_1) + A^2\\ &= M(a_1^2) - (Ma_1)^2 + (Ma_1 - A)^2.\end{aligned}$$

Rejecting the last term, as the square of a very small quantity,

$$\lambda_1 = M(a_1^2) - (Ma_1)^2,$$

and we have the probability ϖ (in (53)) that the error in taking the mean of the observations as the truth lies between

$$\pm\tau\sqrt{2\gamma^{-1}\left\{M(a_1^2) - (Ma_1)^2\right\}} \quad . \quad . \quad . \quad . \quad (54).$$

a value depending on the mean square, and mean first power, of the observed values.

These limits may be put in a different form, rather easier for calculation. If $f_1, f_2, f_3 \ldots f_r$ be the *apparent* errors, that is, not the real ones, but what they would be on the hypothesis that the mean is the true value, then, putting M for $r^{-1}(a_1 + a_2 + \ldots a_r)$,

$$f_1 = a_1 - M, \quad f_2 = a_2 - M, \quad \ldots \quad f_r = a_r - M;$$

$$\therefore M(f_1^2) = M(a_1^2) - 2M.\ M + M^2 = M(a_1^2) - (Ma_1)^2;$$

so that $\lambda = M(f_1^2)$, and (54) may be written

$$\pm\tau\sqrt{2r^{-1}.\,(f_1^2 + f_2^2 + \ldots f_r^2)r^{-1}} \quad . \quad . \quad (55).$$

54. In the last article we have made no assumption as to the law of frequency of the error in the observation we are considering, except that it gives positive and negative values with equal facility. If, however, we adopt the hypothesis (see art. 47) that every error in practice arises from the joint operation of a number of independent causes, the partial error due to each of which is of very small importance, then the process in art. 48 will apply, and we may conclude that the errors of every series of observations of the same magnitude made in the same circumstances follow the law of frequency in formula (48); and if we suppose, as is universally done, that positive and negative values are equally probable, the law will be

$$\left.\begin{aligned}&y = Cc^{-1}e^{-x^2c^{-2}}\\ &\text{and the probability (49) will be}\\ &p = c^{-1}\pi^{-\frac{1}{2}}e^{-x^2c^{-2}}dx\end{aligned}\right\} \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (56),$$

where c is a constant which is sometimes called the modulus of the system.

Every error in practice, then, is of the form (56), and is similar to every other. If c be small, the error has small amplitudes, and the series of observations are accurate.

If, as supposed in art. 53, a set of observations have been made, we can determine the modulus c, with an accuracy increasing with the number in the set. For (art. 51)

$\frac{1}{2}c^2 =$ true mean square of all possible values of the error.

This we have called λ_1 in last article, and have shown it nearly equal to $M(a_1^2) - (Ma_1)^2$ or $M(f_1^2)$; so that $\frac{1}{2}c^2 =$ mean square of obs. − (mean of obs.)^2 = mean square of apparent errors.

55. Thus, if a set of observations have been made, and c thus determined from them, it is easy to see that

$$\left.\begin{aligned}&\text{Mean error} = \pm c\pi^{-\frac{1}{2}} = 0.5642c\\ &\text{Mean square of error} = \tfrac{1}{2}c\\ &\text{Probable error} = \pm 0.4769c\end{aligned}\right\} \quad . \quad . \quad . \quad (57).$$

The mean error means that of all the positive or all the negative errors. The probable error is the value which half the errors exceed and half fall short of, so that it is an even chance that the error of any particular observation lies between the limits ±0.4769c. Its value is found from the table in art. 9, taking $I = \frac{1}{2}$.

56. We have often to consider the law of error of the sum of several magnitudes, each of which has been determined by a set of observations. Suppose A and B two such magnitudes, and X their sum, to find the law of error in

$$X = A + B.$$

Let the functions of error for A and B be

$$c^{-1}\pi^{-\frac{1}{2}}e^{-x^2c^{-2}}dx, \quad f^{-1}\pi^{-\frac{1}{2}}e^{-x^2f^{-2}}dx.$$

In formula (49) let $m = o$, $i = o$, $2h = c^2$; then the function for A is the law for the sum of a number of errors (37) the sum of whose mean squares is $h = \frac{1}{2}c^2$; likewise that for B is the law for the sum of a number the sum of whose mean squares is $\frac{1}{2}f^2$; the same formula (49) shows us that the law for the sum of these two series of errors—that is, for the sum of the errors of A and B—is

$$\left\{\pi(c^2 + f^2)\right\}^{-\frac{1}{2}}e^{-x^2(c^2 + f^2)^{-1}}dx;$$

that is, the modulus for X or A + B is

$$\sqrt{c^2 + f^2}$$

Hence $\qquad$ Probable error of X $= .4769\sqrt{c^2 + f^2}$

$$\therefore (\text{p.e. of X})^2 = (\text{p.e. of A})^2 + (\text{p.e. of B})^2 \quad . \quad . \quad . \quad (58).$$

So likewise for the mean error.

If X were the difference A − B, (58) still holds.

If X be the sum of m magnitudes A, B, C . . . instead of two, its probable error is in like manner

$$(\text{p.e. X})^2 = (\text{p.e. A})^2 + (\text{p.e. B})^2 +, \text{etc.};$$

and if the function of error for A, B, C . . . be the same for all $\qquad (\text{p.e. X})^2 = m(\text{p.e. A}^2).$

Also the probable error in the mean

$$M(A) = m^{-1}(A + B + C + \ldots)$$

is the mth part of the above;

$$\therefore \text{p.e. of } M(A) = m^{-\frac{1}{2}}(\text{p.e. of A}) \quad . \quad . \quad . \quad (59).$$

Airy gives the following example. The co-latitude of a place is found by observing m times the Z.D. of a star at its upper culmination and n times its Z.D. at its lower culmination, to find the probable error.

By (59)

$$\text{p.e. upper Z.D.} = m^{-\frac{1}{2}}\,(\text{p.e. of an upper obs.});$$

$$\text{p.e. lower Z.D.} = n^{-\frac{1}{2}}\,(\text{p.e. of a lower obs.});$$

Now $\qquad$ co-latitude $= \frac{1}{2}(\text{U.Z.D.} + \text{L.Z.D.})$.

Hence (58)

$$(\text{p.e. co-lat})^2 = \tfrac{1}{4}m^{-1}\,(\text{p.e. up. obs.})^2 + \tfrac{1}{4}n^{-1}(\text{p.e. low. obs.})^2.$$

If the upper Z.D. observations are equally good with the lower,

$$\text{p.e. co-lat.} = \tfrac{1}{2}(\text{p.e. an. obs.})\sqrt{m^{-1} + n^{-1}}.$$

57. The magnitude to be found is often not observed directly, but another magnitude of which it is some function. Let A = true but unknown value of a quantity depending on another whose true unknown value is a, by the given function

$$A = f(a);$$

let an observed value for a be v, the corresponding value for A being V, then

$$V = f(v).$$

Let ϵ = error of v, then the error of V is

$$V - A = f(a + \epsilon) - f(a) = \epsilon f'(v) \quad . \quad . \quad . \quad (60),$$

as v is nearly equal to a.

Suppose now the same magnitude A also a given function $f_1(a_1)$ of a second magnitude a_1, which is also observed and found to be v_1; also for a third, and so on; hence, writing $C = f'(v)$, $C_1 = f'_1(v_1)$, etc.

$$\left.\begin{aligned}V - A &= f'(v).\,\epsilon = C\epsilon\\ V_1 - A &= f'_1(v_1).\,\epsilon_1 = C_1\epsilon_1\\ V_2 - A &= f'_2(v_2).\,\epsilon_2 = C_2\epsilon_2\\ &\vdots \qquad\quad \vdots\end{aligned}\right\} \quad . \quad . \quad . \quad . \quad (61);$$

and we have to judge of the best value for the unknown quantity, whose true value is called A. The arithmetical mean of V, V_1, V_2 . . . seems the simplest, but it is not here the most probable, and we shall assume it to be a different mean, viz.,

$$X = \frac{mV + m_1V_1 + m_2V_2 + \ldots}{m + m_1 + m_2 + \ldots}.$$

(As V, V_1, V_2 . . . . are very nearly equal, it would be easy to show that any other way of combining them would be equivalent to this.) The factors m, m_1, m_2 . . . . remain to be determined. From (61) the error of X is

$$X - A = \frac{mC\epsilon + m_1C_1\epsilon_1 + m_2C_2\epsilon_2 + \ldots}{m + m_1 + m_2 + \ldots} \quad . \quad . \quad . \quad (62).$$

Let the moduli of the errors $\epsilon, \epsilon_1, \epsilon_2$ . . . . be c, c_1, c_2 . . . . (see art. 56); then (see art. 49) for modulus of the error X − A we have

$$(\text{mod.})^2 = \frac{m^2C^2c^2 + m_1^2C_1^2c_1^2 + m_2^2C_2^2c_2^2 + \ldots}{(m + m_1 + m_2 + \ldots)^2} \quad . \quad (63).$$

If the factors $m m_1 m_2$ . . . are determined so as to make this modulus the least possible, the importance of the error X − A is the least possible.

Differentiate with regard to m, and we find

$$mC^2c^2 = \frac{m^2C^2c^2 + m_1^2C_1^2c_1^2 + \dots}{m + m_1 + m_2 + \dots}$$

Likewise for m_1, and so on. Hence

$$mC^2c^2 = m_1C_1^2c_1^2 = m_2C_2^2c_2^2 =, \text{ etc.};$$

so that the most accurate mean to take is

$$X = \frac{\frac{V}{C^2c^2} + \frac{V_1}{C_1^2c_1^2} + \frac{V_2}{C_2^2c_2^2} + \dots}{\frac{1}{C^2c^2} + \frac{1}{C_1^2c_1^2} + \frac{1}{C_2^2c_2^2} + \dots} \quad . \quad . \quad . \quad . \quad (64).$$

The modulus of error in this value is, from (63),

$$\frac{1}{(\text{mod.})^2} = \frac{1}{C^2c^2} + \frac{1}{C_1^2c_1^2} + \frac{1}{C_2^2c_2^2} + \dots \quad . \quad . \quad (65).$$

58. The errors $\epsilon, \epsilon_1, \epsilon_2$ . . . . are unknown. We have as to the first

$$V - A = \epsilon f'(v) = (v - a)f'(v).$$

Let the values of the quantities observed corresponding to the value X for that sought be x, x_1, x_2 . . .

so that $\quad X = f(x) = f_1(x_1) = f_2(x_2) \dots$

then $\quad X - A = (x - a)f'(v);$

and, subtracting, $V - X = (v - x)f'(v) = (v - x)C.$

Here V − X is the apparent error in V, $v - x$ the apparent error of the observation v, taking X, x as the true values.

Of course we have also

$$V_1 - X = (v_1 - x_1)C_1, \quad V_2 - X = (v_2 - x_2)C_2, \dots.$$

If now *we were to determine X so as to render the sum of squares of apparent errors of the observations, each divided by the square of its modulus, a minimum*,—that is,

$$\frac{(v - x)^2}{c^2} + \frac{(v_1 - x_1)^2}{c_1^2} + \dots = \frac{(V - X)^2}{C^2c^2} + \frac{(V_1 - X)^2}{C_1^2c_1^2} + \frac{(V_2 - X)^2}{C_2^2c_2^2} +,$$

etc.,

a minimum,—we shall find the same value (64) for X.

Of course if the modulus is the same for all the observations the sum of squares simply is to be made a minimum.

To take a very simple instance. An observed value of a quantity is P; an observed value of a quantity known to be the square root of the former is Q; what is the most probable value?

If X be taken for the quantity, the apparent error of P is P − X; the apparent error of Q is found from

$$(Q - e)^2 = X;$$
$$\therefore e = (Q^2 - X)/2Q;$$
$$\therefore (P - X)^2 + (Q^2 - X)^2/4Q^2 = \text{minimum};$$
$$\therefore X = (4P + 1)Q^2/(4Q^2 + 1);$$

the weight of both observations being supposed the same.

Again, suppose a circle is divided by a diameter into two semicircles; the whole circumference is measured and found to be L; also the two semicircles are found to be M and N respectively. What is the most probable value of the circumference?

If X be taken as the circumference, the apparent error in L is L − X; those of M and N are M − ½X, N − ½X. Hence, if all the measurements are equally good,

$$(L - X)^2 + (M - \tfrac{1}{2}X)^2 + (N - \tfrac{1}{2}X)^2 = \text{minimum},$$
$$\therefore X = \tfrac{1}{3}(M + N + 2L)$$

is the most probable value.

The modulus of error of this result is (65) found to be

$$(\text{mod.})^2 = \tfrac{2}{3}(\text{mod. of measurements})^2$$

so that

$$\text{probable error} = (\text{prob. error of a measurement})\sqrt{\tfrac{2}{3}}.$$

59. In the last article we have explained the *method of least squares*, as applied to determine one unknown element from more than one observation of the element itself or of others with which it is connected by known laws. If several observations of the element itself are made, it is obvious that the method of least squares gives the arithmetical mean of the observations as the best value, thus justifying what common sense seems to indicate. If the observations are not equally good, the best value will be

$$X = \frac{wV + w_1V_1 + w_2V_2 + \dots}{w + w_1 + w_2 + \dots}$$

calling $w, w_1, w_2, \dots$ the weights of the different observations V, V_1, V_2 . . . .

i.e., $\quad w = c^{-2}, w_1 = c_1^{-2}, w_2 = c_2^{-2}$, etc.

It would carry us beyond our assigned limits in this article to attempt to demonstrate and explain the method of least squares when several elements have to be determined from a number of observations exceeding the elements in number. We must therefore refer the reader to the works already named, and also to the following: Gauss, *Theoria Combinationis Observationum*; Gauss, *Theoria Motus*; Airy, *Theory of Errors of Observation*; Leslie Ellis, in *Camb. Phil. Trans*, vol. viii.

The rule in such cases is that the sum of squares of the apparent errors is to be made a minimum, as in the case of a single element. To take a very simple example:

A substance is weighed, and the weight is found to be W. It is then divided into two portions, whose weights are found to be P and Q. What is the most probable weight of the body?

Taking A and B as the weights of the two portions, the apparent errors are P − A, Q − B, and that of the whole is W − A − B; hence

$$(P - A)^2 + (Q - B)^2 + (W - A - B)^2 = \text{minimum}$$

there being two independent variables A, B.

$$\therefore P - A + W - A - B = 0;$$
$$Q - B + W - A - B = 0;$$

or

$$2A + B = P + W$$
$$2B + A = Q + W$$
$$\therefore A + B = \tfrac{1}{3}(P + Q + 2W);$$
$$A = \tfrac{1}{3}(2P + W - Q);$$
$$B = \tfrac{1}{3}(2Q + W - P);$$

which are the most probable weights of the whole and the two parts.

VI. On Local Probability.

60. It remains to give a brief account of the methods of determining the probabilities of the fulfilment of given conditions, by variable geometrical magnitudes, as well as the mean values of such magnitudes. Recent researches on this subject have led to many very remarkable results; and we may observe that to English mathematicians the credit almost exclusively belongs. It is a new instance, added to not a few which have gone before, of a revival for which we have to thank the eminent men who, during the 19th century, have enabled the country of Newton to take a place less unworthy of her in the world of mathematical science.

At present the investigations on this subject have not gone beyond the theoretical stage; but they should not be undervalued on this account. The history of the theory of probabilities has sufficiently shown that what at first seems merely ingenious and a matter of curiosity may turn out to have valuable applications to practical questions. How little could Pascal, James Bernoulli, and De Moivre have anticipated the future of the science which they were engaged in creating?

61. The great naturalist Buffon was the first who proposed and solved a question of this description. Is was the following:

A floor is ruled with equidistant parallel lines; a rod, shorter than the distance between each pair, being thrown at random on the floor, to find the chance of its falling on one of the lines.

Let x be the distance of the centre of the rod from the nearest line, θ the inclination of the rod to a perpendicular to the parallels, $2a$ the common distance of the parallels, $2c$ the length of rod; then, as all values of x and θ between their extreme limits are equally probable, the whole number of cases will be represented by

$$\int_0^a \int_{-\frac{\pi}{2}}^{\frac{\pi}{2}} dx\,d\theta = \pi a$$

Now if the rod crosses one of the lines we must have $c > \frac{x}{\cos\theta}$; so that the favorable cases will be measured by

$$\int_{-\frac{\pi}{2}}^{\frac{\pi}{2}} d\theta \int_0^{c\cos\theta} dx = 2c.$$

Thus the probability required is $p = 2c/\pi a$.

Laplace in solving this question suggests that by making a great number of trials, and counting the cases where the rod falls on a line, we could determine the value of π from this result. He further considers, for a given value of a, what length $2c$ should be chosen for the rod so as to give the least chance of error in a given large number N of throws.

In art. 8 we have shown that the chance that the number of successes shall lie between $pN \pm r$ is

$$\varpi=\frac{2}{\sqrt{\pi}}\int_0^{ra} e^{-x^2}dx,$$

where $$a^2=\frac{1}{2p(1-p)N}.$$

For a given probability ϖ, ra is given. We have then a given chance that the number of successes shall differ from its most probable value pN by an error r which is the least possible fraction of the latter when r/pN, or when $1/apN$, or when $\sqrt{p(1-p)}/p$ is the least possible; that is, when $p^{-1}-1 = ra/2c-1$[1] is the least possible, or when c is the greatest possible. Now the greatest value of c is a; the rod therefore should be equal to the distance between the lines.

Laplace's answer is incorrect, though originally given right (see Todhunter, p. 591; also Czuber, p. 90).

62. Questions on local probability and mean values are of course reducible, by the employment of Cartesian or other coördinates, to multiple integrals. Thus any one relating to the position of two variable points, by introducing their coördinates, can be made to depend on quadruple integrals,—whether in finding the sum of the values of a given function of the coördinates, with a view to obtaining its mean value, or in finding the number of the favorable cases, when a probability is sought. The intricacy and difficulty to be encountered in dealing with such multiple integrals and their limits is so great that little success could be expected in attacking such questions directly by this method; and most of what has been done in the matter consists in turning the difficulty by various considerations, and arriving at the result by evading or simplifying the integrations. We have a certain analogy here in the variety of contrivances and artifices used in arriving at the values of definite integrals without performing the integrations. We will now select a few of such questions.

63. If a given space S is included within a given space A, the chance of a point P, taken at random on A, falling on S, is

$$p=S/A.$$

But if the space S be variable, and M(S) be its mean value

$$p=M(S)/A \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (66)$$

For, if we suppose S to have n equally probable values $S_1, S_2, S_3, \ldots$, the chance of any one S_1 being taken, and of P falling on S_1, is

$$p_1=n^{-1}S_1/A;$$

now the whole probability $p=p_1+p_2+p_3+\ldots$, which leads at once to the above expression.

The chance of two points falling on S is, in the same way,

$$p=M(S^2)/A^2 \quad . \quad . \quad . \quad . \quad . \quad . \quad (67);$$

and so on.

In such a case, if the probability be known, the mean value follows, and *vice versa*. Thus, we might find the mean value of the nth power of the distance XY between two points taken at random in a line of length l, by considering the chance that, if n more points are so taken, they shall all fall between X and Y.

This chance is

$$M(XY)^n/l^n=2(n+1)^{-1}(n+2)^{-1};$$

for the chance that X shall be one of the extreme points, out of the whole $(n+2)$, is $2(n+2)^{-1}$; and, if it is, the chance that the other extreme point is Y is $(n+1)^{-1}$. Therefore

$$M(XY)^n=2l^n(n+1)^{-1}(n+2)^{-1}.$$

64. A line l is divided into n segments by $n-1$ points taken at random; to find the mean value of the product of the n segments.

Let $a, b, c, \ldots$ be the segments in one particular case. If n new points are taken at random in the line, the chance that one falls on each segment is

$$1.2.3\ldots nabc\ldots/l^n;$$

hence the chance that this occurs, however the line is divided, is

$$|\underline{n}\, l^{-n}M(abc\ldots).$$

Now the whole number of different orders in which the whole $2n-1$ points may occur is $|\underline{2n-1}$; out of these the number in which one of the first series falls between every two of the second is easily found by the theory of permutations to be

$$|\underline{n}\,|\underline{n-1}.$$

Hence the required mean value of the product is

$$M(abc\ldots)=\frac{|\underline{n-1}}{|\underline{2n-1}}l^n.$$

65. If M be the mean value of any quantity depending on the positions of two points (*e.g.*, their distance) which are taken, one in a space A, the other in a space B (external to A); and if M′ be the same mean when both points are taken indiscriminately in the whole space A+B; M_a, M_b the same mean when both points are taken in A and both in B respectively; then

$$(A+B)^2M'=2ABM+A^2M_a+B^2M_b.$$

If the space A=B,

$$4M'=2M+M_a+M_b;$$

if, also, $M_a=M_b$,

$$2M'=M+M_a.$$

66. The mean distance of a point P within a given area from a fixed straight line (which does not meet the area) is evidently the distance of the centre of gravity G of the area from the line. Thus, if A, B are two fixed points on a line outside the area, the mean value of the area of the triangle APB=the triangle AGB.

From this it will follow that, if X, Y, Z are three points taken at random in three given spaces on a plane (such that they cannot all be cut by any one straight line), the mean value of the area of the triangle XYZ is the triangle GG′G″, determined by the three centres of gravity of the spaces. For example—

Two points X, Y are taken at random within a triangle. What is the mean area M of the triangle XYC, formed by joining them with one of the angles of the triangle?

Bisect the triangle by the line CD; let M_1 be the mean value when both points fall in the triangle ACD, and M_2 the value when one falls in ACD and the other in BCD; then $2M=M_1+M_2$. But $M_1=\frac{1}{2}M$; and $M_2=GG'C$, where G, G′ are the centres of gravity of ACD, BCD, this being a case of the above theorem; hence $M_2=\frac{2}{9}ABC$, and

$$M=\tfrac{4}{27}ABC.$$

Hence the chance that a new point Z falls on the triangle XYC is $\frac{4}{27}$; and the chance that three points X, Y, Z taken at random form, with a vertex C, a re-entrant quadrilateral, is $\frac{4}{9}$.

67. If M be a mean value depending on the positions of n points falling on a space A; and if this space receive a small increment α, and M′ be the same mean when the n points are taken on $A+\alpha$, and M_1 the same mean when one point falls on α and the remaining $n-1$ on A; then, the sum of all the cases being $M'(A+\alpha)^n$, and this sum consisting of the cases (1) when all the points are on A, (2) when one is on α the others on A (as we may neglect all where two or more fall on α), we have

$$M'(A+\alpha)^n=MA^n+nM_1\alpha A^{n-1};$$

$$\therefore (M'-M)A=n\alpha(M_1-M) \quad . \quad . \quad . \quad . \quad (68),$$

as M′ nearly = M.

As an example, suppose two points X, Y are taken in a line of length l, to find the mean value M of $(XY)^n$, as in art. 63.

If l receives an increment dl, formula (68) gives

$$ldM=2dl(M_1-M).$$

Now M_1 here = the mean nth power of the distance of a single point taken at random in l from one extremity of l; and this is $l^n(n+1)^{-1}$ (as is shown by finding the chance of n other points falling on that distance); hence

$$ldM=2dl(l^n(n+1)^{-1}-M);$$

$$\therefore ldM+2Mdl=2(n+1)^{-1}l^ndl,$$

or $$l^{-1}.\,d.\,Ml^2=2(n+1)^{-1}l^ndl;$$

$$\therefore Ml^2=2(n+1)^{-1}\textstyle\int l^{n+1}dl=2l^{n+2}(n+1)^{-1}(n+2)^{-1}+C;$$

$$\therefore M=2l^n(n+1)^{-1}(n+2)^{-1},$$

as in art. 63, C being evidently 0.

68. If p is the probability of a certain condition being satisfied by the n points within A in art. 67, p' the same probability when they fall on the space $A+\alpha$, and p_1 the same when one point falls on α and the rest on A, then, since the numbers of favorable cases are respectively $p'(A+\alpha)^n$, pA^n, $np_1\alpha A^{n-1}$, we find

$$(p'-p)A=n\alpha(p_1-p) \quad . \quad . \quad . \quad . \quad . \quad (69).$$

Hence if $p'=p$ then $p_1=p$; this result is often of great value. Thus if we have to find the chance of three points within a circle forming an acute-angle triangle, by adding an infinitesimal concentric ring to the circle, we have evidently $p'=p$; hence the required chance is unaltered by assuming one of the three points taken on the circumference.

Again, in finding the chance that four points within a triangle shall form a convex quadrilateral, adding to the triangle a small band between the base and a line parallel to it, the chance is clearly unaltered. Therefore by (69) we may take one of the points at random in the base of the triangle without altering the probability.

---

[1] If S = number of successes, we have an assigned chance ϖ that S lies between $pN\pm r$; that is, the value of π lies between $\frac{2c}{a}\cdot\frac{N}{S\pm r}$, or $\frac{2c}{a}\left(\frac{N}{S}\pm\frac{Nr}{S^2}\right)$. Hence the error in π is least when $2cr/S^2$ is least. Now $r\propto\sqrt{p(1-p)}$, $2c\propto p$, and $S\propto p$ nearly; hence $\sqrt{p(1-p)}/p$ is to be the least possible.

69. Historically, it would seem that the first question given on local probability, since Buffon, was the remarkable four-point problem of Prof. Sylvester. It is, in general, to find the probability that four points taken at random within a given boundary shall form a re-entrant quadrilateral. It is easy to see that this problem is identical with the problem of finding the mean area of the triangle formed by three points taken at random; for, if M be this mean, and A the given area, the chance of a fourth point falling on the triangle is M/A; and the chance of a re-entrant quadrilateral is four times this, or 4M/A.

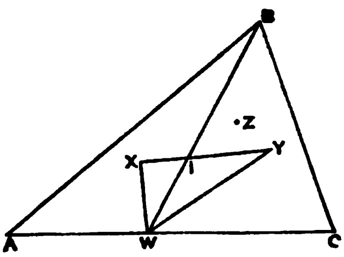

FIG. 3.

Let the four points be taken with a triangle. We may take one of them W (Fig. 3) at random on the base (art. 68); the others X, Y, Z within the triangle. Now the four lines from the vertex B to the four points are as likely to occur in any specified order as any other. Hence it is an even chance that X, Y, Z fall on one of the triangles ABW, CBW, or that two fall on one of these triangles and the remaining one on the other. Hence the probability of a re-entrant quadrilateral is

$$\tfrac{1}{4}p_1+\tfrac{3}{4}p_2,$$

where p_1 = prob. (WXYZ re-entrant), X, Y, Z in one triangle p_2 = do., X in one triangle, Y in the other, Z in either.

But $p_1=\frac{2}{3}$ (art. 66). Now to find p_2; the chance of Z falling within the triangle WXY is the mean area of WXY divided by ABC. Now by the principle in art. 66, for any particular position of W, M WXY)=WGG′, where G, G′ are the centres of gravity of ABW, CBW. It is easy to see that WGG′$=\frac{1}{9}$ABC$=\frac{1}{9}$, putting ABC = 1. Now, if Z falls in CBW, the chance of WXYZ re-entrant is 2M(IYW), for Y is as likely to fall in WXZ as Z to fall in WXY; also if Z falls in ABW the chance of WXYZ re-entrant is 2M(IXW). Thus the whole chance is p_2=2M(IYW+IXW)$=\frac{2}{9}$.

Hence the probability of a re-entrant quadrilateral is

$$\tfrac{1}{4}\cdot\tfrac{2}{3}+\tfrac{3}{4}\cdot\tfrac{2}{9}=\tfrac{1}{3}.$$

That of its being convex is $\frac{2}{3}$.

70. If three points X, Y, Z are taken at random in a triangle, the mean value of the triangle XYZ $=\frac{1}{12}$ of the given triangle. For we have seen that the chance of four points forming a re-entrant figure is 4M/Δ, where M is the required mean and Δ the given triangle; as this has been shown to be $\frac{1}{3}$,

$$\mathrm{M}=\tfrac{1}{12}\Delta.$$

71. Let the three points be taken within a circle; and let M be the mean value of the triangle formed. Adding a concentric ring α, we have (68) since M′: M as the areas of the circles, $\mathrm{M}'=\frac{\mathrm{A}+\alpha}{\mathrm{A}}\mathrm{M}$.

$$\therefore\ \mathrm{A}\frac{\alpha}{\mathrm{A}}\mathrm{M}=3\alpha(\mathrm{M}_1-\mathrm{M});\quad \therefore\ \mathrm{M}=\tfrac{3}{4}\mathrm{M}_1,$$

where M_1 is the value of M when one of the points is on the circumference.

Take O fixed; we have to find the mean value of OXY (Fig. 4). Taking (ρ,θ) (ρ',θ') as coördinates of X, Y,

$$\mathrm{M}_1=(\pi a^2)^{-2}\iint\rho\,d\rho\,d\theta\iint\rho'\,d\rho'\,d\theta'.(\mathrm{OXY}).$$

$$\therefore\ \mathrm{M}_1=(\pi^2a^4)^{-1}\iiiint\tfrac{1}{2}\rho\rho'\sin(\theta-\theta')\rho\rho'\,d\rho\,d\rho'\,d\theta\,d\theta'$$

$$=(\pi^2a^4)^{-1}.\tfrac{1}{2}\iint\tfrac{1}{9}r^3r'^3.\sin(\theta-\theta')\,d\theta\,d\theta',$$

putting r=OH, r'=OK; as $r=2a\sin\theta$, $r'=2a\sin\theta'$,

$$\mathrm{M}_1=\frac{1}{\pi^2a^4}.\frac{(2a)^6}{9}\int_0^\pi\int_0^\theta\sin^3\theta\sin^3\theta'\sin(\theta-\theta')\,d\theta\,d\theta'.$$

Professor Sylvester has remarked that this double integral, by means of the theorem

$$\int_0^a\int_0^x f(x,y)\,dx\,dy=\int_0^a\int_0^x f(a-y,a-x)\,dx\,dy,$$

is easily shown to be identical with

$$2\int_0^\pi\int_0^\theta\sin^4\theta\sin^3\theta'\cos\theta'\,d\theta\,d\theta'=\tfrac{1}{2}\int_0^\pi\sin^8\theta\,d\theta=\tfrac{1}{2}\frac{1.3.5.7}{2.4.6.8}\pi.$$

$$\therefore\ \mathrm{M}_1=\frac{35a^2}{36\pi};\quad \therefore\ \mathrm{M}=\frac{35}{48\pi^2}\pi a^2.$$

Hence the probability that four points within a circle shall form a re-entrant figure is

$$p=\frac{35}{12\pi^2}.$$

72. Professor Sylvester has remarked that it would be a novel question in the calculus of variations to determine the form of the convex contour which renders the probability a maximum or minimum that four points taken within it shall give a re-entrant quadrilateral. It will not be difficult to show, by means of the principles we have been examining, that the circle is the contour which gives the minimum.

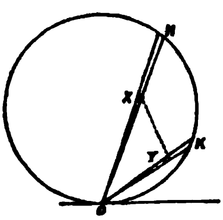

FIG. 4.

For, if p be the probability of a re-entrant figure for four points within a circle of area A, p' the same probability when a small addition α, of any kind, which still leaves the whole contour convex, is made to the circle, we have by (69)

$$(p'-p)\mathrm{A}=4\alpha(p_1-p),$$

where p_1=the probability when one point is taken in α—that is, in the limit, when one point is taken on the circumference of the circle. But $p_1=p$, as is shown in art. 68; hence

$$p'-p=0.$$

Hence any infinitesimal variation of the contour from the circumference of the circle gives δp, the variation of the probability, zero,—the same method being applicable when portions are taken away, instead of being added, provided the contour is left convex.

Hence, for the circle, the probability is a maximum or minimum. It will be a minimum, because in the formula (68) for the mean triangle formed by three points

$$(\mathrm{M}'-\mathrm{M})\mathrm{A}=3\alpha(\mathrm{M}_1-\mathrm{M}).$$

M_1, which is the mean triangle when one point is in α, is really greater than when it is on the circumference, though the same in the limit; hence

$$\mathrm{M}_1>\tfrac{4}{3}\mathrm{M};$$
$$\therefore(\mathrm{M}'-\mathrm{M})\mathrm{A}>\alpha\mathrm{M};$$
$$\therefore\mathrm{M}'/(\mathrm{A}+\alpha)>\mathrm{M}/\mathrm{A}.$$

Therefore, if we consider infinitesimals of the second order, the chance of a re-entrant figure is increased by the addition of the space α to the circle. It will be an exercise for the reader to verify this when the space is subtracted.

For an ellipse, being derived by projection from the circle, the probability is the same, and a minimum.

It is pretty certain that a triangle will be found to be the contour which gives the probability the greatest.

Mr. Woolhouse has given (*Educ. Times*, Dec., 1867) the values of p for

	Triangle.	Parallelogram.	Reg. Hexagon.	Circle.
$p=$	$\frac{1}{3}$ or .3333	$\frac{11}{36}$ .3056	$\frac{683}{2297}$ .2973	$\frac{35}{12}\pi^{-2}$ .2955

73. Many questions may be made to depend upon the four-point problem. Thus, if two points A, B are taken at random in a given convex area, to find the chance that two others C, D, also taken at random, shall lie on opposite sides of the line AB.

Let p be the chance that ABCD is re-entrant. If it is, the chance is easily seen to be $\frac{1}{2}$ that any two of the four lie on opposite sides of the line joining the two others. If ABCD is convex, the same chance is $\frac{1}{3}$; hence the required probability is

$$\omega=\tfrac{1}{2}p+\tfrac{1}{3}(1-p)=\tfrac{1}{3}+\tfrac{1}{6}p.$$

Or we might proceed as follows, *e.g.*, in the case of a triangle:

The sides of the triangle ABC (Fig. 5) produced divide the whole triangle into seven spaces. Of these, the mean value of those marked α is the same, viz., the mean value of ABC, or $\frac{1}{12}$ of the triangle, as we have shown—the mean value of those marked β being $\frac{2}{9}$ of the triangle.

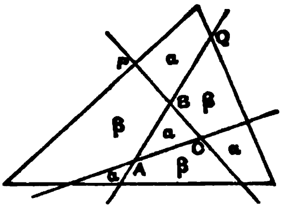

FIG. 5.

This is easily seen: for instance, if the whole area = 1, the mean value of the space PBQ gives the chance that if the fourth point D be taken at random B shall fall within the triangle ADC; now the mean value of ABC gives the chance that D shall fall within ABC; but these two chances are equal. Hence we see that if A, B, C be taken at random, the mean value of that portion of the whole triangle which lies on the same side of AB as C does is $\frac{11}{18}$ of the whole, and that of the opposite portion is $\frac{7}{18}$. Hence the chance of C and D falling on opposite sides of AB is $\frac{7}{18}$.

74. We can give but few of the innumerable questions depending on the position of points in a plane, or in space. Some may be solved without any aid from the integral calculus, by using a few very evident subsidiary principles. As an instance, we will state the following two propositions, and proceed to apply them to one or two questions.

(1) In a triangle ABC, the frequency of any direction for the line CX is the same when X is a point taken at random on the base AB as when X is taken at random in the area of the triangle.

(2) If X (Fig. 6) is a point taken at random in the triangle ABb (Bb being infinitesimal), the frequency of the distance AX is the same as that of AZ, Y and Z being two points taken at random in AB, and Z denoting always *that one of the two which is nearest to B.* For the frequency in each case is proportional to the distance AX or AZ.

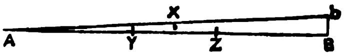

FIG. 6.

Let us apply these to the following question:

A point O is taken at random in a triangle (Fig. 7); if n more points are taken at random, to find the chance that they shall lie on some one of the three triangles AOB, AOC, BOC.

If C be joined with all the points in question, every joining line is equally likely to be nearest to CB. Hence the chance that all the n points fall on the triangle ACD is

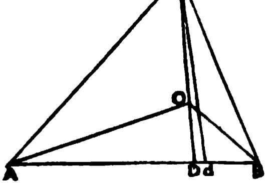

FIG. 7.

$$(n+1)^{-1}.$$

If this is so, we have to find the chance that all lie on AOC. Now if O range over the infinitesimal triangle DCd, we may, by principle (2) above, suppose it to be the nearest to D of two points taken at random in CD. If so, the chance that AO is nearer to AD than any of the lines from A to the n points is

$$2(n+2)^{-1};$$

for, by (1) above, we may suppose all the points taken at random in CD; now any one of the $n+2$ is equally likely to be the last; and O is the last of the two additional points. Hence, if O is in the triangle CDd, the chance that the n points fall on AOC is

$$2(n+1)^{-1}(n+2)^{-1};$$

therefore this is the chance wherever O falls in ABC.

Therefore the required chance that the n points fall on some one of the triangles AOB, AOC, BOC is

$$P=6(n+1)^{-1}(n+2)^{-1}.$$

Again, if O be taken at random in the triangle, and three more points X, Y, Z, be also taken at random in it, to find the chance that they shall fall, one on each of the triangles AOB, AOC, BOC.

First, two of the points are to fall on one of the triangles ACD, BCD, and the remaining one on the other; say two on ACD, the chance of this is $\frac{1}{4}$, as CO must then be the third in order of the four distances from C. If this is so, the chance that the point X in BCD falls on BOC is $\frac{2}{3}$. For, as above, if O ranges over the triangle CDd, we may take it to be the lowest of two points taken at random on CD; and the chance that, if another point be also taken at random in CD, it shall be lower than O is $\frac{1}{3}$. Now if one of the points X is in BOC, the frequency of O in CDd will be the same as that of the lowest of three points taken on CD; and the chance that one of the remaining points shall fall in AOC and the other in AOD is the chance that O, the lowest of three particular points out of five, all taken at random in CD, shall be the fourth in order from C. It is easy to see that this chance is $\frac{3}{10}$. Hence the chance that one point falls on BOC, one on AOC, and the third on AOD is

$$\tfrac{1}{4}\cdot\tfrac{2}{3}\cdot\tfrac{3}{10}=\tfrac{1}{20}.$$

And it will be the same for the case where the third falls on BOD. Hence the chance that one point falls on each of the three triangles above is double this, or $\frac{1}{10}$.

75. *Straight lines falling at Random on a Plane.*—If an infinite number of straight lines be drawn at random in a plane, there will be as many parallel to any given direction as to any other, all directions being equally probable; also those having any given direction will be disposed with equal frequency all over the plane. Hence, if a line be determined by the coördinates p, ω, the perpendicular on it from a fixed origin O, and the inclination of that perpendicular to a fixed axis, then, if p, ω be made to vary by equal infinitesimal increments, the series of lines so given will represent the entire series of random straight lines. Thus the number of lines for which p falls between p and $p+dp$, and ω between ω and $\omega+d\omega$, will be measured by $dpd\omega$, and the integral

$$\iint dp\,d\omega,$$

between any limits, measures the number of lines within those limits.

It is easy to show from this that *the number of random lines which meet any closed convex contour of length L is measured by L.* For, taking O inside the contour, and integrating first for p, from 0 to p, the perpendicular on the tangent to the contour, we have $\int p\,d\omega$; taking this through four right angles for ω, we have by Legendre's theorem on rectification, N being the measure of the number of lines,

$$\mathrm{N}=\int_0^{2\pi} p\,d\omega=\mathrm{L}.^{1}$$

Thus, if a random line meet a given contour, of length L, the chance of its meeting another convex contour, of length l, internal to the former, is

$$p=l/\mathrm{L}.$$

If the given contour be not convex, or not closed, N will evidently be the length of an endless string, drawn tight around the contour.

76. If a random line meet a closed convex contour, of length L, the chance of it meeting another such contour, external to the former is

$$p=(\mathrm{X}-\mathrm{Y})/\mathrm{L},$$

where X is the length of an endless band enveloping both contours, and Y that of a band also enveloping both, but not crossing. This may be shown by means of Legendre's integral above; or as follows:

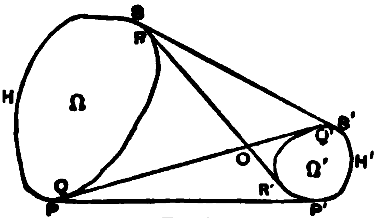

FIG. 8.

Call, for shortness, N(A) the number of lines meeting an area A; N(A, A′) the number which meet both A and A′; then (Fig. 8)

$$\mathrm{N(SROQPH)}+\mathrm{N(S'Q'OR'P'H')}=\mathrm{N(SROQPH}$$
$$+\mathrm{S'Q'OR'P'H')}+\mathrm{N(SROQPH,\ S'Q'OR'P'H')},$$

since in the first member each line meeting both areas is counted twice. But the number of lines meeting the non-convex figure consisting of OQPHSR and OQ′S′H′P′R′ is equal to the band Y, and the number meeting both these areas is identical with that of those meeting the given areas Ω, Ω′; hence

$$\mathrm{X}=\mathrm{Y}+\mathrm{N}(\Omega,\Omega').$$

---

[1] This result also follows by considering that if an infinite plane be covered by an infinity of lines drawn at random, it is evident that the number of these which meet a given finite straight line is proportional to its length and is the same whatever be its position. Hence, if we take l the length of the line as the measure of this number, the number of random lines which cut any element ds of the contour is measured by ds, and the number which meet the contour is therefore measured by ½ L, half the length of the boundary. If we take $2l$ as the measure for the line, the measure for the contour will be L as above. Of course we have to remember that each line must meet the contour twice. It would be possible to rectify any closed curve by means of this principle. Suppose it traced on the surface of a circular disk, of circumference L, and the disk thrown a great number of times on a system of parallel lines, whose distance asunder equals the diameter, if we count the number of cases in which the closed curve meets one of the parallels, the ratio of this number to the whole number of trials will be ultimately the ratio of the circumference of the curve to that of the circle.

Thus the number meeting both the given areas is measured by X − Y. Hence the theorem follows.

77. Two random chords cross a given convex boundary, of length L, and area Ω; to find the chance that their intersection falls inside the boundary.

Consider the first chord in any position; let C be its length; considering it as a closed area, the chance of the second chord meeting it is

$$2C/L\,;$$

and the whole chance of its coördinates falling in dp, $d\omega$ and of the second chord meeting it in that position is

$$\frac{2C}{L}\frac{dp\,d\omega}{\iint dp\,d\omega}=\frac{2}{L^2}C\,dp\,d\omega\,.$$

But the whole chance is the sum of these chances for all its positions;

$$\therefore \text{prob.}=2L^{-2}\iint C\,dp\,d\omega\,.$$

Now, for a given value of ω, the value of $\int C\,dp$ is evidently the area Ω; then, taking ω from π to 0,

$$\text{required probability}=2\pi\Omega L^{-2}.$$

The mean value of a chord drawn at random across the boundary is

$$M=\frac{\iint C\,dp\,d\omega}{\iint dp\,d\omega}=\frac{\pi\Omega}{L}\,.$$

78. A straight band of breadth c being traced on a floor, and a circle of radius r thrown on it at random; to find the mean area of the band which is covered by the circle. (The cases are omitted where the circle falls outside the band.)[1]

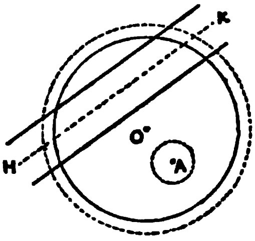

FIG. 9.

If S be the space covered, the chance of a random point on the circle falling on the band is

$$p=M(S)/\pi r^2.$$

This is the same as if the circle were fixed, and the band thrown on it at random. Now let A (Fig. 9) be a position of the random point; the favorable cases are when HK, *the bisector of the band*, meets a circle, centre A, radius $\frac{1}{2}c$; and the whole number are when HK meets a circle, centre O, radius $r+\frac{1}{2}c$; hence the probability is

$$p=\frac{2\pi\,.\,\frac{1}{2}c}{2\pi(r+\frac{1}{2}c)}=\frac{c}{2r+c}\,.$$

This is constant for all positions of A; hence, equating these two values of p, the mean value required is

$$M(S)=c(2r+c)^{-1}\pi r^2\,.$$

The mean value of the portion of the *circumference* which falls on the band is the same fraction $\frac{c}{2r+c}$ of the whole circumference.

If *any convex area* whose surface is Ω and circumference L be thrown on the band, instead of a circle, the mean area covered is

$$M(S)=\pi c(L+\pi c)^{-1}\Omega.$$

For as before, fixing the random point at A, the chance of a random point in Ω falling on the band is

$$p=2\pi\,.\,\tfrac{1}{2}c/L'\,,$$

where L′ is the perimeter of a *parallel* curve to L, at a normal distance $\frac{1}{2}c$ from it. Now

$$L'=L+2\pi\,.\,\tfrac{1}{2}c.$$

$$\therefore \frac{M(S)}{\Omega}=\frac{\pi c}{L+\pi c}\,.$$

79. Buffon's problem may be easily deduced in a similar manner. Thus, if $2r$ = length of line, a = distance between the parallels, and we conceive a circle (Fig. 10) of diameter a with its centre at the middle O of the line,[2] rigidly attached to the latter, and thrown with it on the parallels, this circle must meet one of the parallels; if it be thrown an infinite number of times, we shall thus have an infinite number of chords crossing it at random. Their number is measured by $2\pi\,.\,\frac{1}{2}a$, and the number which meet $2r$ is measured by $4r$. Hence the chance that the line $2r$ meets one of the parallels is

$$p=4r/\pi a\,.$$

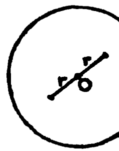

FIG. 10.

80. To investigate the probability that the inclination of the line joining any two points in a given convex area Ω shall lie within given limits. We give here a method of reducing this question to calculation, for the sake of an integral to which it leads, and which is not easy to deduce otherwise.

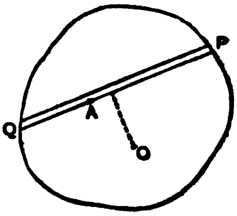

FIG. 11.

First let one of the points A (Fig. 11) be fixed; draw through it a chord PQ = C, at an inclination θ to some fixed line; put AP = r, AQ = r'; then the number of cases for which the direction of the line joining A and B lies between θ and $\theta+d\theta$ is measured by

$$\tfrac{1}{2}(r^2+r'^2)d\theta\,.$$

Now let A range over the space between PQ and a parallel chord distant dp from it, the number of cases for which A lies in this space and the direction of AB is from θ to $\theta+d\theta$ is (first considering A to lie in the element $dr\,dp$)

$$\tfrac{1}{2}dp\,d\theta\int_0^C(r^2+r'^2)dr=\tfrac{1}{3}C^3dp\,d\theta\,.$$

Let p be the perpendicular on C from a given origin O, and let ω be the inclination of p (we may put $d\omega$ for $d\theta$), C will be a given function of p, ω; and, integrating first for ω constant, the whole number of cases for which ω falls between given limits ω', ω'' is

$$\tfrac{1}{3}\int_{\omega''}^{\omega'}d\omega\int C^3dp\,;$$

the integral $\int C^3dp$ being taken for all positions of C between two tangents to the boundary parallel to PQ. The question is thus reduced to the evaluation of this double integral, which, of course, is generally difficult enough; we may, however, deduce from it a remarkable result; for, if the integral

$$\tfrac{1}{3}\iint C^3dp\,d\omega$$

be extended to all possible positions of C, it gives the whole number of pairs of positions of the points A, B which lie inside the area; but this number is Ω^2; hence

$$\iint C^3dp\,d\omega=3\Omega^2,\,^{3}$$

the integration extending to all possible positions of the chord C—its length being a given function of its coördinates p, ω.

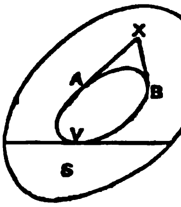

FIG. 12.

COR. Hence if L, Ω be the perimeter and area of any closed convex contour, the mean value of the cube of a chord drawn across it at random is $3\Omega^2/L$.

81. Let there be any two convex boundaries (Fig. 12) so related that a tangent at any point V to the inner cuts off a constant segment S from the outer (*e.g.*, two concentric similar ellipses); let the annular area between them be called A; from a point X taken at random on this annulus draw tangents XA, XB to the inner. Find the mean value of the arc AB. We shall find

$$M(AB)=LS/A,$$

L being the whole length of the inner curve ABV.

We will first prove the following lemma:

If there be any convex arc AB (Fig. 13), and if N_1 be (the measure of) the number of random lines which meet it once, N_2 the number which meet it twice,

$$2\text{ arc AB}=N_1+2N_2\,.$$

FIG. 13.

For draw the chord AB; the number of lines meeting the convex figure so formed is

$$N_1+N_2=\text{arc}+\text{chord (the perimeter)}\,;$$

but N_1 = the number of lines meeting the chord = 2 chord;

$$\therefore 2\text{ arc}+N_1=2N_1+2N_2\,,\quad \therefore 2\text{ arc}=N_1+2N_2\,.$$

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[1] Or the floor may be supposed painted with parallel bands, at a distance asunder equal to the diameter; so that the circle must fall on one.

[2] The line might be anywhere within the circle without altering the question.

[3] This integral was given by the present writer in the *Comptes Rendus*, 1869, p. 1469. An analytical proof was given by Serret, *Annales scient. de l'École Normale*, 1869, p. 177.

Now fix the point X and draw XA, XB. If a random line cross the boundary L, and p_1 be the probability that it meets the arc AB once, p_2 that it does so twice,

$$2AB/L = p_1 + 2p_2;$$

and if the point X range all over the annulus, and p_1, p_2 are the same probabilities for all positions of X,

$$2M(AB)/L = p_1 + 2p_2.$$

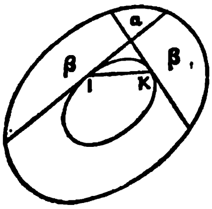

FIG. 14.

Let now IK (Fig. 14) be any position of the random line; drawing tangents at I, K, it is easy to see that it will cut the arc AB twice when X is in the space marked α, and once when X is in either space marked β; hence, for this position of the line,

$$p_1 + 2p_2 = \frac{2\alpha + 2\beta}{A} = \frac{2S}{A}, \text{ which is constant; hence}$$

$$\frac{M(AB)}{L} = \frac{S}{A}.$$

Hence the mean value of the arc is the same fraction of the perimeter that the constant area S is of the annulus.

If L be not related as above to the outer boundary,

$$M(AB)/L = M(S)/A,$$

M(S) being the mean area of the segment cut off by a tangent at a random point on the perimeter L.

The above result may be expressed as an integral. If s be the arc AB included by tangents from any point (x, y) on the annulus,

$$\iint s\,dx\,dy = LS.$$

It has been shown (*Phil. Trans.*, 1868, p. 191) that, if θ be the angle between the tangents XA, XB,

$$\iint \theta\,dx\,dy = \pi(A - 2S).$$

The mean value of the tangent XA or XB may be shown to be

$$M(XA) = \frac{S}{2A}P,$$

where P = perimeter of locus of centre of gravity of the segment S.

82. If C be the length of a chord crossing any convex area Ω; Σ, Σ' the areas of the two segments into which it divides the area; and p, ω the coördinates of C, viz., the perpendicular on C from any fixed pole, and the angle made by p with any fixed axis; then

$$\iint C^4\,dp\,d\omega = 6\iint \Sigma\Sigma'\,dp\,d\omega,$$

both integrations extending to all possible values of p, ω which give a line meeting the area.

This identity will follow by proving that, if ρ be the distance between two points taken at random in the area, the mean value of ρ will be

$$M(\rho) = \Omega^{-2}\iint \Sigma\Sigma'\,dp\,d\omega \quad . \quad . \quad . \quad . \quad (1),$$

and also

$$M(\rho) = \tfrac{1}{6}\Omega^{-2}\iint C^4\,dp\,d\omega \quad . \quad . \quad . \quad . \quad (2).$$

The first follows by considering that, if a random line crosses the area, the chance of its passing between the two points is $2L^{-1}M(\rho)$, L being the perimeter of Ω. Again, for any given position of the random line C, the chance of the two points lying on opposite sides of it is $2\Sigma\Sigma'\Omega^{-2}$; therefore, for all positions of C, the chance is $2\Omega^{-2}M(\Sigma\Sigma')$; but the mean value $M(\Sigma\Sigma')$, for all positions of the chord, is

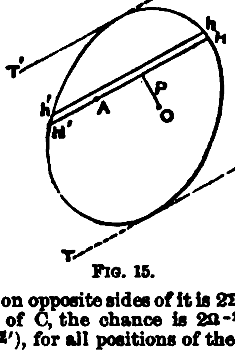

FIG. 15.

$$M(\Sigma\Sigma') = \frac{\iint \Sigma\Sigma'\,dp\,d\omega}{\iint dp\,d\omega} = \frac{1}{L}\iint \Sigma\Sigma'\,dp\,d\omega.$$

To prove equation (2), we remark that the mean value of ρ is found by supposing each of the points A, B to occupy in succession every possible position in the area, and dividing the sum of their distances in each case by the whole number of cases, the measure of which number is Ω^2. Confining our attention to the cases in which the inclination of the distance AB to some fixed direction lies between θ and $\theta + d\theta$, let the position of A be fixed (Fig. 15), and draw through it a chord HH′ = C, at the inclination θ; the sum of the cases found by giving B all its positions is

$$d\theta\int_0^r \rho\,.\,\rho d\rho + d\theta\int_0^{r'} \rho\,.\,\rho d\rho = \tfrac{1}{3}(r^3 + r'^3)d\theta,$$

where $r = AH$, $r' = AH'$. Now let A occupy successively all positions between HH′ and hh', a chord parallel to it at a distance $= dp$; the sum of all the cases so given will be

$$\tfrac{1}{3}d\theta dp\int_0^C (r^3 + r'^3)dr = \tfrac{1}{3}d\theta dp\tfrac{1}{4}2C^4$$
$$= \tfrac{1}{6}d\theta dp C^4.$$

Now, if A moves over the whole area, the sum of the cases will be

$$\tfrac{1}{6}d\theta\int C^4 dp,$$

where p = perpendicular on C from any fixed pole O, and the integration extends to all parallel positions of C between two tangents T, T′ to the boundary, the inclination of which is θ. Removing now the restriction as to the direction of the distance AB, and giving it all values from 0 to π, the sum of all the cases is

$$\tfrac{1}{6}\int_0^\pi d\theta\int C^4 dp;$$

or, if ω = inclination of p, $d\omega = d\theta$, and the sum is

$$\tfrac{1}{6}\iint C^4\,dp\,d\omega.$$

The mean value of the reciprocal of the distance AB of two points taken at random in a convex area is easily shown to be

$$M\rho^{-1} = \Omega^{-2}\iint C^2\,dp\,d\omega.$$

Thus, for a circle, $\quad M\rho^{-1} = \frac{16}{3\pi r}.$

It may also be shown that the mean area of the triangle formed by taking three points A, B, C within any convex area is

$$M(ABC) = \Omega - \Omega^{-3}\iint C^3\Sigma^2\,dp\,d\omega.$$

83. In the last question if we had sought for the mean value of the chord HH′ or C, which joins A and B, the sum of the cases when A is fixed and the inclination lies between θ and $\theta + d\theta$ would have been

$$C\,.\,\tfrac{1}{2}(r^2 + r'^2)d\theta,$$

and when A lies between HH′ and hh'

$$\tfrac{1}{2}C d\theta dp\int_0^C (r^2 + r'^2)dr = \tfrac{1}{3}d\theta dp C^4;$$

and finally, the mean value of C is

$$M(C) = \tfrac{1}{3}\Omega^{-2}\iint C^4\,dp\,d\omega.$$

Thus the mean value of a chord, passing through two points taken at random within any convex boundary, is double the mean distance of the points.

84. We have now done enough to give the reader some idea of the subject of local probability. We refer him for fuller information to the very interesting work just published by Emanuel Czuber of Prague, *Geometrische Wahrscheinlichkeiten und Mittelwerte*, Leipsic, 1884; also to the *Educational Times Journal*, in which most of the recent theorems on the subject have first appeared in the form of questions, under the able editorship of Mr. Miller, who has himself largely contributed. In Williamson's *Integral Calculus*, and a paper by Prof. Crofton, *Phil. Trans.*, 1868, the subject is also treated.

Literature.—Besides the works named in the course of this article, see De Morgan's treatise in the *Encyclopædia Metropolitana*; Laurent, *Traité du Calcul des Probabilités*, Paris, 1873; Gourand, *Histoire du Calcul des Prob.*, Paris, 1848; J. W. L. Glaisher, "On the Law of Facility of Errors of Observations, and the Method of Least Squares," *Trans. R.A.S.*, vol. xxxix.; Cournot, *Théorie des Chances*; Liagre, *Calcul des Prob.*; General Didion, *Calcul des Prob. appliqué au tir des projectiles*. Those who are interested in the metaphysical aspect of the question may consult Boole's *Laws of Thought*, also J. S. Mill's *Logic*. To these and the other works we have named we refer the reader for an account of what we have had to omit, but above all, to the great work of Laplace, of which it is sufficient to say that it is worthy of the genius of its author—the *Théorie analytique des Probabilités*. It is no light task to master the methods and the reasonings there employed: but it is, and will long continue to be, one that must be attempted by all who desire to understand and to apply the theory of probability. (M. W. C.)

PROBATE. See Will.

PROBUS, Marcus Aurelius, Roman emperor from 276 to 282 A.D., was a native of Sirmium on the Save, and son of a military officer of moderate fortune. He early entered the army, where he recommended himself to the emperor Valerian, and against all rule became tribune while still a mere lad. In these times there were abundant opportunities for a capable officer, and Probus served with great distinction in all parts of the empire. Under Aurelian he operated against the Palmyrene realm in Egypt and had a large part in the restoration of Roman authority in the East. On Aurelian's death he was quite the most prominent military officer of Rome and had a great hold on the troops by his constant care for their comfort, his judicious discipline, and his unselfishness. Tacitus is said to have hesitated to assume the purple which Probus was better fitted to wear, and it is certain that he felt the support of Probus indispensable, and raised him to the rank of commander of the whole East. In a few months the purple actually fell to him, for on the news of Tacitus's death his soldiers at once made him emperor, Florianus, who had claimed to succeed his brother, was put to death by his own troops, and the senate were eager to ratify the choice of the army. The reign of Probus was mainly spent in successful wars by which he re-established the security of all the frontiers; the fiercest and most bloody of these operations was directed to clearing Gaul of the Germans. Probus had also to put down three usurpers, Saturninus, Proculus, and Bonosus. One of his principles was never to allow the soldiers to be idle, and to employ them in time of peace on useful works, such as the planting of vineyards in Gaul, Pannonia, and other districts where a selfish policy had previously forbidden this form of husbandry. This increase of duties was naturally unpopular with the troops, and while the emperor was urging on the draining of the marshes of his native place he was attacked and slain by a sudden mutiny. Scarcely any emperor has left behind him so good a reputation; his death was mourned alike by senate and people, and even the soldiers presently repented and raised a monument in honor of "Probus imperator vere probus." According to the *Chron. Alex.* Probus was fifty years old at the time of his death; he left a family, but they withdrew into private life in northern Italy, and the empire fell to Carus.

PROCESS, in law, denotes in the widest sense of the word any means by which a court of justice gives effect to its authority. In the old practice of the English common law courts process was either original or judicial. Original process was a means of compelling a defendant to compliance with an original writ (see Writ). Judicial process was any compulsory proceeding rendered necessary after the appearance of the defendant. Process was also divided in civil matters into original, mesne, and final. Original process in this sense was any means taken to compel the appearance of the defendant. A writ of summons is now the universal means in the High Court of Justice. Mesne process was either any proceeding against the defendant taken between the beginning and the end of the action, such as to compel him to give bail, or was directed to persons not parties to the action, such as jurors or witnesses. Arrest on mesne process was abolished in England by the Debtors Act, 1869. Final process is practically coexistent with execution. It includes writs of *fieri facias*, *capias*, *elegit*, sequestration, and attachment. In criminal matters process only applies where the defendant does not appear upon summons or otherwise. A warrant is now the usual form of such process. Service of process on Sunday is void, except in cases of treason, felony, or breach of the peace, 29 Car. II., c. 7. Recent legislation gives facilities for service and execution of certain kinds of process of the courts of one part of the United Kingdom in another part. Thus by 44 & 45 Vict. c. 24, process of an English court of summary jurisdiction may be served in Scotland, and *vice versa*. A writ of summons in the High Court of Justice may be served out of the jurisdiction in certain cases (*Rules of the Supreme Court*, 1883, Ord. xi.).

Stet processus was a technical term used in old common law practice. It consisted of an entry on the record by consent of the parties for a stay of proceedings. Since the Judicature Acts there has been no record, and the *stet processus* has disappeared with it.

In Scotch law process is used in a much wider sense, almost equivalent to practice or procedure in English law. Process in the English sense corresponds rather to diligence. Where papers forming steps of a process are borrowed and not returned, diligence of process caption lies for their recovery.

In the United States process is governed by numerous statutes, both of Congress and of the State legislatures. The law is founded upon the English common law.

PROCIDA, an island less than 2 miles off the west coast of southern Italy between Capo Miseno (or rather Monte Procida) on the mainland and the island of Ischia, forming part of the circondario of Pozzuoli and the province of Naples. Its total area is not much more than 1½ square miles, but it is fertile, well-cultivated, and thickly peopled (10,788 inhabitants in 1871, 10,891 in 1881). Like the neighboring mainland it is largely of volcanic origin, and the ancient Greek name Prochyte (Πρόχύτη), Latinized as Procita, possibly refers to this fact. The two fine bays on the south coast are remains of craters, and the soil is almost exclusively tuff. The coasts are usually a rocky scarp; the general surface of the island is comparatively low and flat. Procida, the chief town, lies on the isthmus of a peninsula, at the landward extremity, looking out over a spacious bay. It contains a castle, now used as a prison, and an old royal palace of the Bourbons, who had a hunting park in the island; and the harbor is defended by a fort. In the Piazza dei Martiri is a monument to the twelve who were executed as political offenders in 1799. The islanders are mainly engaged in market-gardening, vine-growing, the fisheries, and the coasting trade; but the number of fishing-boats belonging to Procida is much smaller than it used to be. In accordance with their claim to be of Greek descent the women are accustomed to wear on the festival of St. Michael a picturesque Greek costume and to dance the tarantula.

In the 13th century the island was the feudal possession of Giovanni da Procida, the chief conspirator in the Sicilian Vespers. The capture off the coast, by the Ottoman fleet, of a number of Andrea Doria's galleys in 1522 was the last of many instances in which Procida was made to realise the hostility of Mohammedan powers. In 1799, from 1806 to 1809, and again in 1813 it was occupied by the English.

PROCLUS. See Neoplatonism.

PROCONSUL. See Consul, vol. vi. p. 280, and Province.

PROCOPIUS, the most eminent historian of the Eastern Roman Empire, was born at Cæsarea in Palestine, then one of the chief cities of the Roman East, towards the end of the 5th century, probably between 485 and 495 A.D. Of his family and earlier life nothing is known, but it has been plausibly conjectured from the aristocratic sympathies he manifests that he belonged to one of the better families of his city, and from the place of his birth that he was educated at the great law school of Berytus (Beirut). He became a lawyer, probably at Constantinople, and was in 526 appointed *σύμβουλος* to Belisarius, who was proceeding to command the imperial army in the war against the Persians (Proc., *Pers.*, i. 12). The chief duties of this office, which is also described as that of *πάρεδρος* or *συγκάθεδρος*, seem to have been the giving of legal advice to the general, who had a measure of judicial as well as administrative power, and have been well compared by Mr. Hodgkin (*Italy and Her Invaders*, vol. iii. p. 638) to those of an English judge advocate. When the Persian War was suspended Procopius probably returned with his general to Constantinople; and when Belisarius was despatched against the Vandals of Africa in 533 Procopius again accompanied him, as he subsequently did in the war against the Ostrogoths of Italy which began in 536. Whether he held the same position of legal assessor through these campaigns or was merely a member of the large personal following which Belisarius had we do not know. Suidas calls him the secretary (ὑπογραφεύς) of Belisarius, but this may be merely a reference to his original appointment as σύμβουλος in the Persian campaign. He was evidently much valued by Belisarius, who twice employed him on difficult and important missions—once in 533 to obtain from Syracuse provisions for the Roman fleet and information as to the preparations of the Vandals, and again in 537, when the historian was despatched from Rome, which Belisarius was holding against the Goths, to collect troops and corn in Campania and bring them in a fleet to Ostia. On both occasions Procopius acquitted himself with skill and success. He passes lightly over his own performances, and nowhere strikes us as eager for an opportunity of singing his own praises.

After the capture of Ravenna in 539 Procopius would seem to have returned to Constantinople, where he was in 542, the year of the great plague, which he has minutely described (*Pers.*, ii. 22). It does not appear whether he was with the Roman armies in the later stages of the Gothic War, when Belisarius and afterwards Narses fought against Totila in Italy, though his narrative of these years is so much less full and minute than that of the earlier warfare that probably he was not an eye-witness of these campaigns. Of his subsequent fortunes we know nothing, except that he was living in 559. He was an advocate by profession (Agathius, Evagrius, and other Byzantine writers call him ῥήτωρ), but whether he practiced law after his return from the Italian wars may be doubted, for he must have been then occupied with the composition of his histories, and his books show that he spent a good deal of time in travel. He seldom refers to legal matters, and shows little interest in them, mentioning only in the most cursory way the legislation and codification of Justinian. Whether he was the Procopus who was prefect of Constantinople in 562 (Theophanes, *Chronographia*, 201, 202) and was removed from office in the year following cannot be determined. Little can be founded on the name, for it was a common one in that age, and had this Procopius been our historian one might have expected some of the subsequent writers who refer to the latter to have mentioned this fact about him. On the other hand the historian was evidently a person of note, who had obtained the rank of *Illustris* (Suidas calls him Ἰλλούστριος), and a passage in the *Anecdota* looks as if he had risen to be a senator (*Anecd.*, c. 12), so that there is no improbability in his having been raised to the high office of prefect.

There has been some controversy as to his religion. So far as external profession went, he must have been a Christian; for paganism, persecuted by Justinian, would hardly have been tolerated in so conspicuous a person; nor is there any evidence for his being a heathen other than the cool indifference with which (except in the *De Ædificiis*) he speaks about Christian beliefs and practices. He seems to have been so far a Christian as to have believed in a God and have held Christ to be a supernatural being, but he frequently expresses himself in skeptical language, talks of God and Fate as if practically synonymous, and entertained great contempt for the theological controversies which raged so hotly in his own time.

Procopius's writings fall into three divisions—the *Histories* (Persian, Vandal, and Gothic Wars) in eight books, the treatise on the *Buildings of Justinian* (*De Ædificiis*) in six books, and the *Unpublished Memoirs* (τὰ Ἀνέκδοτα, *Historia Arcana*), here cited as the *Anecdota*.

The *Histories* are called by the author himself the *Books about the Wars* (οἱ ὑπὲρ τῶν πολέμων λόγοι). They consist of—(1) the Persian wars, in two books, giving a narrative of the long struggle of the emperors Justin and Justinian against the Persian kings Kobad and Chosroes Anushirvan down to 550; (2) the Vandal War, in two books, describing the conquest of the Vandal kingdom in Africa and the subsequent events there from 532 down to 546 (with a few words on later occurrences); (3) the Gothic War, in four books, narrating the war against the Ostrogoths in Sicily and Italy from 536 to 552. These three treatises were written continuously to form one connected history; but, as the arrangement of events is geographical, not chronological, they overlap in time, the Persian War carrying its narrative over a large part of the period embraced in the Vandal War and the Gothic War. The fourth and last of the four books of the Gothic War is really a general history of the empire, designed to continue the Persian War as well as the Gothic. It was written after the year in which the preceding seven books had been published and was itself published apparently in 554 or 555. These eight books of *Histories*, although mainly occupied with military matters, contain notices of some of the more important domestic events, such as the Nika insurrection at Constantinople in 532, the plague in 542, the conspiracy of Artabanes in 548. They tell us, however, comparatively little about the civil administration of the empire, and nothing about legislation. On the other hand they are rich in geographical and ethnographical information, often of the highest value for our knowledge of the barbarian and particularly of the Teutonic tribes who lived on the borders of the empire and were either its enemies or the material of its armies.

As an historian, Procopius would have deserved honor in any age, and is of quite unusual merit when one considers the generally low literary level of the age which produced him. From the 4th to the 15th century the Eastern empire has no lay writer of gifts approaching his. He is industrious in collecting facts, careful and impartial in stating them; his judgment is sound, his reflections generally acute, his conceptions of the general march and movement of things not unworthy of the great events he has recorded. His discriptions, particularly of military operations, are clear, and his especial fondness for this part of the subject seldom leads him into unnecessary minuteness. The style, although marked by mannerisms, by occasional affectations and rhetorical devices, is on the whole direct and business-like, nor is the Greek bad, when one considers the time. Thucydides and Herodotus are the two models whom he keeps always before his eyes; he imitates the former in the maxims (γνῶμαι) he throws in, and the speeches which he puts into the mouth of the chief actors; the latter in his frequent geographical digressions, in the personal anecdotes, in the tendency to collect and attach some credence to marvellous tales. It need hardly be said that he falls far short of the vigor and profundity of the Attic, as well as of the genial richness, the grace, the simplicity, the moral elevation, the poetical feeling of the Ionic historian. The speeches are obviously composed by Procopius himself, rarely showing any dramatic variety in their language, but they seem sometimes to convey the substance of what was said, and even when this is not the case they frequently serve to bring out the points of a critical situation. The geographical and ethnological notices are precious. Procopius is almost as much a geographer as an historian—it is one of his merits to have perceived the importance of each science to the other—and his descriptions of the peoples and places he himself visited are generally careful and thorough. Although a warmly patriotic Roman, he does full justice to the merits of the barbarian enemies of the empire, and particularly of the Ostrogoths; although the subject of a despotic prince, he criticises the civil and military administration of Justinian and his dealings with foreign peoples with a freedom which gives a favorable impression of the tolerance of the emperor. His chief defects are a somewhat pretentious and at the same time monotonous style, and a want of sympathy and intensity which prevents him from giving full life and reality to the personages who figure in his narrative, or raising it to a level worthy of the great and terrible scenes which he has sometimes to describe.

The *De Ædificiis*, or treatise on the Buildings of Justinian, contains an account of the chief public works executed during the reign of the emperor down to 558, in which year it seems to have been composed, particularly churches, palaces, hospitals, fortresses, roads, bridges and other river works. All these are of course ascribed to the personal action of the monarch. The treatise is a little longer than the average length of one single book of the eight books of the *Histories*. Its arrangement is geographical; beginning from Constantinople, it describes works executed in the Mesopotamian provinces, in Armenia and the Caucasian countries, in Thrace and Macedonia, in Asia Minor and Syria, in Egypt and Africa as far as the Pillars of Hercules. If not written at the command of Justinian (as some have supposed), it is at any rate semi-official, being evidently grounded on official information, and is full of gross flattery of the emperor and of the (then deceased) empress. In point of style it is greatly inferior to the *Histories*—florid, pompous, and affected, and at the same time tedious. Its chief value lies in the geographical notices which it contains.

The *Anecdota*, or Secret History, in length almost equal to the *De Ædificiis*, and somewhat shorter than the average length of a book of the *Histories*, purports to be a supplement to these, containing explanations and additions which the author could not place in the *Histories* for fear of Justinian and Theodora. It is a furious invective against these sovereigns, their characters, personal conduct, and government, with attacks on Belisarius and his wife Antonina, and on other official persons of note in the civil and military services of the empire—attacks whose effect is weakened by the passion the author betrays. Frequent references to the *Histories* are interspersed, but the events of the wars are seldom referred to, the main topic being the personal and official misdeeds of the rulers as shown in domestic affairs. The ferocity and brutality of this scandalous chronicle astonish us, for modern writings of the same order have usually been the work of vulgar and anonymous scribblers, not of an able, accomplished, and highly placed man such as Procopius was. Hence its authenticity has been often called in question, and a few words are needed both on that question and on the further question of the credibility of its contents.

It was unknown to Agathias and Evagrius, younger contemporaries of Procopius who frequently mention his *Histories*, and is first referred to by Suidas (writing in the 10th century), who ascribes it to Procopius. Two MSS. (since lost) are mentioned as having been brought to Italy in the days of the Renaissance, but the first publication was made by Nicholas Alemanni, an official of the Vatican, who found a MS. in that library and edited it with copious and learned notes and a Latin translation (Lyons, 1623). Since his day several jurists (led thereto by jealousy for Justinian's reputation) and other scholars have denied it to be the work of Procopius, among whom it is sufficient to refer to the latest, J. H. Reinkens.[1] The external argument against its genuineness, drawn from its not being mentioned till four centuries after the death of Procopius, appears weak when we recollect that it was obviously not written to be published at the time, and may well have remained concealed for generations. The internal argument from the difference between the view of Justinian it presents and that given in the *De Ædificiis* will impress no one who has observed the almost patent insincerity of the latter book, and the censure, severe though carefully guarded, which the *Histories* frequently bestow on Justinian's policy. On the other hand the agreement in many points of fact between the *Histories* and the *Anecdota*, and the exactness of the references from the latter to the former, point to unity of authorship; while the similarity of opinions, ideas, beliefs, prejudices, and still more the similarities of literary manner, style, and language, supply an overwhelming body of evidence that the *Anecdota* are a genuine, and so far as his deep-seated feelings go the most genuine, work of Procopius. The question, which ought never to have been deemed doubtful, has been set at rest by the careful comparison of the use of words and phrases in the acknowledged works of Procopius and in the *Anecdota*, which we owe to the industry of Dr. Felix Dahn, and which is set forth in his excellent book mentioned at the close of this article. It is less easy to pronounce on the credibility of the picture which the *Anecdota* give of the court and government of Justinian. Plainly there are many exaggerations and some absurdities; yet, when we find some of the severest statements of the book confirmed by other annalists and others substantially tallying with or explaining those made by Procopius himself in the *Histories*, we are led to conclude that there is a substantial basis of fact for the charges it brings. It is of course often difficult, sometimes impossible, to say what deductions must be made from the form these charges take; but after studying the book closely one becomes rather less than more skeptical.

In point of style, the *Anecdota* are inferior to the *Histories*, and have the air of being unfinished or at least unrevised. Their merit lies in the furious earnestness with which they are written, and which gives them a force and reality sometimes wanting in the more elaborate books written for publication.

The character of a man who could revenge himself for having been obliged to bestow gross flattery on his sovereign by ferocious invective meant to be launched after his death inspires little respect. Otherwise Procopius is a favorable specimen of his age. He is patriotic, with a strong feeling for the greatness of the empire, its dignity, the preservation of its ancient order. He is a worshipper of the past, whose ideal is such a government as that of Trajan or Hadrian. His ethical standard is scarcely affected by Christianity, but is that of a Greek of classical times, with too great a tolerance of deceit when practiced against barbarian enemies, and doubtless also with a deficient sense of honor and personal independence. Yet his patriotism does not prevent him from doing justice to the valor of the Persians, or the still finer qualities of the Goths as he had learnt to know them in Italy. He is, however, frigid in sentiment as well as in style, and throws little geniality into his narratives and descriptions. In his attitude towards the unseen world he is at once skeptical and superstitious—skeptical in that he speaks with equal hesitation about the practices and doctrines of different faiths, and declares his persuasion that nothing more can be known about God than that He is all-wise and all-powerful; superstitious in his readiness to accept all kinds of marvels, omens, prophecies, apparitions, and to find in the sudden changes of human affairs the action of a spiteful fortune which delights to startle men and confound their schemes. Procopius has little philosophy in his history; he is a vague and inconsistent thinker, and is strongest when he is describing events or facts, or drawing such direct inferences from them as strike an acute man of the world.

The best edition of Procopius is that by Dindorf in the *Corpus Scriptorum Historiæ Byzantinæ*, 3 vols., Bonn, 1833-38. The best criticisms and examinations of his writings are those by W. S. Teuffel, in his *Studien und Charakteristiken zur Literaturgeschichte*, Leipzic, 1871; and F. Dahn, *Prokopius von Cäsarea*, Berlin, 1865. (J. BR.)

PROCOPIUS. Two leaders of this name are mentioned in connection with the wars of the HUSSITES (*q.v.*).

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[1] *Anecdota sintne scripta a Procopio Cæsariensi inquiritur*, Breslau, 1858.

I. ANDREAS PROCOPIUS, surnamed "the Great" or "the Bald," was a native of Bohemia, born about 1380. He had travelled extensively in Europe, and had even visited Jerusalem before he received priestly orders. On the outbreak of the Hussite War he joined Ziska, and was chosen to succeed him after his death in 1425. From 1426 onwards he met with a succession of military successes in Austria, Moravia, Silesia, and Hungary which compelled various potentates to purchase peace, and disposed even the council of Basel to a spirit of compromise. Procopius and his "Taborites" were, however, dissatisfied with the "Compactata" which the "Calixtines" accepted, and resolved to carry on the contest. He perished in the decisive battle fought near Böhmischbrod on May 30, 1434.

II. Of PROCOPIUS surnamed "the Little" nothing is known save that he co-operated with Procopius "the Great" from 1427 onwards, and that he shared his fate.

PROCTER, BRYAN WALLER (1787–1874), poet and miscellaneous writer, was born on the 21st November, 1787. At an early age he was sent to a small boarding school near London, and thence in his thirteenth year to Harrow, where he had for contemporaries Lord Byron and Sir Robert Peel. On leaving school he was placed in the office of a solicitor at Calne, Wiltshire, remaining there until about 1807, when he returned to pursue his legal studies in London. By the death of his father in 1816 he became possessed of a small property, and soon after entered into partnership with a solicitor; but in 1820 the partnership was dissolved, and during the temporary difficulties thus occasioned he supported himself in part by literary work under the pseudonym of Barry Cornwall. After his marriage in 1824 to Miss Skepper, a daughter of Mrs. Basil Montagu, he returned to his professional work as conveyancer, and was called to the bar in 1831. In the following year he was appointed metropolitan commissioner of lunacy—an appointment annually renewed until his election to the permanent commission constituted by the Act of 1842. He resigned office in 1861. During the last years of his life a failure of speech led him to withdraw increasingly from society, and his death took place on October 4, 1874. The period of his poetic productiveness had closed many years previously, the larger proportion of his verse having been composed between 1815, when he began to contribute to the *Literary Gazette*, and 1823, or at latest 1832.

His principal works in the verse form were—*Dramatic Scenes and other Poems* (1819), *A Sicilian Story* (1820), *Mirandola*, a tragedy performed at Covent Garden with Macready, Charles Kemble, and Miss Foote in the leading parts (1821), *The Flood of Thessaly* (1823), and *English Songs* (1832). He was also the author of *Effigies Poetica* (1824), *Life of Edmund Kean* (1835), *Essays and Tales in Prose* (1851), *Charles Lamb; a Memoir* (1866), and of memoirs of Ben Jonson and Shakespeare for editions of their works. A posthumous autobiographical fragment with notes of his literary friends, of whom he had a wide range from Bowles to Browning, was published in 1877. His genius cannot be said to have been entirely mimetic, but his works are full of subdued echoes. His songs have caught some notes from the Elizabethan and Cavalier lyrics, and blended them with others from the leading poets of his own time; and his dramatic fragments show a similar infusion of the early Victorian spirit into pre-Restoration forms and cadences. The results are somewhat heterogeneous, and without the impress of a pervading and dominant personality to give them unity, but they abound in pleasant touches, with here and there the flash of a higher, though casual inspiration.

His daughter, ADELAIDE ANNE PROCTER (1825–1864), also attained some distinction as a poet, her principal works being her *Legends and Lyrics*, of which a first series, published in 1858, ran through nine editions in seven years, and a second series issued in 1860 met with a similar success. Her unambitious verses dealing with simple emotional themes in a simple manner have a charm which is scarcely explicable on the ground of high literary merit, but which is due rather to the fact that they are the cultured expression of an earnest and beneficent life. Latterly she became a convert to Roman Catholicism, and her philanthropic zeal appears to have hastened her death, which took place February 3, 1864.

PROCTOR, the English form of the Latin *procurator*, denotes a person who acts for another, and so approaches very nearly in meaning to AGENT (*q.v.*). The word is used in three senses. (1) A particular kind of university official. (2) A representative of the clergy in convocation. A proctor represents either the chapter of a cathedral or the beneficed clergy of a diocese. In the province of Canterbury two proctors represent the clergy of each diocese; in that of York there are two for each archdeaconry. In both alike each chapter is represented by one. (3) A practitioner in the ecclesiastical and admiralty courts. A proctor is a qualified person licensed by the archbishop of Canterbury to undertake duties such as are performed in other courts by solicitors. The word in this sense is now only of historical interest. The effect of recent legislation is that all the business formerly confined to proctors may now be conducted by solicitors. The instrument by which a procurator or proctor is appointed is called a *proxy*, a term also applied to the representative himself. Proxies are still in use in bankruptcy and in some of the Vice-Admiralty Courts. Formerly peers could give their vote in parliament by proxy, but this right was discontinued by the standing order of March 31, 1868. A shareholder in a joint-stock company may vote by proxy. A proxy must, by the Stamp Act, 1870, bear a penny stamp.

There are no proctors in the United States. In Scotland the original term procurator is used to denote a law agent who practices in an inferior court. A procurator has been, since the Law Agents Act, 1873, exactly in the same legal position as other law agents. The procurator-fiscal is a local officer charged with the prosecution of crimes. He is appointed by the sheriff. He also performs the duties of an English coroner by holding inquiries into the circumstances of suspicious deaths.

PRODICUS of Ceos, whose birth is conjecturally assigned to 465–460 B.C., was a humanist of the first period of the Sophistical movement. He was still living in 399 B.C. Visiting Athens, in the first instance (it is said) as the accredited agent of his native island, he became known in the intellectual capital as a good speaker and a successful teacher. Like Protagoras, he professed to train his pupils for domestic and civic affairs; but it would appear that, while Protagoras's chief instruments of education were rhetoric and style, Prodicus made ethics prominent in his curriculum. As a moralist he seems to have been orthodox, neither impugning nor developing traditional notions. In his literary teaching he laid special stress upon distinctions in the use of words. The Platonic Socrates (as well as Aristophanes) speaks of Prodicus with a certain respect, earned perhaps by his simple though conventional morality; but it is easy to see that Plato thought him affected and pedantic, and did not rank him either with Protagoras as a thinker or with Gorgias as a stylist. Two of Prodicus's discourses were especially famous: one, "on propriety of language," is repeatedly alluded to by Plato; the other, entitled *ὧραι*, contained the celebrated apologue of the choice of Heracles, of which the Xenophontean Socrates (*Mem.*, ii. 1, 21 *sq.*) gives a summary. Theramenes, Euripides, and Isocrates are said to have been pupils or hearers of Prodicus. For some personal traits, and a caricature of his teaching, see Plato's *Protagoras*, 315 C *sq.*, 337 A *sq.*

On the Sophistical movement, as well as for bibliographical information, see SOPHISTS.

PROHIBITION is defined by Blackstone as if a writ directed to the judge and parties of a suit in any inferior court, commanding them to cease from the prosecution thereof, upon a surmise either that the cause originally or some collateral matter arising therein does not belong to that jurisdiction, but to the cognizance of some other court." A writ of prohibition is a prerogative writ—that is to say, it does not issue as of course, but is granted only on proper grounds being shown. Before the Judicature Acts prohibition was granted by one of the Superior Courts at Westminster; it also issued in certain cases from the Court of Chancery. It is now granted by the High Court of Justice. Up to 1875 the High Court of Admiralty was for the purposes of prohibition an inferior court. But now by the Judicature Act, 1873, 36 & 37 Vict. c. 66, § 24, it is provided that no proceeding in the High Court of Justice or the Court of Appeal is to be restrained by prohibition, a stay of proceedings taking its place where necessary. The Admiralty Division being now one of the divisions of the High Court can therefore no longer be restrained by prohibition. The courts to which it most frequently issues in the present day are the ecclesiastical courts, and county and other local courts, such as the Lord Mayor's Court of London, the Court of Passage of the city of Liverpool, and the Court of Record of the hundred of Salford. In the case of courts of quarter sessions, the same result is generally obtained by *certiorari*. The extent to which the ecclesiastical courts were restrainable by prohibition led to continual disputes for centuries between the civil and ecclesiastical authorities. Attempts were made at different times to define the scope of the writ, the most conspicuous instances being the statute *Circumspecte Agatis*, 13 Edw. I. st. 4; the *Articuli Cleri*, 9 Edw. II. st. 1; and the later *Articuli Cleri* of 3 Jac. I., consisting of the claims asserted by Archbishop Bancroft and the reply of the judges. The law seems to be undoubted that the spiritual court acting in spiritual matters *pro salute animæ* cannot be restrained. The difficulties arise in the application of the principle to individual cases.

Prohibition lies either before or after judgment. In order that proceedings should be restrained after judgment it is necessary that want of jurisdiction in the inferior court should appear upon the face of the proceedings, that the party seeking the prohibition should have taken his objection in the inferior court, or that he was in ignorance of a material fact. A prohibition goes either for excess of jurisdiction, as if an ecclesiastical court were to try a claim by prescription to a pew, or for transgression of clear laws of procedure, as if such a court were to require two witnesses to prove a payment of tithes. It will not as a rule be awarded on a matter of practice. The remedy in such a case is appeal. Nor will it go, unless in exceptional cases, at the instance of a stranger to the suit. The procedure in prohibition is partly common law, partly statutory. By 50 Edw. III. c. 4, prohibition is not to be awarded after consultation, *i.e.*, after the judges of the superior court have remitted the case as within the jurisdiction of the inferior court. 1 Will. IV. c. 21 (an Act to improve the proceedings in prohibition and on writs of mandamus) was repealed as to England by 46 & 47 Vict. c. 49, but it still applies to Ireland, to which it was extended by 9 & 10 Vict. c. 113. Application for a prohibition is usually made *ex parte* to a judge in chambers on affidavit. The application may be granted or refused. If granted, a rule to show cause why a writ of prohibition should not issue goes to the inferior judge and the other party. In prohibition to courts other than county courts pleadings in prohibition may be ordered. These pleadings are as far as possible assimilated to pleadings in actions. They are rare in practice, and are only ordered in cases of great difficulty and importance. In prohibition to county courts they cannot be ordered, 19 & 20 Vict. c. 108, § 42. Further statutory regulations as to prohibition to county courts are contained in §§ 40, 41, and 44 of the same Act, and in 13 & 14 Vict. c. 61, § 22. Much learning on the subject of prohibition will be found in the opinion of Mr. Justice Wills delivered to the House of Lords in The Mayor and Aldermen of London *v.* Cox (*Law Reports*, 2 Eng. and Ir. Appeals, 239).

In Scotch law prohibition is not used in the English sense. The same result is obtained by suspension or reduction. In the United States the supreme court has power to issue a prohibition to the district courts when proceeding as courts of admiralty and maritime jurisdiction. Most of the States have also their own law upon the subject, generally giving power to the supreme judicial authority in the State to prohibit courts of inferior jurisdiction.

PROJECTILES. See MECHANICS (vol. xv. pp. 689 *sq.*, 714 *sq.*) and GUNNERY, vol. xi. 268 *sq.*

PROJECTION. If from a fixed point S in space lines or rays be drawn to different points A, B, C, . . . in space, and if these rays are cut by a plane in points A', B', C', . . . the latter are called the projections of the given points on the plane. Instead of the plane another surface may be taken, and then the points are projected to that surface instead of to a plane. In this manner any figure, or plane in space of three dimensions, may be projected to any surface from any point which is called the centre of projection. If the figure projected is in three dimensions then this projection is the same as that used in what is generally known as *perspective*.

In modern mathematics the word *projection* is often taken with a slightly different meaning, supposing that plane figures are projected into plane figures, but three-dimensional ones into three-dimensional figures. Projection in this sense, when treated by coördinate geometery, leads in its algebraical aspect to the theory of linear substitution and hence to the theory of invariants and covariants.

In this article projection will be treated from a purely geometrical point of view.

We shall first and principally treat of the projection of plane figures into plane figures, and consider a number of special cases due to special positions of the two planes or of the centre of projection. We shall next consider the representation of figures of three dimensions by plane figures (orthographic projections, drawing in plan and elevation, etc.), then treat of perspective in its ordinary sense, and speak shortly of projections to curved surfaces.

References like (G. § 87) relate to section II. of the article GEOMETRY, vol. x. pp. 346 *sq.*

§ 1. PROJECTION OF PLANE FIGURES.—Let us suppose we have in space two planes π and π'. In the plane π a figure is given having known properties; then we have the problem to find its projection from some centre S to the plane π', and to deduce from the known properties of the given figure the properties of the new one.

If a point A is given in the plane π we have to join it to the centre S and find the point A' where this ray SA cuts the plane π'; it is the projection of A. On the other hand if A' is given in the plane π', then A will be its projection in π. Hence *if one figure in π' is the projection of another in π, then conversely the latter is also the projection of the former.*

A point and its projection are therefore also called corresponding points, and similarly we speak of corresponding lines and curves, etc.

§ 2. We at once get the following properties:

The projection of a point is a point, and one point only.

The projection of a line (straight line) is a line; for all points in a line are projected by rays which lie in the plane determined by S and the line, and this plane cuts the plane π' in a line which is the projection of the given line.

If a point lies in a line its projection lies in the projection of the line.

The projection of the line joining two points A, B *is the line which joins the projections* A', B' *of the points* A, B. For the projecting plane of the line AB contains the rays SA, SB which project the points A, B.

The projection of the point of intersection of two lines a, b is the point of intersection of the projections a', b' of those lines.

Similarly we get—

The projection of a curve will be a curve.

The projections of the points of intersection of two curves are the points of intersection of the projections of the given curves.

If a line cuts a curve in n points, then the projection of the line cuts the projection of the curve in n points. Or

The order of a curve remains unaltered by projection.

The projection of a tangent to a curve is a tangent to the projection of the curve. For the tangent is a line which has two coincident points in common with a curve.

The number of tangents that can be drawn from a point to a curve remains unaltered by projection. Or

The class of a curve remains unaltered by projection.

Example.—The projection of a circle is a curve of the second order and second class.

§ 3. Two figures of which one is a projection of the other obtained in the manner described may be moved out of the position in which they are obtained. They are then still said to be one the projection of the other, or to be projective or homographic. But when they are in the position originally considered they are said to be in *perspective position*, or (shorter) to be *perspective*.

All the properties stated in §§ 1, 2, hold for figures which are projective, whether they are perspective or not. There are others which hold only for projective figures when they are in perspective position, which we shall now consider.

If two planes π and π' are perspective, then their line of intersection is called the *axis of projection*. Any point in this line coincides with its projection. Hence

All points in the axis are their own projections. Hence also

Every line meets its projection on the axis.

The property that the lines joining corresponding points all pass through a common point, that any pair of corresponding points and the centre are in a line, is also expressed by saying that the figures are co-linear; and the fact that both figures have a line, the axis, in common on which corresponding lines meet is expressed by saying that the figures are co-axal.

The connection between these properties has to be investigated.

For this purpose we consider in the plane π a triangle ABC, and let the lines BC, CA, AB be denoted by a, b, c. The projection will consist of three points A′, B′, C′ and three lines a', b', c'. These have such a position that the lines AA′, BB′, CC′ meet in a point, viz., at S, and the points of intersection of a and a', b and b', c and c' lie on the axis (by § 2). The two triangles therefore are said to be both co-linear and co-axal. Of these properties either is a consequence of the other, as will now be proved.

§ 4. **Desargue's theorem.**—*If two triangles, whether in the same plane or not, are co-linear they are co-axal.* Or

If the lines AA′, BB′, CC′ *joining the vertices of two triangles meet in a point, then the intersections of the sides* BC *and* B′C′, CA *and* C′A′, AB *and* A′B′ *are three points in a line.* Conversely,

If two triangles are co-axal they are co-linear. Or

If the intersection of the sides of two triangles ABC *and* A′B′C′, *viz., of* BC *and* B′C′, *of* CA *and* C′A′, *and of* AB *and* A′B′, *lie in a line, then the lines* AA′, BB′, *and* CC′ *meet in a point.*

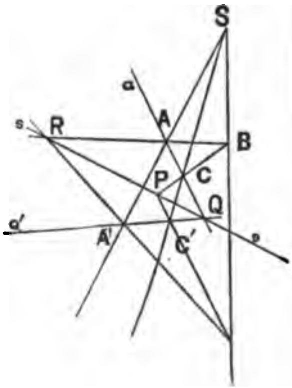

FIG. 1.

Proof.—Let us first suppose the triangles to be in different planes. By supposition the lines AA′, BB′, CC′ (Fig. 1) meet in a point S. But three intersecting lines determine three planes, SBC, SCA, and SAB. In the first lie the points B, C and also B′, C′. Hence the lines BC and B′C′ will intersect at some point P, because any two lines in the same plane intersect. Similarly CA and C′A′ will intersect at some point Q, and AB and A′B′ at some point R. These points P, Q, R lie in the plane of the triangle ABC because they are points on the sides of this triangle, and similarly in the plane of the triangle A′B′C′. Hence they lie in the intersection of two planes,—that is, in a line.

Secondly, If the triangles ABC and A′B′C′ lie both in the same plane the above proof does not hold. In this case we may consider the plane figure as the projection of the figure in space of which we have just proved the theorem. Let ABC, A′B′C′ be the co-linear triangles with S as centre, so that AA′, BB′, CC′ meet at S. Take now any point in space, say your eye E, and from it draw the rays projecting the figure. In the line ES take any point S_1, and in EA, EB, EC take points A_1, B_1, C_1 respectively, but so that S_1, A_1, B_1, C_1 are not in a plane. In the plane ESA which projects the line S_1A_1 lie then the line S_1A_1 and also EA′; these will therefore meet in a point A'_1, of which A′ will be the projection. Similarly points B'_1, C'_1 are found. Hence we have now in space two triangles $A_1B_1C_1$ and $A'_1B'_1C'_1$ which are co-linear. They are therefore co-axal, that is, the points P_1, Q_1, R_1, where A_1B_1, etc., meet will lie in a line. The projections therefore lie in a line. But these are the points P, Q, R, which were to be proved to lie in a line.

This proves the first part of the theorem. The second part or converse theorem is proved in exactly the same way. For another proof see (G. § 37).

§ 5. By aid of Desargue's theorem we can now prove a fundamental property of two projective planes.

Let s be the axis, S the centre, and let A, A′ and B, B′ be two pairs of corresponding points which we suppose fixed, and C, C′ any other pair of corresponding points. Then the triangles ABC and A′B′C′ are co-axal, and they will remain co-axal if the one plane π' be turned relative to the other about the axis. They will therefore, by Desargue's theorem, remain co-linear, and the centre will be the point S′, where AA′ meets BB′. Hence the line joining any pair of corresponding points C, C′ will pass through the centre S′. The figures are therefore perspective. This will remain true if the planes are turned till they coincide, because Desargue's theorem remains true.

Theorem.—*If two planes are perspective, then if the one plane be turned about the axis through any angle, especially if the one plane be turned till it coincides with the other, the two planes will remain perspective; corresponding lines will still meet on a line called the axis, and the lines joining corresponding points will still pass through a common centre* S *situated in the plane.*

Whilst the one plane is turned this point S *will move in a circle whose centre lies in the plane* π, *which is kept fixed, and whose plane is perpendicular to the axis.*

The last part will be proved presently. As the plane π' may be turned about the axis in one or the opposite sense, there will be two perspective positions possible when the planes coincide.

§ 6. Let (Fig. 2) π, π' be the planes intersecting in the axis s, whilst S is the centre of projection. To project a point A in π we join A to S and see where this line cuts π'. This gives the point A′. But if we draw through S any line parallel to π, then this line will cut π' in some point I′, and if all lines through S be drawn which are parallel to π these will form a plane parallel to π which will cut the plane π' in a line i parallel to the axis s. If we say that a line parallel to a plane cuts the latter at an infinite distance, we may say that all points at an infinite distance in π are projected into points which lie in a straight line i', and conversely all points in the line are projected to an infinite distance in π, whilst all other points are projected to finite points. We say therefore that all points in the plane π at an infinite distance may be considered as lying in a straight line, because their projections lie in a line. Thus we are again led to consider points at infinity in a plane as lying in a line (comp. G. §§ 2–4).

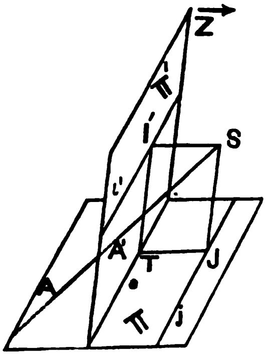

FIG. 2.

Similarly there is a line j in π which is projected to infinity in π'; this projection shall be denoted by j' so that i' and j' are lines at infinity.

§ 7. If we suppose through S a plane drawn perpendicular to the axis s cutting it at T, and in this plane the two lines SI′ parallel to π and SJ parallel to π', then the lines through I′ and J parallel to the axis will be the lines i' and j. At the same time a parallelogram SJTI′S has been formed. If now the plane π' be turned about the axis, then the points I′ and J will not move in their planes; hence the lengths TJ and TI′, and therefore also SI′ and SJ, will not change. If the plane π is kept fixed in space the point J will remain fixed, and S describes a circle about J as centre and with SJ as radius. This proves the last part of the theorem in § 5.

§ 8. The plane π' may be turned either in the sense indicated by the arrow at Z or in the opposite sense till π' falls into π. In the first case we get a figure like Fig. 3; i' and j will be on the same side of the axis, and on this side will also lie the centre S; and then ST=SJ +SI′ or SI′=JT, SJ=I′T. In the second case (Fig. 4) i' and j will be on opposite sides of the axis, and the centre S will lie between them in such a position that I′S=TJ, and I′T=SJ. If I′S=SJ, the point S will lie on the axis.

It follows that any one of the four points S, T, J, I′ is completely determined by the other three: if the axis, the centre and one of the lines *i′* or *j* are given the other is determined; the three lines *s*, *i′*, *j*, determine the centre; the centre and the lines *i′*, *j* determine the axis.

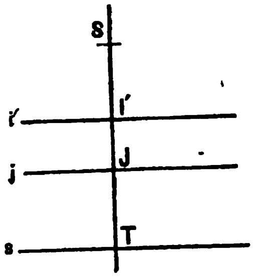

FIG. 3.

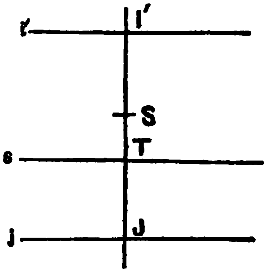

FIG. 4.

§ 9. We shall now suppose that the two projective planes *π*, *π′* are perspective and have been made to coincide.

THEOREM.—*If the centre, the axis and either one pair of corresponding points on a line through the centre or one pair of corresponding lines meeting on the axis are given, then the whole projection is determined.*

Proof.—If A and A′ (Fig. 1) are given corresponding points, it has to be shown that we can find to every other point B the corresponding point B′. Join AB to cut the axis in R. Join RA′; then B′ must lie on this line. But it must also lie on the line SB. Where both meet is B′. That the figures thus obtained are really projective can be seen by aid of Desargue's theorem. For, if for any point C the corresponding point C′ be found, then the triangles ABC and A′B′C′ are, by construction, co-linear, hence co-axal; and *s* will be the axis, because AB and AC meet their corresponding lines A′B′ and A′C′ on it. BC and B′C′ therefore also meet on *s*.

If on the other hand, *a*, *a′* are given corresponding lines, then any line through S will cut them in corresponding points, A, A′ which may be used as above.

§ 10. Rows and pencils which are projective or perspective have been considered in the article GEOMETRY (G. §§ 12–40). All that has been said there holds, of course, here for any pair of corresponding rows or pencils. The centre of perspective for any pair of corresponding rows is at the centre of projection S, whilst the axis contains coincident corresponding elements. Corresponding pencils on the other hand have their axis of perspective on the axis of projection whilst the coincident rays pass through the centre.

We mention here a few of those properties which are independent of the perspective position:

The correspondence between two projective rows, or pencils, is completely determined if to three elements in one the corresponding ones in the other are given. If for instance in two projective rows three pairs of corresponding points are given, then we can find to every other point in either the corresponding point (G. §§ 29–36).

If A, B, C, D *are four points in a row and* A′, B′, C′, D′ *the corresponding points, then their cross-ratios are equal* (ABCD) =(A′B′C′D′)—where (ABCD)=AC/CB : AD/DB.

If in particular the point D lies at infinity we have (ABCD)=−AC/CB=AC/BC. If therefore the points D and D′ are both at infinity we have AC/BC=AD/BD, and the rows are similar (G. § 39). This can only happen in special cases. For the line joining corresponding points passes through the centre; the latter must therefore lie at infinity if D D′ are different points at infinity. But if D and D′ coincide they must lie on the axis, that is, at the point of infinity of the axis unless the axis is altogether at infinity.

Hence—*In two perspective planes every row which is parallel to the axis is similar to its corresponding row, and in general no other row has this property.*

But if the centre or the axis is at infinity then every row is similar to its corresponding row.

In either of these two cases the metrical properties are particularly simple. If the axis is at infinity the ratio of similitude is the same for all rows and the figures are similar. If the centre is at infinity we get parallel projection; and the ratio of similitude changes from row to row (see §§ 16, 17).

In both cases the mid-points of corresponding segments will be corresponding points.

§ 11. INVOLUTION.—If the planes of two projective figures coincide, then every point in their common plane has to be counted twice, once as a point A in the figure *π*, once as a point B′ in the figure *π′*. The points A′ and B corresponding to them will in general be different points; but it may happen that they coincide. Here a theorem holds similar to that about rows (G. §§ 76 *sq*).

THEOREM.—*If two projective planes coincide, and if it happens that to one point in their common plane the same point corresponds, whether we consider the point as belonging to the first or to the second plane, then the same will happen for every other point—that is to say, to every point will correspond the same point in the first as in the second plane.*

In this case the figures are said to be in *involution*.

Proof.—Let (Fig. 5) S be the centre, *s* the axis of projection, and let a point which has the name A in the first plane and B′ in the second have the property that the points A′ and B corresponding to them again coincide. Let C and D′ be the names which some other point has in the two planes. If the line AC cuts the axis in X, then the point where the line XA′ cuts SC will be the point C′ corresponding to C (§ 9). The line B′D′ also cuts the axis in X and therefore the point D corresponding to D′ is the point where XB cuts SD′. But this is the same point as C′. Q.E.D.

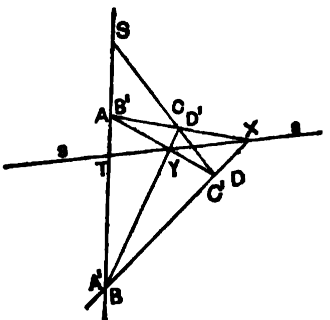

FIG. 5.

This point C′ might also be got by drawing CB and joining its intersection Y with the axis to B′. Then C′ must be the point where B′Y meets SC. This figure, which now forms a complete quadrilateral, shows that in order to get involution the corresponding points A and A′ have to be harmonic conjugates with regard to S and the point T where AA′ cuts the axis.

THEOREM.—*If two perspective figures are in involution, two corresponding points are harmonic conjugates with regard to the centre and the point where the line joining them cuts the axis.* Similarly—

Any two corresponding lines are harmonic conjugates with regard to the axis and the line from their point of intersection to the centre.

Conversely—*If in two perspective planes one pair of corresponding points are harmonic conjugates with regard to the centre and the point where the line joining them cuts the axis, then every pair of corresponding points has this property and the planes are in involution.*

§ 12. PROJECTIVE PLANES WHICH ARE NOT IN PERSPECTIVE POSITION.—We return to the case that two planes *π* and *π′* are projective but not in perspective position, and state in some of the more important cases the conditions which determine the correspondence between them. Here it is of great advantage to start with another definition which, though at first it may seem to be of far greater generality, is in reality equivalent to the one given before.

DEFINITION.—*We call two planes projective if to every point in one corresponds a point in the other, to every line a line, and to a point in a line a point in the corresponding line, in such a manner that the cross-ratio of four points in a line, or of four rays in a pencil, is equal to the cross-ratio of the corresponding points or rays.*

The last part about the equality of cross-ratios can be proved to be a consequence of the first. But as space does not allow us to give an exact proof for this we include it in the definition.

If one plane is actually projected to another we get a correspondence which has the properties required in the new definition. This shows that a correspondence between two planes conforming to this definition is possible. That it is also definite we have to show. It follows at once that—

Corresponding rows, and likewise corresponding pencils, are projective in the old sense (G. §§ 25, 30). Further,

If two planes are projective to a third they are projective to each other.

THEOREM.—*The correspondence between two projective planes π and π′ is determined if we have given either two rows u, v in π and the corresponding rows u′, v′ in π′, the point where u and v meet corresponding to the points where u′ and v′ meet, or two pencils,* U′ V′, *in π′, the ray* UV *joining the centres of the pencils in π corresponding to the ray* U′V′.

It is sufficient to prove the first part. Let any line *s* cut *u*, *v* in the points A and B. To these will correspond points A′ and B′ in *u′* and *v′* which are known. To the line *s* corresponds then the line A′B′. Thus to every line in the one plane the corresponding line in the other can be found, hence also to every point the corresponding point.

§ 13. THEOREM.—*If the planes of two projective figures coincide, and if either four points, of which no three lie in a line, or* *else four lines, of which no three pass through a point, in the one coincide with their corresponding points, or lines, in the other, then every point and every line coincides with its corresponding point or line so that the figures are identical.*

If the four points A, B, C, D coincide with their corresponding points, then every line joining two of these points will coincide with its corresponding line. Thus the lines AB and CD, and therefore also their point of intersection E, will coincide with their corresponding elements. The row AB has thus three points A, B, E coincident with their corresponding points, and is therefore identical with it (§ 10). As there are six lines which join two and two of the four points A, B, C, D, there are six lines such that each point in either coincides with its corresponding point. Every other line will thus have the six points in which it cuts these, and therefore all points, coincident with their corresponding points. The proof of the second part is exactly the same. It follows—

§ 14. *If two projective figures which are not identical lie in the same plane, then not more than three points which are not in a line, or three lines which do not pass through a point, can be coincident with their corresponding points or lines.*

If the figures are in perspective position, then they have in common one line, the axis, with all points in it, and one point, the centre, with all lines through it. No other point or line can therefore coincide with its corresponding point or line without the figures becoming identical.

It follows also that—

The correspondence between two projective planes is completely determined if there are given—either to four points in the one the corresponding four points in the other provided that no three of them lie in a line, or to any four lines the corresponding lines provided that no three of them pass through a point.

To show this we observe first that two planes π, π' may be made projective in such a manner that four given points A, B, C, D in the one correspond to four given points A′, B′, C′, D′ in the other; for to the lines AB, CD will correspond the lines A′B′ and C′D′, and to the intersection E of the former the point E′ where the latter meet. The correspondence between these rows is therefore determined, as we know three pairs of corresponding points. But this determines a correspondence (by § 12). To prove that in this case and also in the case of § 12 there is but one correspondence possible, let us suppose there were two, or that we could have in the plane π' two figures which are each projective to the figure in π and which have each the points A′B′C′D′ corresponding to the points ABCD in π. Then these two figures will themselves be projective and have four corresponding points coincident. They are therefore identical by § 13.

THEOREM.—*Two projective planes will be in perspective position if one row coincides with its corresponding row. The line containing these rows will be the axis of projection.*

Proof.—As in this case every point on s coincides with its corresponding point, it follows that every row a meets its corresponding row a' on s where corresponding points are united. The two rows a, a' are therefore perspective (G. § 30), and the lines joining corresponding points will meet in a point S. If r be any one of these lines cutting a, a' in the points A and A′ and the line s at K, then to the line AK corresponds A′K, or the ray r corresponds to itself. The points B, B′ in which r cuts another pair b, b' of corresponding rows must therefore be corresponding points. Hence the lines joining corresponding points in b and b' also pass through S. Similarly all lines joining corresponding points in the two planes π and π' meet in S; hence the planes are perspective.

The following proportion is proved in a similar way:

THEOREM.—*Two projective planes will be in perspective position if one pencil coincides with its corresponding one. The centre of these pencils will be the centre of perspective.*

In this case the two planes must of course coincide, whilst in the first case this is not necessary.

§ 15. We shall now show that two planes which are projective according to definition § 12 can be brought into perspective position, hence that the new definition is really equivalent to the old. We use the following property: If two coincident planes π and π' are perspective with S as centre, then any two corresponding rows are also perspective with S as centre. This therefore is true for the rows j and j' and for i and i', of which i' and j' are the lines at infinity in the two planes. If now the plane π' be made to slide on π so that each line moves parallel to itself, then the point at infinity in each line, and hence the whole line at infinity in π' remains fixed. So does the point at infinity on j, which thus remains coincident with its corresponding point on j', and therefore the rows j and j' remain perspective, that is to say the rays joining corresponding points in them meet at some point T. Similarly the lines joining corresponding points in i and i' will meet in some point T′. These two points T and T′ originally coincided with each other and with S.

Conversely, if two projective planes are placed one on the other, then as soon as the lines j and i' are parallel the two points T and T′ can be found by joining corresponding points in j and j', and also in i and i'. If now a point at infinity is called A as a point in π and B′ as a point in π', then the point A′ will lie on i' and B on j, so that the line AA′ passes through T′ and BB′ through T. These two lines are parallel. If then the plane π' be moved parallel to itself till T′ comes to T, then these two lines will coincide with each other, and with them will coincide the lines AB and A′B′. This line and similarly every line through T will thus now coincide with its corresponding line. The two planes are therefore according to the last theorem in § 14 in perspective position.

It will be noticed that the plane π' may be placed on π in two different ways, viz., if we have placed π' on π we may take it off and turn it over in space before we bring it back to π, so that what was its upper becomes now its lower face. For each of these positions we get one pair of centres T, T′, and only one pair, because the above process must give every perspective position. It follows—

In two projective planes there are in general two and only two pencils in either such that angles in one are equal to their corresponding angles in the other. If one of these pencils is made coincident with its corresponding one, then the planes will be perspective.

This agrees with the fact that two perspective planes in space can be made coincident by turning one about their axis in two different ways (§ 8).

In the reasoning employed it is essential that the lines j and i' are finite. If one lies at infinity, say j, then i and j coincide, hence their corresponding lines i' and j' will coincide; that is, i' also lies at infinity, so that the lines at infinity in the two planes are corresponding lines. If the planes are now made coincident and perspective, then it may happen that the lines at infinity correspond point for point, or can be made to do so by turning the one plane in itself. In this case the line at infinity is the axis, whilst the centre may be a finite point. This gives similar figures (see § 16). In the other case the line at infinity corresponds to itself without being the axis; the lines joining corresponding points therefore all coincide with it, and the centre S lies on it at infinity. The axis will be some finite line. This gives parallel projection (see § 17). For want of space we do not show how to find in these cases the perspective position, but only remark that in the first case any pair of corresponding points in π and π' may be taken as the points T and T′, whilst in the other case there is a pencil of parallels in π such that any one line of these can be made to coincide point for point with its corresponding line in π', and thus serve as the axis of projection. It will therefore be possible to get the planes in perspective position by first placing any point A′ on its corresponding point A and then turning π' about this point till lines joining corresponding points are parallel.

§ 16. SIMILAR FIGURES.—If the axis is at infinity every line is parallel to its corresponding line. Corresponding angles are therefore equal. The figures are similar, and (§ 10) the ratio of similitude of any two corresponding rows is constant.

If similar figures are in perspective position they are said to be similarly situated, and the centre of projection is called the centre of similitude. To place two similar figures in this position, we observe that their lines at infinity will coincide as soon as both figures are put in the same plane, but the rows on them are not necessarily identical. They are projective, and hence in general not more than two points on one will coincide with their corresponding points in the other (G. § 34). To make them identical it is either sufficient to turn one figure in its plane till three lines in one are parallel to their corresponding lines in the other, or it is necessary before this can be done to turn the one plane over in space. It can be shown that in the former case all lines are, or no line is, parallel to its corresponding line, whilst in the second case there are two directions, at right angles to each other, which have the property that each line in either direction is parallel to its corresponding line. We also see that—

If in two similar figures three lines, of which no two are parallel, are parallel respectively to their corresponding lines, then every line has this property and the two figures are similarly situated; or

Two similar figures are similarly situated as soon as two corresponding triangles are so situated.

If two similar figures are perspective without being in the same plane, their planes must be parallel as the axis is at infinity. Hence

Any plane figure is projected from any centre to a parallel plane into a similar figure.

If two similar figures are similarly situated, then corresponding points may either be on the same or on different sides of the centre. If, besides, the ratio of similitude is unity, then corresponding points will be equidistant from the centre. In the first case therefore the two figures will be identical. In the second case they will be identically equal but not coincident. They can be made to coincide by turning one in its plane through two right angles about the centre of similitude S. The figures are in involution, as is seen at once, and they are said to be *symmetrical with regard to the point* S *as centre*. If the two figures be considered as part of one, then this is said to have a centre. Thus regular polygons of an even number of sides and parallelograms have each a centre, which is a centre of symmetry.

§ 17. PARALLEL PROJECTION.—If, instead of the axis, the centre be moved to infinity, all the projecting rays will be parallel, and we get what is called *Parallel Projection*. In this case the line at infinity passes through the centre and therefore corresponds to itself,—but not point for point as in the case of similar figures. To any point I at infinity corresponds therefore a point I′ also at infinity but different from the first. Hence to parallel lines meeting at I correspond parallel lines of another direction meeting at I′. Further, in any two corresponding rows the two points at infinity are corresponding points; hence the rows are similar. This gives the principal properties of parallel projection:

To parallel lines correspond parallel lines; or

To a parallelogram corresponds a parallelogram.

The correspondence of parallel projection is completely determined as soon as for any parallelogram in the one figure the corresponding parallelogram in the other has been selected, as follows from the general case in § 14.

Corresponding rows are similar (§ 10).

The ratio of similitude for these rows changes with the direction:

If a row is parallel to the axis, its corresponding row, which is also parallel to the axis, will be equal to it, because any two pairs AA′ and BB′ of corresponding points will form a parallelogram.

Another important property is the following:

The areas of corresponding figures have a constant ratio.

We prove this first for parallelograms. Let ABCD and EFGH be any two parallelograms in π, A′B′C′D′ and E′F′G′H′ the corresponding parallelograms in π'. Then to the parallelogram KLMN which lies (Fig. 6) between the lines AB, CD and EF, GH will correspond a parallelogram K′L′M′N′ formed in exactly the same manner. As ABCD and KLMN are between the same parallels, their areas are as the bases. Hence

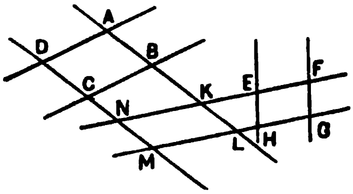

FIG. 6.

$$\frac{ABCD}{KLMN}=\frac{AB}{KL} \text{ and similarly } \frac{A'B'C'D'}{K'L'M'N'}=\frac{A'B'}{K'L'}$$

But AB/KL=A′B′/K′L′, as the rows AB and A′B′ are similar. Hence

$$\frac{ABCD}{A'B'C'D'}=\frac{KLMN}{K'L'M'N'} \text{ and similarly } \frac{EFGH}{E'F'G'H'}=\frac{KLMN}{K'L'M'N'}$$

Hence also

$$\frac{ABCD}{A'B'C'D'}=\frac{EFGH}{E'F'G'H'}$$

This proves the theorem for parallelograms and also for their halves, that is, for any triangles. As polygons can be divided into triangles the truth of the theorem follows at once for them, and is then by the well-known method of exhaustion extended to areas bounded by curves by inscribing polygons in, and circumscribing polygons about, the curves.

Just as (G. § 8) a segment of a line is given a sense, so a sense may be given to an area. This is done as follows. If we go round the boundary of an area, the latter is either to the right or to the left. If we turn round and go in the opposite sense, then the area will be to the left if it was first to the right, and *vice versa*. If we give the boundary a definite sense, and go round in this sense, then the *area is said to be either of the one or of the other sense according as the area is to the right or to the left*. The area is generally said to be positive if it is to the left. The sense of the boundary is indicated either by an arrowhead or by the order of the letters which denote points in the boundary. Thus, if A, B, C be the vertices of a triangle, then ABC shall denote the area in magnitude and sense, the sense being fixed by going round the triangle in the order from A to B to C. It will then be seen that ABC and ACB denote the same area but with opposite sense, and generally ABC = BCA = CAB = − ACB = − BAC = − CBA; that is, an interchange of two letters changes the sense. Also, if A and A′ are two points on opposite sides of, and equidistant from, the line BC, then ABC = − A′BC.

Taking account of the sense, we may make the following statement:

If A, A′ are two corresponding points, if the line AA′ cuts the axis in B, and if C is any other point in the axis, then the triangles ABC and A′BC are corresponding, and

$$\frac{ABC}{A'BC}=\frac{AB}{A'B}=\frac{AB}{BA'};$$

or *The constant ratio of corresponding areas is equal and opposite to the ratio in which the axis divides the segment joining two corresponding points.*

§ 18. Several special cases of parallel projection are of interest.

ORTHOGRAPHIC PROJECTION.—If the two planes π and π' have a definite position in space, and if a figure in π is projected to π' by rays perpendicular to this plane, then the projection is said to be orthographic. If in this case the plane π be turned till it coincides with π' so that the figures remain perspective, then *the projecting rays will be perpendicular to the axis of projection*, because any one of these rays is, and remains during the turning, perpendicular to the axis.

The constant ratio of the area of the projection to that of the original figure is, in this case, the cosine of the angle between the two planes π *and* π', as will be seen by projecting a rectangle which has its base in the axis.

Orthographic projection is of constant use in geometrical drawing, and will be treated of fully later on in this article (§ 28 *sq*).

SHEAR.—If the centre of projection be taken at infinity on the axis, then the projecting rays are parallel to the axis; hence corresponding points will be equidistant from the axis. In this case therefore *areas of corresponding figures will be equal.*

If A, A′ and B, B′ (Fig. 7) are two pairs of corresponding points on the same line, parallel to the axis, then, as corresponding segments parallel to the axis are equal, it follows that AB = A′B′, hence also AA′ = BB′. If these points be joined to any point O on the axis, then AO and A′O will be corresponding lines; they will therefore be cut by any line parallel to the axis in corresponding points. In the figure therefore C, C′ and also D, D′ will be pairs of corresponding points and CC′ = DD′. As the ratio CC′/AA′ equals the ratio of the distances of C and A from the axis, therefore—

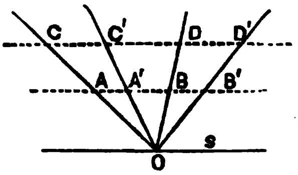

FIG. 7.

Two corresponding figures may be got one out of the other by moving all points in the one parallel to a fixed line, the axis, through distances which are proportional to their own distances from the axis. Points in a line remain hereby in a line.

Such a transformation of a plane figure is produced by a shearing stress in any section of a homogeneous elastic solid. For this reason Sir William Thomson has given it the name of shear.

A shear of a plane figure is determined if we are given the axis and the distance through which one point has been moved; for in this case the axis, the centre, and a pair of corresponding points are given.

§ 19. SYMMETRY AND SKEW-SYMMETRY.—If the centre is not on the axis, and if corresponding points are at equal distances from it, they must be on opposite sides of it. The figures will be in involution (§ 11). In this case the direction of the projecting rays is said to be *conjugate* to the axis.

The conjugate direction may be perpendicular to the axis. If the line joining two corresponding points A, A′ cuts the axis in B, then AB = BA′. Therefore, if the plane be folded over along the axis, A will fall on A′. Hence by this folding over every point will coincide with its corresponding point. The figures therefore are identically equal or congruent, and in their original position they are *symmetrical* with regard to the axis, which itself is called *an axis of symmetry*. If the two figures are considered as one this one is said to be symmetrical with regard to an axis, and is said to have an axis of symmetry or simply an axis. Every diameter of a circle is thus an axis; also the median line of an isosceles triangle and the diagonals of a rhombus are axes of the figures to which they belong.

In the more general case where the projecting rays are not perpendicular to the axis we have a kind of twisted symmetry which may be called *skew-symmetry*. It can be got from symmetry by giving the whole figure a shear. It will also be easily seen that we get skew-symmetry if we first form a shear to a given figure and then separate it from its shear by folding it over along the axis of the shear, which thereby becomes an axis of skew-symmetry.

Skew-symmetrical and therefore also symmetrical figures have the following properties:

Corresponding areas are equal, but of opposite sense.

Any two corresponding lines are harmonic conjugates with regard to the axis and a line in the conjugate direction.

If the two figures be again considered as one whole, this is said to be skew-symmetrical and to have an axis of skew-symmetry. Thus the median line of any triangle is an axis of skew-symmetry, the side on which it stands having the conjugate direction, the other sides being conjugate lines. From this it follows, for instance, that the three median lines of a triangle meet in a point. For two median lines will be corresponding lines with regard to the third as axis, and must therefore meet on the axis.

An axis of skew-symmetry is generally called a *diameter*. Thus every diameter of a conic is an axis of skew-symmetry, the conjugate direction being the direction of the chords which it bisects.

§ 20. We state a few properties of these figures useful in mechanics, but we omit the easy proofs:

If a plane area has an axis of skew-symmetry, then the mass-centre (centre of mean distances or centre of inertia) *lies on it.*

If a figure undergoes a shear, the mass-centre of its area remains the mass-centre; and generally—

In parallel projection the mass-centres of corresponding areas (*or of groups of points, but not of curves*) *are corresponding points.*

The moment of inertia of a plane figure does not change if the figure undergoes a shear in the direction of the axis with regard to which the moment has been taken.

If a figure has an axis of skew-symmetry, then this axis and the conjugate direction are conjugate diameters of the momental ellipse for every point in the axis.

If a figure has an axis of symmetry, then this is an axis of the momental ellipse for every point in it.

The truth of the last propositions follows at once from the fact that the product of inertia for the lines in question vanishes.

It is of interest to notice how a great many propositions of Euclid are only special cases of projection. The theorems Eucl. I. 35–41 about parallelograms or triangles on equal bases and between the same parallels are examples of shear, whilst I. 43 gives a case of skew-symmetry, hence of involution. Figures which are identically equal are of course projective, and they are perspective when placed so that they have an axis or a centre of symmetry (comp. Henrici, *Elementary Geometry, Congruent Figures*). In this case again the relation is that of involution. The importance of treating similar figures when in perspective position has long been recognized; we need only mention the well-known proposition about the centres of similitude of circles.

APPLICATIONS TO CONICS.

§ 21. THEOREM.—*Any conic can be projected into any other conic. This may be done in such a manner that three points on one conic and the tangents at two of them are projected to three arbitrarily selected points and the tangents at two of them on the other.*

Proof.—If u and u' are any two conics, then we have to prove that we can project u in such a manner that five points on it will be projected to points on u'. As the projection is determined as soon as the projections of any four points or four lines are selected, we cannot project any five points of u to any five arbitrarily selected points on u'. But if A, B, C be any three points on u, and if the tangents at B and C meet at D, if further A′, B′, C′ are any three points on u', and if the tangents at B′ and C′ meet at D′, then the plane of u may be projected to the plane of u' in such a manner that the points A, B, C, D are projected to A′, B′, C′, D′. This determines the correspondence (§ 14). The conic u will be projected into a conic, the points A, B, C and the tangents BD and CD to the points A′, B′, C′ and the lines B′D′ and C′D′, which are tangents to u' at B′ and C′. The projection of u must therefore (G. § 52) coincide with u', because it is a conic which has three points and the tangents at two of them in common with u'.

Similarly we might have taken *three tangents and the points of contact of two of them as corresponding to similar elements on the other.*

If the one conic be a circle which cuts the line j, the projection will cut the line at infinity in two points; hence it will be an hyperbola. Similarly, if the circle touches j, the projection will be a parabola; and, if the circle has no point in common with j, the projection will be an ellipse. These curves appear thus as sections of a circular cone, for in case that the two planes of projection are separated the rays projecting the circle form such a cone.

Any conic may be projected into itself.

If we take any point S in the plane of a conic as centre, the polar of this point as axis of projection, and any two points in which a line through S cuts the conic as corresponding points, then these will be harmonic conjugates with regard to the centre and the axis. We therefore have involution (§ 11), and every point is projected into its harmonic conjugate with regard to the centre and the axis,—hence every point A on the conic into that point A′ on the conic in which the line SA′ cuts the conic again, as follows from the harmonic properties of pole and polar (G. § 62 *sq.*).

Two conics which cut the line at infinity in the same two points are similar figures and similarly situated,—the centre of similitude being in general some finite point.

To prove this we take the line at infinity and the asymptotes of one as corresponding to the line at infinity and the asymptotes of the other, and besides a tangent to the first as corresponding to a parallel tangent to the other. The line at infinity will then correspond to itself point for point; hence the figures will be similar and similarly situated.

§ 22. AREAS OF PARABOLIC SEGMENTS.—One parabola may always be considered as a parallel projection of another in such a manner that any two points A, B on the one correspond to any two points A′, B′ on the other; that is, the points A, B and the point at infinity on the one may be made to correspond respectively to the points A′, B′ and the point at infinity on the other, whilst the tangents at A and at infinity of the one correspond to the tangent at B′ and at infinity of the other. This completely determines the correspondence, and it is parallel projection because the line at infinity corresponds to the line at infinity. Let the tangents at A and B meet at C, and those at A′, B′ at C′; then C, C′ will correspond, and so will the triangles ABC and A′B′C′ as well as the parabolic segments cut off by the chords AB and A′B′. If (AB) denotes the area of the segment cut off by the chord AB we have therefore

$$(AB)/ABC = (A'B')/A'B'C'\text{; or}$$

The area of a segment of a parabola stands in a constant ratio to the area of the triangle formed by the chord of the segment and the tangents at the end points of the chord.

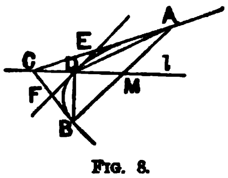

FIG. 8.

If then (Fig. 8) we join the point C to the mid-point M of AB, then this line l will be bisected at D by the parabola (G. § 74), and the tangent at D will be parallel to AB. Let this tangent cut AC in E and CB in F, then by the last theorem

$$\frac{(AB)}{ABC} = \frac{(AD)}{ADE} = \frac{(BD)}{BFD} = m,$$

where m is some number to be determined. The figure gives

$$(AB) = ABD + (AD) + (BD).$$

Combining both equations, we have

$$ABD = m\,(ABC - ADE - BFD).$$

But we have also $ABD = \tfrac{1}{2}\,ABC$, and $ADE = BFD = \tfrac{1}{8}\,ABC$; hence

$$\tfrac{1}{2}\,ABC = m\,(1 - \tfrac{1}{8} - \tfrac{1}{8})\,ABC,\text{ or } m = \tfrac{2}{3}.$$

The area of a parabolic segment equals two-thirds of the area of the triangle formed by the chord and the tangents at the end points of the chord.

§ 23. ELLIPTIC AREAS.—To consider one ellipse a parallel projection of another we may establish the correspondence as follows. If AC, BD are any pair of conjugate diameters of the one and A′C′, B′D′ any pair of conjugate diameters of the other, then these may be made to correspond to each other, and the correspondence will be completely determined if the parallelogram formed by the tangents at A, B, C, D is made to correspond to that formed by the tangents A′, B′, C′, D′ (§§ 17 and 21). As the projection of the first conic has the four points A′, B′, C′, D′ and the tangents at these points in common with the second, the two ellipses are projected one into the other. Their areas will correspond, and so do those of the parallelograms ABCD and A′B′C′D′. Hence

The area of an ellipse has a constant ratio to the area of any inscribed parallelogram whose diagonals are conjugate diameters, and also to every circumscribed parallelogram whose sides are parallel to conjugate diameters.

It follows at once that

All parallelograms inscribed in an ellipse whose diagonals are conjugate diameters are equal in area; and

All parallelograms circumscribed about an ellipse whose sides are parallel to conjugate diameters are equal in area.

If a, b are the length of the semi-axis of the ellipse, then the area of the circumscribed parallelogram will be $4ab$ and of the inscribed one $2ab$.

For the circle of radius r the inscribed parallelogram becomes the square of area $2r^2$ and the circle has the area $r^2\pi$; the constant ratio of an ellipse to the inscribed parallelogram has therefore also the value $\frac{1}{2}\pi$. Hence

The area of an ellipse equals $ab\pi$.

§ 24. PROJECTIVE PROPERTIES.—The properties of the projection of a figure depend partly on the relative position of the planes of the figure and the centre of projection, but principally on the properties of the given figure. Points in a line are projected into points in a line, harmonic points into harmonic points, a conic into a conic; but parallel lines are not projected into parallel lines nor right angles into right angles, neither are the projections of equal segments or angles again equal. There are then some properties which remain unaltered by projection, whilst others change. The former are called projective or descriptive, the latter metrical properties of figures, because the latter all depend on measurement.

To a triangle and its median lines correspond a triangle and three lines which meet in a point, but which as a rule are not median lines.

In this case, if we take the triangle together with the line at infinity, we get as the projection a triangle ABC, and some other line j which cuts the sides a, b, c of the triangle in the points A_1, B_1, C_1. If we now take on BC the harmonic conjugate A_2 to A_1 and similarly on CA and AB the harmonic conjugates to B_1 and C_1 respectively, then the lines AA_2, BB_2, CC_2 will be the projections of the median lines in the given figure. Hence these lines must meet in a point.

As the triangle and the fourth line we may take any four given lines, because any four lines may be projected into any four given lines (§ 14). This gives a theorem:

If each vertex of a triangle be joined to that point in the opposite side which is, with regard to the vertices, the harmonic conjugate of the point in which the side is cut by a given line, then the three lines thus obtained meet in a point.

We get thus out of the special theorem about the median lines of a triangle a more general one. But before this could be done we had to add the line at infinity to the lines in the given figure.

In a similar manner a great many theorems relating to metrical properties can be generalized by taking the line at infinity or points at infinity as forming part of the original figure. Conversely special cases relating to measurement are obtained by projecting some line in a figure of known properties to infinity. This is true for all properties relating to parallel lines or to bisection of segments, but not immediately for angles. It is, however, possible to establish for every metrical relation the corresponding projective property. To do this it is necessary to consider imaginary elements. These have originally been introduced into geometry by aid of coördinate geometry, where imaginary quantities constantly occur as roots of equations.

Their introduction into pure geometry is due principally to Poncelet, who by the publication of his great work *Traité des Propriétés Projectives des Figures* became the founder of projective geometry in its widest sense. Monge had considered parallel projection and had already distinguished between permanent and accidental properties of figures, the latter being those which depended merely on the accidental position of one part to another. Thus in projecting two circles which lie in different planes it depends on the accidental position of the centre of projection whether the projections be two conics which do or do not meet. Poncelet introduced the principle of continuity in order to make theorems general and independent of those accidental positions which depend analytically on the fact that the equations used have real or imaginary roots. But the correctness of this principle remained without a proof. Von Straudt has, however, shown how it is possible to introduce imaginary elements by purely geometrical reasoning, and we shall now try to give the reader some idea of his theory.

§ 25. IMAGINARY ELEMENTS.—If a line cuts a curve and if the line be moved, turned for instance about a point in it, it may happen that two of the points of intersection approach each other till they coincide. The line then becomes a tangent. If the line is still further moved in the same manner it separates from the curve and two points of intersection are lost. Thus in considering the relation of a line to a conic we have to distinguish three cases—the line cuts the conic in two points, touches it, or has no point in common with it. This is quite analogous to the fact that a quadratic equation with one unknown quantity has either two, one, or no roots. But in algebra it has long been found convenient to express this differently by saying a quadratic equation has always two roots, but these may be either both real and different, or equal, or they may be imaginary. In geometry a similar mode of expressing the fact above stated is not less convenient.

We say therefore a line has always two points in common with a conic, but these are either distinct, or coincident, or invisible. The word imaginary is generally used instead of invisible; but, as the points have nothing to do with imagination, we prefer the word "invisible" recommended originally by Clifford.

Invisible points occur in pairs of conjugate points, for a line loses always two visible points of intersection with a curve simultaneously. This is analogous to the fact that an algebraical equation with real coefficients has imaginary roots in pairs. *Only one real line can be drawn through an invisible point*, for two real lines meet in a real or visible point. *The real line through an invisible point contains also its conjugate.*

Similarly there are invisible lines—tangents, for instance, from a point within a conic—which occur in pairs of conjugates, two conjugates having a real point in common.

The introduction of invisible points would be nothing but a play upon words unless there is a real geometrical property indicated which can be used in geometrical constructions—that it has a definite meaning, for instance, to say that two conics cut a line in the same two invisible points, or that we can draw one conic through three real points and the two invisible ones which another conic has in common with a line that does not actually cut it. We have in fact to give a geometrical definition of invisible points. This is done by aid of the theory of involution (G. § 76 *sq.*).

An involution of points on a line has (according to G. § 77 (2)) either two or one or no foci. Instead of this we now say it has always two foci, which may be distinct, coincident, or invisible. These foci are determined by the involution, but they also determine the involution. If the foci are real this follows from the fact that conjugate points are harmonic conjugates with regard to the foci. That it is also the case for invisible foci will presently appear. If we take this at present for granted we may replace a pair of real, coincident, or invisible points by the involution of which they are the foci.

Now any two pairs of conjugate points determine an involution (G. § 77 (6)).

Hence any point-pair, whether real or invisible, is completely determined by any two pairs of conjugate points of the involution which has the given point-pair as foci and may therefore be replaced by them.

Two pairs of invisible points are thus said to be identical if, and only if, they are the foci of the same involution.

We know (G. § 82) that a conic determines on every line an involution in which conjugate points are conjugate poles with regard to the conic—that is, that either lies on the polar of the other. This holds whether the line cuts the conic or not. Furthermore, in the former case the points common to the line and the conic are the foci of the involution. Hence we now say that this is always the case, and that the *invisible* points common to a line and a conic are the *invisible* foci of the involution in question. If then we state the problem of drawing a conic which passes through two points given as the intersection of a conic and a line as that of drawing a conic which determines a given involution on the line, we have it in a form in which it is independent of the accidental circumstance of the intersections being real or invisible. So is the solution of the problem, as we shall now show.

§ 26. We have seen (§ 21) that a conic may always be projected into itself by taking any point S as centre and its polar s as axis of projection, corresponding points being those in which a line through S cuts the conic. If then (Fig. 9) A, A′ and B, B′ are pairs of corresponding points so that the lines AA′ and BB′ pass through S, then the lines AB and A′B′, as corresponding lines, will meet at a point R on the axis, and the lines AB′ and A′B will meet at another point R′ on the axis. These points R, R′ are conjugate points in the involution which the conic determines on the line s because the triangle RSR′ is a polar triangle (G. § 62), so that R′ lies on the polar of R.

This gives a simple means of determining for any point Q on the line s its conjugate point Q′. We take any two points A, A′ on the conic which lie on a line through S, join Q to A by a line cutting the conic again in C, and join C to A′. This line will cut s in the point Q′ required.

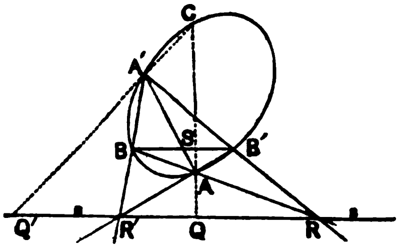

FIG. 9.

PROBLEM.—*To draw some conic which shall determine on a line s a given involution.*

Solution.—We have here to reconstruct the Fig. 9, having given on the line s an involution. Let Q, Q′ and R, R. (Fig. 9) be two pairs of conjugate points in this involution. We take any point B and join it to R and R′, and another point C to Q and Q′. Let BR and CQ meet at A, and BR′ and CQ′ at A′. If now a point P be moved along s its conjugate point P′ will also move and the two points will describe projective rows. The two rays AP and A′P′ will therefore describe projective pencils, and the intersection of corresponding rays will lie on a conic which passes through A, A′, B, and C. This conic determines on s the given involution.

Of these four points not only B and C but also the point A may be taken arbitrarily, for if A, B, C are given, the line AB will cut s in some point R. As the involution is supposed known, we can find the point R′ conjugate to R, which we join to B. In the same way the line CA will cut s in some point Q. Its conjugate point Q′ we join to C. The line CQ′ will cut BR′ in a point A′, and then AA′ will pass through the pole S (comp. Fig. 9). We may now interchange A and B and find the point B′. Then BB′ will also pass through S, which is thus found. At the same time five points A, B, C, A′, B′ on the conic have been found, so that the conic is completely known, which determines on the line s the given involution. Hence—

THEOREM.—*Through three points we can always draw one conic, and only one, which determines on a given line a given involution, all the same whether the involution has real, coincident, or invisible foci.*

In the last case the theorem may now also be stated thus:

THEOREM.—*It is always possible to draw a conic which passes through three given real points and through two invisible points which any other conic has in common with a line.*

§ 27. The above theory of invisible points gives rise to a great number of interesting consequences, of which we state a few.

The theorem at the end of § 21 may now be stated:

THEOREM.—*Any two conics are similar and similarly situated if they cut the line at infinity in the same two points—real, coincident, or invisible.*

It follows that

Any two parabolas are similar; and they are similarly situated as soon as their axes are parallel.

The involution which a circle determines at its centre is circular (G. § 79); that is, every line is perpendicular to its conjugate line. This will be cut by the line at infinity in an involution which has the following property: The lines which join any finite point to two conjugate points in the involution are at right angles to each other. Hence all circular involutions in a plane determine the same involution on the line at infinity. The latter is therefore called *the circular involution on the line at infinity;* and the involution which a circle determines at its centre is called *the circular involution at that point.* All circles determine thus on the line at infinity the same involution; in other words, they have the same two invisible points in common with the line at infinity.

THEOREM.—*All circles may be considered as passing through the same two points at infinity.*

These points are called the *circular points* at infinity, and by Prof. Cayley the *absolute* in the plane. They are the foci of the circular involution in the line at infinity.

Conversely—*Every conic which passes through the circular points is a circle;* because the involution at its centre is circular, hence conjugate diameters are at right angles, and this property only circles possess.

We now see why we can draw always one and only one circle through any three points; these three points together with the circular points at infinity are five points through which one conic only can be drawn.

Any two circles are similar and similarly situated because they have the same points at infinity (§ 21).

Any two concentric circles may be considered as having double contact at infinity, because the lines joining the common centre to the circular points at infinity are tangents to both circles at the circular points, as the line at infinity is the polar of the centre.

Any two lines at right angles to one another are harmonic conjugates with regard to the rays joining their intersection to the circular points, because these rays are the focal rays of the circular involution at the intersection of the given lines.

To bisect an angle with the vertex A means (G. § 23) to find two rays through A which are harmonic conjugates with regard to the limits of the angle and perpendicular to each other. These rays are therefore harmonic with regard to the limits of the given angle and with regard to the rays through the circular points. Thus perpendicularity and bisection of an angle have been stated in a projective form

It must not be forgotten that the circular points do not exist at all; but to introduce them gives us a short way of making a statement which would otherwise be long and cumbrous.

We can now generalize any theorem relating to metrical properties. For instance, the simple fact that the chord of a circle is touched by a concentric circle at its *mid point* proves the theorem:'

If two conics have double contact, then the points where any tangent to one of them cuts the other are harmonic with regard to the point of contact and the point where the tangent cuts the chord of contact.

DESCRIPTIVE GEOMETRY.

For many, especially technical, purposes it is of the utmost importance to represent solids and other figures in three dimensions by a drawing in one plane.

A variety of methods have been introduced for this purpose. The most important is that which towards the end of the last century was invented by Monge under the name of "descriptive geometry." We give the elements of his method. It is based on parallel projections to a plane by rays perpendicular to the plane. Such a projection is called orthographic (§ 18). If the plane is horizontal the projection is called the plan of the figure, and if the plane is vertical the elevation. In Monge's method a figure is represented by its plan and elevation. It is therefore often called drawing in plan and elevation, and sometimes simply orthographic projection.

§ 28. We suppose then that we have two planes, one horizontal, the other vertical, and these we call the planes of plan and of elevation respectively, or the horizontal and the vertical plane, and denote them by the letters π_1 and π_2. Their line of intersection is called the axis, and shall be denoted by the letter x.

If the surface of the drawing paper is taken as the plane of the plan, then the vertical plane will be the plane perpendicular to it through the axis x. To bring this also into the plane of the drawing paper we turn it about the axis till it coincides with the horizontal plane. This process of turning one plane down till it coincides with another is called *rabatting* one to the other. Of course there is no necessity to have one of the two planes horizontal, but even when this is not the case it is convenient to retain the above names.

The whole arrangement will be better understood by a glance at Fig. 10. A point A in space is there projected by the perpendicular AA_1 and AA_2 to the planes π_1 and π_2, so that A_1 and A_2 are the horizontal and vertical projections of A.

If we remember that a line is perpendicular to a plane that is perpendicular to every line in the plane if only it is perpendicular to any two intersecting lines in the plane,[1] we see that the axis which is perpendicular both to AA_1 and to AA_2 is also perpendicular to A_1A_0 and to A_2A_0 because these four lines are all in the same plane. Hence, if the plane π_2 be turned about the axis till it coincides with the plane π_1, then A_2A_0 will be the continuation of A_1A_0. This position of the planes is represented in Fig. 11, in which the line A_1A_2 is perpendicular to the axis x.

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[1] It is very convenient here to make use of the modern extension of the meaning of an angle according to which we take as the angle between two non-intersecting lines the angle between two intersecting lines parallel respectively to the given ones. If this angle is a right angle, the lines are called perpendiculars. Euclid's definition (XI. def. 3), and theorem (XI. 4) may then be stated as in the text. Compare also articles GEOMETRY (EUCLIDIAN), § 75, vol. x. p. 344.

Conversely any two points A_1, A_2 in a line perpendicular to the axis will be the projections of some point in space when the plane π_2 is turned about the axis till it is perpendicular to the plane π_1, because in this position the two perpendiculars to the planes π_1, and π_2 through the points A_1 and A_2 will be in a plane and therefore meet at some point A.

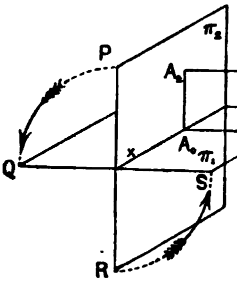

FIG. 10.

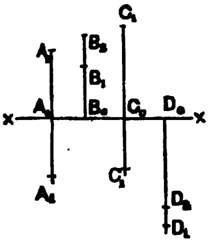

FIG. 11.

REPRESENTATION OF POINTS.—We have thus the following method of representing in a single plane the position of points in space: *we take in the plane a line x as the axis, and then any pair of points A_1, A_2 in the plane on a line perpendicular to the axis represent a point A in space.* If the line A_1A_2 cuts the axis at A_0, and if at A_1 a perpendicular be erected to the plane, then the point A will be in it at a height $A_1A=A_0A_2$ above the plane. This gives the position of the point A relative to the plane π_1. In the same way, if in a perpendicular to π_2 through A_2 a point A be taken such that $A_2A=A_0A_1$, then this will give the point A relative to the plane π_2.

§ 29. The two planes π_1, π_2 in their original position divide space into four parts. These are called the four quadrants. We suppose that the plane π_2 is turned as indicated in Fig. 10, so that the point P comes to Q and R to S, then the quadrant in which the point A lies is called the first, and we say that in the first quadrant a point lies above the horizontal and in front of the vertical plane. Now we go round the axis in the sense in which the plane π_2 is turned and come in succession to the second, third, and fourth quadrant. In the second a point lies above the plane of the plan and behind the plane of elevation, and so on. In Fig 12, which represents a side view of the planes in Fig. 10 the quadrants are marked, and in each a point with its projection is taken. Fig. 11 shows how these are represented when the plane π_2 is turned down. We see that

A point lies in the first quadrant if the plan lies below, the elevation above the axis; in the second if plan and elevation both lie above; in the third if the plan lies above, the elevation below; in the fourth if plan and elevation both lie below the axis.

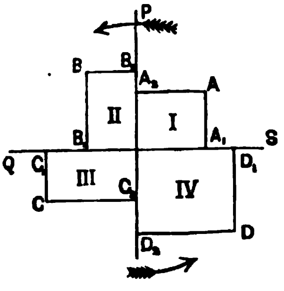

FIG. 12.

If a point lies in the horizontal plane, its elevation lies in the axis and the plan coincides with the point itself. *If a point lies in the vertical plane,* its plan lies in the axis and the elevation coincides with the point itself. *If a point lies in the axis,* both its plan and elevation lie in the axis and coincide with it.

Of each of these propositions, which will easily be seen to be true, the converse holds also.

§ 30. REPRESENTATION OF A PLANE.—As we are thus enabled to represent points in a plane, we can represent any finite figure by representing its separate points. It is, however, not possible to represent a plane in this way, for the projections of its points completely cover the planes π_1 and π_2, and no plane would appear different from any other. But any plane α cuts each of the planes π_1, π_2 in a line. These are called the traces of the plane. They cut each other in the axis at the point where the latter cuts the plane α.

A plane is determined by its two traces, which are two lines that meet on the axis, and, conversely, *any two lines which meet on the axis determine a plane.*

If the plane is parallel to the axis its traces are parallel to the axis. Of these one may be at infinity; then the plane will cut one of the planes of projection at infinity and will be parallel to it. Thus a plane parallel to the horizontal plane of the plan has only one finite trace, viz., that with the plane of elevation.

If the plane passes through the axis both its traces coincide with the axis. This is the only case in which the representation of the plane by its two traces fails. A third plane of projection is therefore introduced, which is best taken perpendicular to the other two. We call it simply the third plane, and denote it by π_3. As it is perpendicular to π_1, it may be taken as the plane of elevation, its line of intersection y with π_1 being the axis, and be turned down to coincide with π_1. This is represented in Fig. 13. OC is the axis x whilst OA and OB are the traces of the third plane. They lie in one line y. The plane is rabatted about y to the horizontal plane. A plane α through the axis x will then show in it a trace α_3. In Fig. 13 the lines OC and OP will thus be the traces of a plane through the axis x which makes an angle POQ with the horizontal plane.

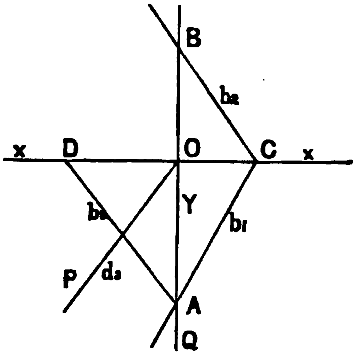

FIG. 13.

We can also find the trace which any other plane makes with π_3. In rabatting the plane π_3 its trace OB with the plane π_2 will come to the position OD. Hence a plane β having the traces CA and CB will have with the third plane the trace β_3, or AD if OD = OB.

It also follows immediately that—

If a plane α is perpendicular to the horizontal plane, then every point in it has its horizontal projection in the horizontal trace of the plane, as all the rays projecting these points lie in the plane itself.

Any plane which is perpendicular to the horizontal plane has its vertical trace perpendicular to the axis.

Any plane which is perpendicular to the vertical plane has its horizontal trace perpendicular to the axis and the vertical projections of all points in the plane lie in this trace.

§ 31. REPRESENTATION OF A LINE.—A line is determined either by two points in it or by two planes through it. We get accordingly two representations of it either by projections or by traces.

First.—*A line a is represented by its projections a_1 and a_2 on the two planes π_1 and π_2.* These may be any two lines, for, bringing the planes π_1, π_2 into their original position, the planes through these lines perpendicular to π_1 and π_2 respectively will intersect in some line a which has a_1, a_2 as its projections.

Secondly.—*A line a is represented by its traces—that is, by the points in which it cuts the two planes π_1, π_2.* Any two points may be taken as the traces of a line in space, for it is determined when the planes are in their original position as the line joining the two traces. This representation becomes undetermined if the two traces coincide in the axis. In this case we again use a third plane, or else the projections of the line.

§ 32. The fact that there are different methods of representing points and planes, and hence two methods of representing lines, suggests the principle of duality (G. § 41). It is worth while to keep this in mind. It is also worth remembering that traces of planes or lines always lie in the planes or lines which they represent. Projections do not as a rule do this excepting when the point or line projected lies in one of the planes of projection.

§ 33. Having now shown how to represent points, planes, and lines, we have to state the conditions which must hold in order that these elements may lie one in the other, or else that the figure formed by them may possess certain trical properties. It will be found that the former are y much simpler than the latter.

Before we do this, however, we shall explain the notation d; for it is of great importance to have a systematic no-ion. We shall denote points in space by capitals A, B, C; nes in space by Greek letters α, β, γ; lines in space by ıll letters *a*, *b*, *c*; horizontal projections by suffixes 1, like a_1; vertical projections by suffixes 2, like A_2, a_2; traces single and double dashes a' a'', α' α''. Hence P_1 will be the izontal projection of a point P in space; a line *a* will ve the projections a_1, a_2, and the traces a' and a''; a plane as the traces α' and α''.

34. *If a point lies in a line, the projections of the point lie he projections of the line.*

f a line lies in a plane, the traces of the line lie in the traces he plane.

These propositions follow at once from the definitions of projections and of the traces.

f a point lies in two lines its projections must lie in the jections of both. Hence

f two lines, given by their projections, intersect, the intersection heir plans and the intersection of their elevations must lie in a perpendicular to the axis, because they must be the pro-tions of the point common to the two lines.

imilarly—*If two lines given by their traces lie in the same ıe or intersect, then the lines joining their horizontal and verti-traces respectively must meet on the axis,* because they must he traces of the plane through them.

35. *To find the projections of a line which joins two points* B, *given by their projections,* A_1, A_2, *and* B_1, B_2 we join A_1, ınd A_2, B_2; these will be the projections required. For mple, the traces of a line are two points in the line ose projections are known or at all events easily found. ey are the traces themselves and the feet of the perpen-ılars from them to the axis.

Lence *if* a', a'' (Fig. 14) *are the traces of a line a, and if the pendiculars from cut the axis in* P Q *respectively, then line* a'Q *will be the zontal and* a''P *the ical projection of the*

onversely, if the ections a_1, a_2 of a are given, and if e cut the axis in nd P respectively, n *the perpendiculars and* Qa'' *to the axis on through these ts cut the projections nd* a_2 *in the traces nd* a''.

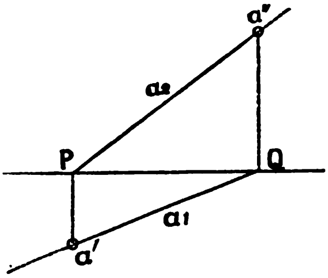

FIG. 14.

o *find the line of intersection of two planes,* we observe that line lies in both planes; its traces must therefore lie in traces of both. Hence the points where the horizontal es of the given planes meet will be the horizontal, and point where the vertical traces meet the vertical trace he line required.

36. *To decide whether a point* A, *given by its projections, lies plane* α, *given by its traces,* we draw a line *p* by joining A ome point in the plane α and determine its traces. If e lie in the traces of the plane, then the line, and there- the point A, lies in the plane; otherwise not. This is veniently done by joining A_1 to some point p' in the e α_1; this gives p_1; and the point where the perpen-ılar from p' to the axis cuts the latter we join to A_2; this s p_2. If the vertical trace of this line lies in the verti-trace of the plane, then, and then only, does the line *p*, with it the point A, lie in the plane α.

37. *Parallel planes have parallel traces,* because parallel ıes are cut by any plane, hence also by π_1 and by π_2, in ıllel lines.

arallel lines have parallel projections, because points at in-ty are projected to infinity.

a line is parallel to a plane, then lines through the traces of ine and parallel to the traces of the plane must meet on the , because these lines are the traces of a plane parallel to given plane.

38. *To draw a plane through two intersecting lines or through parallel lines,* we determine the traces of the lines; the s joining their horizontal and vertical traces respectively be the horizontal and vertical traces of the plane. They meet, at a finite point or at infinity, on the axis if the s do intersect.

o *draw a plane through a line and a point without the line,* join the given point to any point in the line and deter-e the plane through this and the given line.

o *draw a plane through three points which are not in a line,* we draw two of the lines which each join two of the given points and draw the plane through them. If the traces of all three lines AB, BC, CA be found, these must lie in two lines which meet on the axis.

§ 39. We have in the last example got more points, or can easily get more points, than are necessary for the determination of the figure required—in this case the traces of the plane. This will happen in a great many constructions and is of considerable importance. It may happen that some of the points or lines obtained are not convenient in the actual construction. The horizontal traces of the lines AB and AC may, for instance, fall very near together, in which case the line joining them is not well defined. Or, one or both of them may fall beyond the drawing paper, so that they are practically non-existent for the construction. In this case the traces of the line BC may be used. Or, if the vertical traces of AB and AC are both in convenient position, so that the vertical trace of the required plane is found and one of the horizontal traces is got, then we may join the latter to the point where the vertical trace cuts the axis.

Furthermore the draughtsman will never forget that the lines which he draws are not mathematical lines without thickness. For this reason alone every drawing is affected by some errors. And inaccuracies also come in in drawing the lines required in the construction. It is therefore very desirable to be able constantly to check the latter. Such checks always present themselves when the same result can be obtained by different constructions, or when, as in the above case, some lines must meet on the axis, or if three points must lie in a line. A careful draughtsman will always avail himself of these checks.

§ 40. *To draw a plane through a given point parallel to a given plane* α, we draw through the point two lines which are parallel to the plane α, and determine the plane through them; or, as we know that the traces of the required plane are parallel to those of the given one (§ 37), we need only draw one line *l*, through the point parallel to the plane and find one of its traces, say the vertical trace l''; a line through this parallel to the vertical trace of α will be the vertical trace β'' of the required plane β, and a line parallel to the horizontal trace of α meeting β'' on the axis will be the horizontal trace β'.

Let A_1 A_2 (Fig. 15) be the given point, α' α'' the given plane, a line l_1 through A_1 parallel to α' and a horizontal line l_2 through A_2 will be the projections of a line *l* through A parallel to the plane, because the horizontal plane through this line will cut the plane α in a line *c* which has its horizontal projection c_1 parallel to α'.

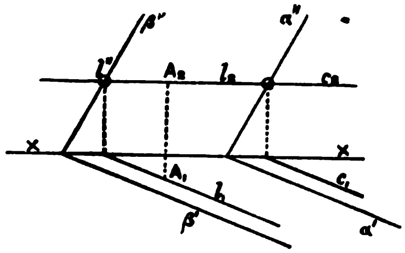

FIG. 15.

§ 41. We now come to the metrical properties of figures.

A line is perpendicular to a plane if the projections of the line are perpendicular to the traces of the plane. We prove it for the horizontal projection. If a line *p* is perpendicular to a plane α, every plane through *p* is perpendicular to α; hence also the vertical plane which projects the line *p* to p_1. As this plane is perpendicular both to the horizontal plane and to the plane α, it is also perpendicular to their intersection—that is, to the horizontal trace of α. It follows that every line in this projecting plane, therefore also p_1, the plan of *p*, is perpendicular to the horizontal trace of α. Q.E.D.

To draw a plane through a given point A *perpendicular to a given line p,* we first draw through some point O in the axis lines γ', γ'' perpendicular respectively to the projections p_1 and p_2 of the given line. These will be the traces of a plane γ which is perpendicular to the given line. We next draw through the given point A a plane parallel to the plane γ; this will be the plane required.

Other metrical properties depend on the determination of the real size or shape of a figure.

In general the projection of a figure differs both in size and shape from the figure itself. But figures in a plane parallel to a plane of projection will be identical with their projections, and will thus be given in their true dimensions.

In other cases there is the problem, constantly recurring, either to find the true shape and size of a plane figure when plan and elevation are given, or, conversely, to find the latter from the known true shape of the figure itself. To do this, the plane is turned about one of its traces till it is laid down into that plane of projection to which the trace belongs. This is technically called rabatting the plane respectively into the plane of the plan or the elevation. As there is no difference in the treatment of the two cases, we shall consider only the case of rabatting a plane α into the plane of the plan. The plan of the figure is a parallel (orthographic) projection of the figure itself. The results of parallel projection (§§ 17 and 18) may therefore now be used. The trace α' will hereby take the place of what formerly was called the axis of projection. Hence we see that corresponding points in the plan and in the rabatted plane are joined by lines which are perpendicular to the trace α' and that corresponding lines meet on this trace. We also see that the correspondence is completely determined if we know for one point or one line in the plan the corresponding point or line in the rabatted plane.

Before, however, we treat of this we consider some special cases.

§ 42. *To determine the distance between two points* A, B *given by their projections* A_1, B_1 *and* A_2, B_2.

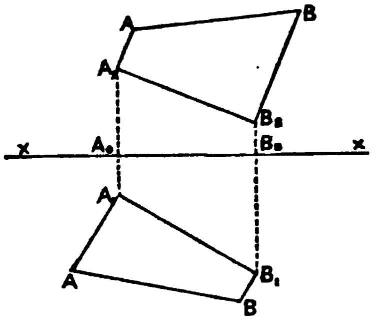

FIG. 16.

Solution. The two points A. B in space lie vertically above their plans A_1, B_1 (Fig. 16) and $A_1A=A_0A_2$, $B_1B=B_0B_2$. The four points A, B, A_1, B_1 therefore form a plane quadrilateral on the base A_1B_1 and having right angles at the base. This plane we rabatt about A_1B_1 by drawing A_1A and B_1B perpendicular to A_1B_1 and making $A_1A=A_0A_2$, $B_1B=B_0B_2$. Then AB will give the length required.

The construction might have been performed in the elevation by making $A_2A=A_0A_1$ and $B_2B=B_0B_1$ on lines perpendicular to A_2B_2. Of course AB must have the same length in both cases.

This figure may be turned into a model. We cut the paper along A_1A, AB, and BB_1 and fold the piece A_1ABB_1 over along A_1B_1 till it stands upright at right angles to the horizontal plane. The points A, B will then be in their true position in space relative to π_1. Similarly if B_2BAA_2 be cut out and turned along A_2B_2 through a right angle we shall get AB in its true position relative to the plane π_2. Lastly we fold the whole plane of the paper along the axis x till the plane π_2 is at right angles to π_1. In this position the two sets of points AB will coincide if the drawing has been accurate.

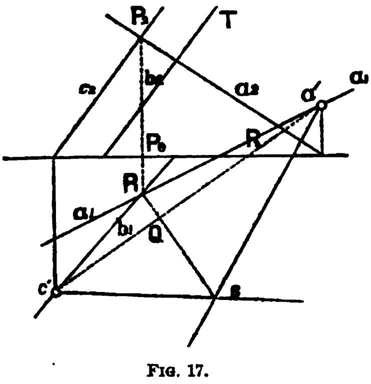

FIG. 17.

Models of this kind can be made in many cases and their construction cannot be too highly recommended in order to realize orthographic projection.[1]

§ 43. *To find the angle between two given lines a, b of which the projections a_1 b_1 and a_2, b_2 are given.*

Solution.—Let a_1, b_1 (Fig. 17) meet in P_1, a_2, b_2 in T, then if the line P_1T is not perpendicular to the axis the two lines will not meet. In this case we draw a line parallel to b to meet the line a. This is easiest done by drawing first the line P_1P_2 perpendicular to the axis to meet a_2 in P_2, and then drawing through P_2 a line c_2 parallel to b_2; then b_1, c_2 will be the projections of a line c, which is parallel to b and meets a in P. The plane α which these two lines determine we rabatt to the plan. We determine the traces a' and c' of the lines a and c; then $a'c'$ is the trace α' of their plane. On rabatting the point P comes to a point S on the line P_1Q perpendicular to $a'c'$, so that QS=QP. But QP is the hypothenuse of a triangle PP_1Q with a right angle P_1. This we construct by making $QR=P_0P_2$; then $P_1R=PQ$. The lines $a'S$ and $c'S$ will therefore include angles equal to those made by the given lines. It is to be remembered that two lines include two angles which are supplementary. Which of these is to be taken in any special case depends upon the circumstances.

To determine the angle between a line and a plane, we draw through any point in the line a perpendicular to the plane (§ 41) and determine the angle between it and the given line. The complement of this angle is the required one.

To determine the angle between two planes, we draw through any point two lines perpendicular to the two planes and determine the angle between the latter as above.

In special cases it is simpler to determine at once the angle between the two planes by taking a plane section perpendicular to the intersection of the two planes and rabatt this. This is especially the case if one of the planes is the horizontal or vertical plane of projection.

Thus in Fig. 18 the angle P_1QR is the angle which the plane α makes with the horizontal plane.

§ 44. We return to the general case of rabatting a plane α of which the traces α' α'' are given.

Here it will be convenient to determine first the position which the trace α''—which is a line in α—assumes when rabatted. Points in this line coincide with their elevations. Hence it is given in its true dimension, and we can measure off along it the true distance between two points in it. If therefore (Fig. 18) P is any point in α'' originally coincident with its elevation P_2, and if O is the point where α'' cuts the axis x, so that O is also in α', then the point P will after rabatting the plane assume such a position that $OP=OP_2$.

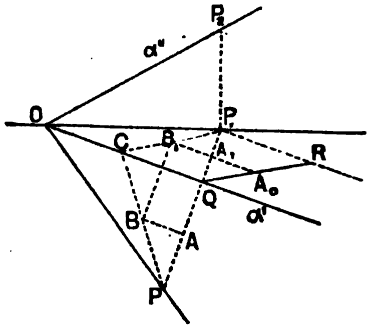

FIG. 18.

At the same time the plan is an orthographic projection of the plane α. Hence the line joining P to the plan P_1 will after rabatting be perpendicular to α'. But P_1 is known; it is the foot of the perpendicular from P_2 to the axis x. We draw therefore, to find P, from P_1 a perpendicular P_1Q to α' and find on it a point P such that $OP=OP_2$. Then the line OP will be the position of α'' when rabatted. This line corresponds therefore to the plan of α''—that is, to the axis x, corresponding points on these lines being those which lie on a perpendicular to α'.

We have thus one pair of corresponding lines and can now find for any point B_1 in the plan the corresponding point B in the rabatted plane. We draw a line through B_1, say B_1P_1, cutting α' in C. To it corresponds the line CP, and the point where this is cut by the projecting ray through B_1, perpendicular to α', is the required point B.

Similarly any figure in the rabatted plane can be found when the plan is known; but this is usually found in a different manner without any reference to the general theory of parallel projection. As this method and the reasoning employed for it have their peculiar advantages, we give it also.

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[1] In order to make a sharp crease along A_1B_1, it is well to place a straight edge along this line, and then to turn the piece A_1ABB_1 up against it.

Supposing the planes π_1 and π_2 to be in their positions in space perpendicular to each other, we take a section of the whole figure by a plane perpendicular to the trace α' about which we are going to rabatt the plane α. Let this section pass through the point Q in α'. Its traces will then be the lines QP_1 and P_1P_2 (Fig. 18). These will be at right angles, and will therefore, together with the section QP_2 of the plane α, form a right-angled triangle QP_1P_2 with the right angle at P_1, and having the sides P_1Q and P_1P_2 which both are given in their true lengths. This triangle we rabatt about its base P_1Q making $P_1R = P_1P_2$. The line QR will then give the true length of the line QP in space. If now the plane α be turned about α' the point P will describe a circle about Q as centre with radius $QP = QR$, in a plane perpendicular to the trace α'. Hence when the plane α has been rabatted into the horizontal plane the point P will lie in the perpendicular P_1Q to α', so that $QP = QR$.

If A_1 is the plan of a point A in the plane α, and if A_1 lies in QP_1, then the point A will lie vertically above A_1 in the line QP. On turning down the triangle QP_1P_2, the point A will come to A_0, the line A_1A_0 being perpendicular to QP_1. Hence A will be a point in QP such that $QA = QA_0$.

If B_1 is the plan of another point, but such that A_1B_1 is parallel to α', then the corresponding line AB will also be parallel to α'. Hence, if through A a line AB be drawn parallel to α' and B_1 B perpendicular to α', then their intersection gives the point B. Thus of any point given in plan the real position in the plane α, when rabatted, can be found by this second method. This is the one most generally given in books on geometrical drawing. The first method explained is, however, in most cases preferable as it gives the draughtsman a greater variety of constructions. It requires a somewhat greater amount of theoretical knowledge.

If instead of our knowing the plan of a figure the latter is itself given; then the process of finding the plan is the reverse of the above and needs little explanation. We give an example.

§ 45. PROBLEM.—*It is required to draw the plan and elevation of a polygon of which the real shape and position in a given plane α are known.*

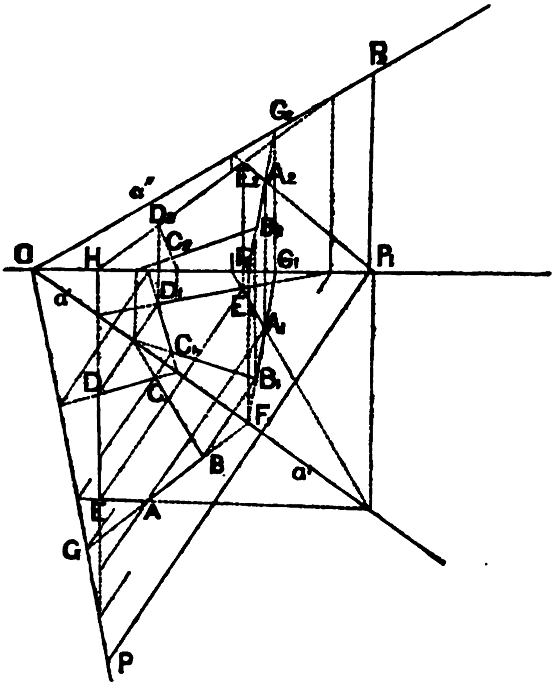

FIG. 19.

Solution.—We first rabatt the plane α (Fig. 19) as before so that P_1 comes to P, hence OP_1 to OP. Let the given polygon in α be the figure ABCDE. We project, not the vertices, but the sides. To project the line AB, we produce it to cut α' in F and OP in G, and draw GG_1 perpendicular to α'; then G_1 corresponds to G, therefore FG_1 to FG. In the same manner we might project all the other sides, at least those which cut OF and OP in convenient points. It will be best, however, first to produce all the sides to cut OP and α' and then to draw all the projecting rays through A,B,C . . . perpendicular to α', and in the same direction the lines G,G_1, etc. By drawing FG we get the points A_1, B_1 on the projecting ray through A and B. We then join B to the point M where BC produced meets the trace α'. This gives C_1. So we go on till we have found E_1. The line A_1 E_1 must then meet AE in α', and this gives a check. If one of the sides cuts α' or OP beyond the drawing paper this method fails, but then we may easily find the projection of some other line, say of a diagonal, or directly the projection of a point, by the former methods. The diagonals may also serve to check the drawing, for two corresponding diagonals must meet in the trace α'.

Having got the plan we easily find the elevation. The elevation of G is above G_1 in α'', and that of F is at F_2 in the axis. This gives the elevation F_2G_2 of FG and in it we get A_2B_2 in the verticals through A_1 and B_1. As a check we have $OG = OG_2$. Similarly the elevation of the other sides and vertices are found.

§ 46. We have now obtained the ABC of descriptive geometry, and proceed to give some applications to the representation of solids and of the solution of problems connected with them.

PROBLEM.—*Of a pyramid are given its base, the length of the perpendicular from the vertex to the base, and the point where this perpendicular cuts the base; it is required first to develop the whole surface of the pyramid into one plane, and second to determine its section by a plane which cuts the plane of the base in a given line and makes a given angle with it.*

Solution.—(1) As the planes of projection are not given we can take them as we like, and we select them in such a manner that the solution becomes as simple as possible. We take the plane of the base as the horizontal plane and the vertical plane perpendicular to the plane of the section. Let then (Fig. 20) ABCD be the base of the pyramid, V_1 the plan of the vertex, then the elevations of A, B, C, D will be in the axis at A_2, B_2, C_2, D_2, and the vertex at some point V_2 above V_1 at a known distance from the axis. The lines V_1A, V_1B, etc., will be the plans and the lines V_2A_2, V_2B_2, etc., the elevations of the edges of the pyramid, of which thus plan and elevation are known.

We develop the surface into the plane of the base by turning each lateral face about its lower edge into the horizontal plane by the method used in § 43. If one face has been turned down, say ABV to AVP, then the point Q to which the vertex of the next face BCV comes can be got more simply by finding on the line V_1Q perpendicular to BC the point Q such that $BQ = BP$, for these lines represent the same edge BV of the pyramid. Next R is found by making $CR = CQ$, and so on till we have got the last vertex—in this case S. The fact that AS must equal AP gives a convenient check.

(2) The plane α whose section we have to determine has its horizontal trace given perpendicular to the axis, and its vertical trace makes the given angle with the axis. This determines it. To find the section of the pyramid by this plane there are two methods applicable: we find the sections of the plane either with the faces or with the edges of the pyramid. We use the latter.

As the plane α is perpendicular to the vertical plane, the trace α'' contains the projection of every figure in it; the points E_2, F_2, G_2, H_2 where this trace cuts the elevations of the edges will therefore be the elevations of the points where the edges cut α. From these we find the plans E_1, F_1, G_1, H_1, and by joining them the plan of the section. If from E_1, F_1, lines be drawn perpendicular to AB, these will determine the points E, F on the developed face in which the plane α cuts it; hence also the line EF. Similarly on the other faces. Of course BF must be the same length on BP and on BQ. If the plane α be rabatted to the plan, we get the real shape of the section as shown in the figure EFGH. This is done easily by making $F_0F = OF_2$, etc. If the figure representing the development of the pyramid, or better a copy of it, is cut out, and if the lateral faces be bent along the lines AB, BC, etc., we get a model of the pyramid with the section marked on its faces. This may be placed on its plan ABCD and the plane of elevation bent about the axis x. The pyramid stands then in front of its elevations. If next the plane α with a hole cut out representing the true section be bent along the trace α' till its edge coincides with α'', the edges of the hole ought to coincide with the lines EF, FG, etc., on the faces.

§ 47. Polyhedra like the pyramid in § 46 are represented by the projections of their edges and vertices. But solids bounded by curved surfaces, or surfaces themselves, cannot be thus represented.

For a surface we may use, as in case of the plane, its traces—that is, the curves in which it cuts the planes of projection. We may also project points and curves on the surface. A ray cuts the surface generally in more than one point; hence it will happen that some of the rays touch the surface, if two of these points coincide. The points of contact of these rays will form some curve on the surface and this will appear from the centre of projection as the boundary of the surface or of part of the surface. The outlines of all surfaces of solids which we see about us are formed by the points at which rays through our eye touch the surface. The projections of these contours are therefore best adapted to give an idea of the shape of a surface.

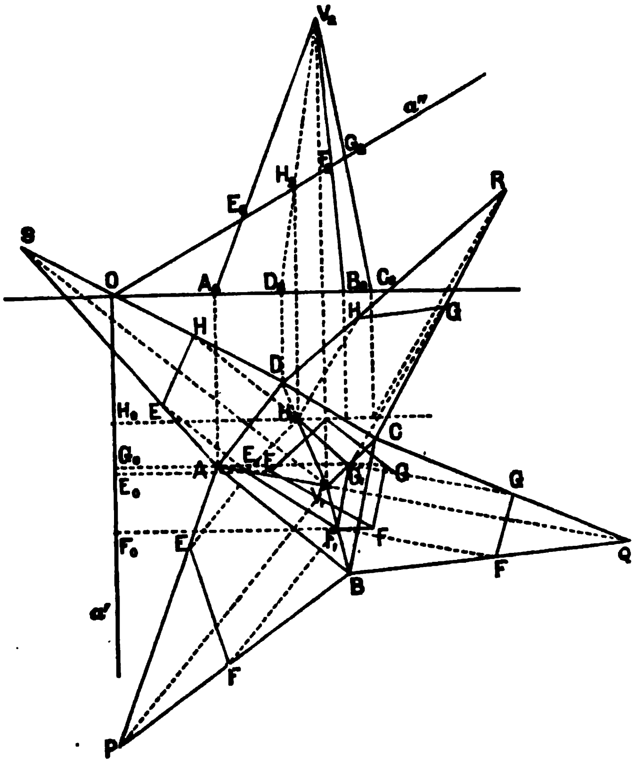

FIG. 20.

Thus the tangents drawn from any finite centre to a sphere form a right-circular cone, and this will be cut by any plane in a conic. It is often called the projection of a sphere, but it is better called the contour-line of the sphere, as it is the boundary of the projections of all points on the sphere.

If the centre is at infinity the tangent cone becomes a right circular cylinder touching the sphere along a great circle, and if the projection is, as in our case, orthographic, then the section of this cone by a plane of projection will be a circle equal to the great circle of the sphere. We get such a circle in the plan and another in the elevation, their centres being plan and elevation of the centre of the sphere.

Similarly the rays touching a cone of the second order will lie in two planes which pass through the vertex of the cone, the contour-line of the projection of the cone consists therefore of two lines meeting in the projection of the vertex. These may, however, be invisible if no real tangent rays can be drawn from the centre of projection: and this happens when the ray projecting the centre of the vertex lies within the cone. In this case the traces of the cone are of importance. Thus in representing a cone of revolution with a vertical axis we get in the plan a circular trace of the surface whose centre is the plan of the vertex of the cone, and in the elevation the contour, consisting of a pair of lines intersecting in the elevation of the vertex of the cone. The circle in the plan and the pair of lines in the elevation do not determine the surface, for an infinite number of surfaces might be conceived which pass through the circular trace and touch two planes through the contour lines in the vertical plane. The surface becomes only completely defined if we write down to the figure that it shall represent a cone. The same holds for all surfaces. Even a plane is fully represented by its traces only under the silent understanding that the traces are those of a plane.

§ 48. Some of the simpler problems connected with the representation of surfaces are the determination of plane sections and of the curves of intersection of two such surfaces. The former is constantly used in nearly all problems concerning surfaces. Its solution depends of course on the nature of the surface.

To determine the curve of intersection of two surfaces, we take a plane and determine its section with each of the two surfaces, rabatting this plane if necessary. This gives two curves which lie in the same plane and whose intersections will give us points on both surfaces. It must here be remembered that two curves in space do not necessarily intersect, hence that the points in which their projections intersect are not necessarily the projections of points common to the two curves. This will, however, be the case if the two curves lie in a common plane. By taking then a number of plane sections of the surfaces we can get as many points on their curve of intersection as we like. These planes have, of course, to be selected in such a way that the sections are curves as simple as the case permits of, and such that they can be easily and accurately drawn. Thus when possible the sections should be straight lines or circles. This not only saves time in drawing but determines all points on the sections, and therefore also the points where the two curves meet, with equal accuracy.

§ 49. We give a few examples how these sections have to be selected.

A cone is cut by every plane through the vertex in lines, and if it is a cone of revolution by planes perpendicular to the axis in circles.

A cylinder is cut by every plane parallel to the axis in lines, and if it is a cylinder of revolution by planes perpendicular to the axis in circles.

A sphere is cut by every plane in a circle.

Hence in case of two cones situated anywhere in space we take sections through both vertices. These will cut both cones in lines. Similarly in case of two cylinders we may take sections parallel to the axis of both. In case of a sphere and a cone of revolution with vertical axis, horizontal sections will cut both surfaces in circles whose plans are circles and whose elevations are lines, whilst vertical sections through the vertex of the cone cut the latter in lines and the sphere in circles. To avoid drawing the projections of these circles, which would in general be ellipses, we rabatt the plane and then draw the circles in their real shape. And so on in other cases.

Special attention should in all cases be paid to those points in which the tangents to the projection of the curve of intersection are parallel or perpendicular to the axis *x*, or where these projections touch the contour of one of the surfaces.

PERSPECTIVE.

§ 50. We have seen that, if all points in a figure be projected from a fixed centre to a plane, each point on the projection will be the projection of all points on the projecting ray. A complete representation by a single projection is therefore possible only when there is but one point to be projected on each ray. This is the case by projecting from one plane to another, but it is also the case if we project the *visible* parts of objects in nature; for every ray of light meeting the eye starts from that point in which the ray, if we follow its course from the eye, backward meets for the first time any object. Thus, if we project from a fixed centre the *visible* part of objects to a plane or other surface, then the outlines of the projection would give the same impression to the eye as the outlines of the things projected, provided that one eye only be used and that this be at the centre of projection. If at the same time the light emanating from the different points in the picture could be made to be of the same kind—that is, of the same color and intensity and of the same kind of polarization—as that coming from the objects themselves, then the projection would give sensibly the same impression as the objects themselves. The art of obtaining this result constitutes a chief part of the technique of a painter, who includes the rules which guide him under the name of perspective, distinguishing between *linear* and *aerial* perspective,—the former relating to the projection, to the *drawing* of the outlines, the latter to the coloring and the shading off of the colors in order to give the appearance of distance. We have to deal only with the former, which is in fact a branch in geometry consisting in the applications of the rules of projection.

§ 51. Our problem is the following: *There is given a figure in space, the plane of a picture, and a point as centre of projection; it is required to project the figure from the point to the plane.*

From what has been stated about projection in general it follows at once that the projection of a point is a point, that of a line a line. Further, the projection of a point at infinity in a line is in general a finite point. Hence parallel lines are projected into a pencil of lines meeting at some finite point. This point is called the *vanishing point of the direction* to which it belongs. To find it, we project the point at infinity in one of the parallel lines; that is, we draw through the eye a line in the given direction. This cuts the picture plane in the point required.

Similarly all points at infinity in a plane are projected to a line (§ 6) which is called the *vanishing line of the plane* and which is *common to all parallel planes.*

All lines parallel to a plane have their vanishing points in a line, viz., in the vanishing line of the plane.

All lines parallel to the picture plane have their vanishing points at infinity in the picture plane; hence *parallel lines which are parallel to the picture plane appear in the projection as parallel lines in their true direction.*

The projection of a line is determined by the projection of two points in it, these being very often its vanishing point and its trace on the picture plane. *The projection of a point is determined by the projection of two lines through it.*

These are the general rules which we now apply. We suppose the picture plane to be vertical.

§ 52. Let (Fig. 21) S be the centre of projection, where the eye is situated, and which in perspective is called the *point of sight*, ABKL the picture plane, ABMN a horizontal plane on which we suppose the objects to rest of which a perspective drawing is to be made. The lowest plane which contains points that are to appear in the picture is generally selected for this purpose, and is therefore called the ground plane, or sometimes the geometrical plane. It cuts the picture plane in a horizontal line AB called the ground line or base line or fundamental line of the picture. A horizontal line SV, drawn through the eye S perpendicular to the picture, cuts the latter at a point V called the centre of the picture or the centre of vision. The distance SV of the eye from the picture is often called the distance simply, and the height ST of the eye above the ground the height of the eye.

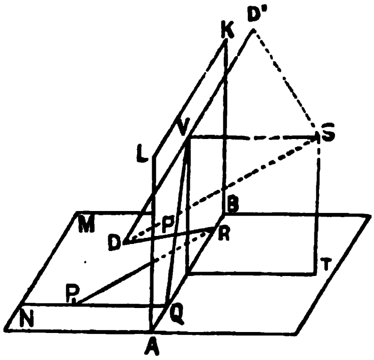

FIG. 21.

The vanishing line of the ground plane, and hence of every horizontal plane, is got by drawing the projecting rays from S to the points at infinity in the plane—in other words, by drawing all horizontal rays through S. These lie in a horizontal plane which cuts the picture plane in a horizontal line DD′ through the centre of vision V. This line is called the horizon in the picture. It contains the vanishing points of all horizontal lines, the centre of vision V being the vanishing point of all lines parallel to SV, that is perpendicular to the picture plane. To find the vanishing point of any other line we draw through S the ray projecting the point at infinity in the line; that is, we draw through S a ray parallel to the line, and determine the point where this ray cuts the picture plane. If the line is given by its plan on the ground plane and its elevation on the picture plane, then its vanishing point can at once be determined; it is the vertical trace of a line parallel to it through the eye (comp. § 35).

§ 53. To have construction in a single plane, we suppose the picture plane turned down into the ground plane; but before this is done the ground plane is pulled forward till, say, the line MN takes the place of AB, and then the picture plane is turned down. By this we keep the plan of the figure and the picture itself separate. In this new position the plane of the picture will be that of the paper (Fig. 22). On it are marked the base line AB, the centre of vision V, and the horizon DD′, and also the limits ABKL of the actual picture. These, however, need not necessarily be marked. In the plan the picture plane must be supposed to pass through A_1B_1, and to be perpendicular to the ground plane. If we further suppose that the horizontal plane through the eye which cuts the picture plane in the horizon DD′ be turned down about the horizon, then the centre of sight will come to the point S, where VS equals the distance of the eye.

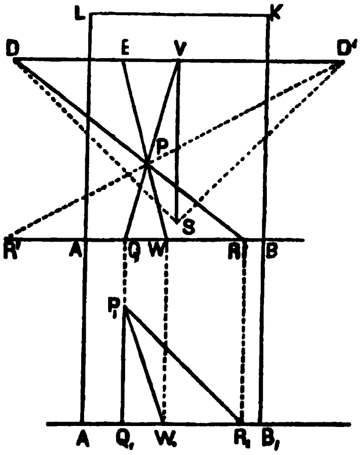

FIG. 22.

To find the vanishing point of any line in a horizontal plane, we have to draw through S a line in the given direction and see where it cuts the horizon. For instance, to find the vanishing points of the two horizontal directions which make angles of 45° with the horizon, we draw through S lines SD and SD′ making each an angle of 45° with the line DD′. These points can also be found by making VD and VD′ each equal to the distance SV. The two points D, D′ are therefore called the distance points.

§ 54. Let it now be required to find the perspective P of a point P_1 (Figs. 21 and 22) in the ground plane. We draw through P_1 two lines of which the projection can easily be found. The most convenient lines are the perpendicular to the base line, and a line making an angle of 45° with the picture plane. These lines in the ground plan are P_1Q_1 and P_1R_1. The first cuts the picture at Q_1, or at Q, and has the vanishing point V; hence QV is its perspective. The other cuts the picture in R_1, or rather in R, and has the vanishing point D; its perspective is RD. These two lines meet at P, which is the point required. It will be noticed that the line $QR=Q_1R_1=Q_1P_1$ gives the distance of the point P behind the picture plane. Hence if we know the point Q where a perpendicular from a point to the picture plane cuts the latter, and also the distance of the point behind the picture plane, we can find its perspective. We join Q to V, set off QR to the right equal to the distance of the point behind the picture plane, and join R to the distance point to the left; where RD cuts QV is the point P required. Or we set off QR′ to the left equal to the distance and join R′ to the distance point D′ to the right.

If the distance of the point from the picture should be very great, the point R might fall at too great a distance from Q to be on the drawing. In this case we might set off QW equal to the *n*th part of the distance and join it to a point E, so that VE equals the *n*th part of VD. Thus if QW=⅓QR and VE=⅓VD, then WE will again pass through P. It is thus possible to find for every point in the ground plane, or in fact in any horizontal plane, the perspective; for the construction will not be altered if the ground plane be replaced by any other horizontal plane. We can in fact now *find the perspective of every point as soon as we know the foot of the perpendicular drawn from it to the picture plane, that is, if we know its elevation on the picture plane, and its distance behind it.* For this reason it is often convenient to draw in slight outlines the elevation of the figure on the picture plane.

Instead of drawing the elevation of the figure we may also proceed as follows. Suppose (Fig. 23) A_1 to be the projection of the plan of a point A. Then the point A lies vertically above A_1 because *vertical lines appear in the perspective as vertical lines* (§ 51). If then the line VA_1 cuts the picture plane at Q, and we erect at Q a perpendicular in the picture plane to its base and set off on it QA_2 equal to the real height of the point A above the ground plane, then the point A_2 is the elevation of A and hence the line A_2V will pass through the point A. The latter thus is determined by the intersection of the vertical line through A_1 and the line A_2V.

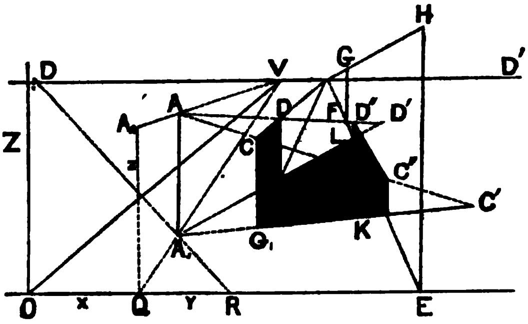

FIG. 23.

This process differs from the one mentioned before in this that the construction for finding the point is not made in the horizontal plane in which it lies, but that its plan is constructed in the ground plane. But this has a great advantage. The perspective of a horizontal plane from the picture to the line at infinity occupies in the picture the space between the line where the plane cuts the picture and the horizon, and this space is the greater the farther the plane is from the eye, that is, the farther its trace on the picture plane lies from the horizon. The horizontal plane through the eye is projected into a line, the horizon; hence no construction can be performed in it. The ground plane on the other hand is the lowest horizontal plane used. Hence it offers most space for constructions, which consequently will allow of greater accuracy.

§ 55. The process is the same if we know the coördinates of the point, viz., we take in the base line a point O as origin, and we take the base line, the line OV, and the perpendicular OZ as axes of coördinates. If we then know the coördinates x, y, z measured in these directions, we make $OQ=x$, set off on QV a distance QA such that its real length $QR=y$, make $QA_2=z$, and find A as before. This process might be simplified by setting off to begin with along OQ and OZ scales in their true dimensions and along OV a scale obtained by projecting the scale on OQ from D to the line OV.

§ 56. The methods explained give the perspective of any point in space. If lines have to be found, we may determine the perspective of two points in them and join these, and this is in many cases the most convenient process. Often, however, it will be advantageous to determine the projection of a line directly by finding its vanishing point. This is especially to be recommended when a number of parallel lines have to be drawn.

The perspective of any curve is in general a curve. The projection of a conic is a conic, or in special cases a line. The perspective of a circle may be any conic, not necessarily an ellipse. Similarly the perspective of the shadow of a circle on a plane is some conic.

§ 57. A few words must be said about the determination of shadows in perspective. The theory of their construction is very simple. We have given, say, a figure and a point L as source of light. We join the point L to any point of which we want to find the shadow and produce this line till it cuts the surface on which the shadow falls. These constructions must in many cases first be performed in plan and elevation, and then the point in the shadow has to be found in perspective. The constructions are different according as we take as the source of light a finite point (say, the flame of a lamp), or the sun, which we may suppose to be at an infinite distance.

If, for instance, in Fig. 23, A is a source of light, EHGF a vertical wall, and C a point whose shadow has to be determined, then the shadow must lie on the line joining A to C. To see where this ray meets the floor we draw through the source of light and the point C a vertical plane. This will cut the floor in a line which contains the feet A_1, C_1 of the perpendiculars drawn from the points A, C to the floor, or the plans of these points. At C′, where the line A_1C_1 cuts AC, will be the shadow of C on the floor. If the wall EHGF prevents the shadow from falling on the floor, we determine the intersection K of the line A_1C_1 with the base EF of the wall and draw a vertical through it, this gives the intersection of the wall with the vertical plane through A and C. Where it cuts AC is the shadow C′′ of C on the wall.

If the shadow of a screen CDD_1C_1 has to be found we find the shadow D′ of D which falls on the floor; then D_1D' is the shadow of D_1D and D′C′ is the shadow on the floor of the line DC. The shadow of D_1D, however, is intercepted by the wall at L. Here then the wall takes up the shadow, which must extend to D′′ as the shadow of a line on a plane is a line. Thus the shadow of the screen is found in the shaded part in the figure.

§ 58. If the shadows are due to the sun, we have to find first the perspective of the sun, that is, the vanishing point of its rays. This will always be a point in the picture plane; but we have to distinguish between the cases where the sun is in the front of the picture, and so behind the spectator, or behind the picture plane, and so in front of the spectator. In the second case only does the vanishing point of the rays of the sun actually represent the sun itself. It will be a point above the horizon. In the other case the vanishing point of the rays will lie below the horizon. It is the point where a ray of the sun through the centre of sight S cuts the picture plane, or it will be the shadow of the eye on the picture. In either case the ray of the sun through any point is the line joining the perspective of that point to the vanishing point of the sun's rays. But in the one case the shadow falls away from the vanishing point, in the other it falls towards it. The direction of the sun's rays may be given by the plan and elevation of one ray.

For the construction of the shadow of points it is convenient first to draw a perpendicular from the point to the ground and to find its shadow on the ground. But the shadows of verticals from a point at infinity will be parallel; hence they have in perspective a vanishing point L_1 in the horizon. To find this point, we draw that vertical plane through the eye which contains a ray of the sun. This cuts the horizon in the required point L_1 and the picture plane in a vertical line which contains the vanishing point of the sun's rays themselves. Let then (Fig. 24) L be the vanishing point of the sun's rays, L_1 be that of their projection in a horizontal plane, and let it be required to find the shadow of the vertical column AH. We draw AL_1 and EL; they meet at E′, which is the shadow of E. Similarly we find the shadows of F, G, H. Then $E'F'G'H'$ will be the shadow of the quadrilateral EFGH. For the shadow of the column itself we join E′ to A, etc., but only mark the outlines; $F'B$, the shadow of BF, does not appear as such in the figure.

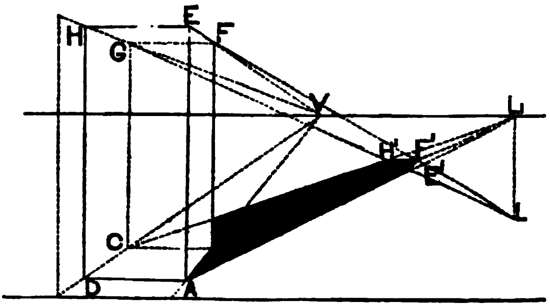

FIG. 24.

If the shadow of E has to be found when falling on any other surface we use the vertical plane through E, determine its intersection with the surface, and find the point where this intersection is cut by the line EL. This will be the required shadow of E.

§ 59. If the picture is not to be drawn on a vertical but on another plane—say, the ceiling of a room—the rules given have to be slightly modified. The general principles will remain true. But if the picture is to be on a curved surface the constructions become somewhat more complicated. In the most general case conceivable it would be necessary to have a representation in plan and elevation of the figure required and of the surface on which the projection has to be made. A number of points might also be found by calculation, using coördinate geometry. But into this we do not enter. As an example we take the case of a panorama, where the surface is a vertical cylinder of revolution, the eye being in the axis. The ray projecting a point A cuts the cylinder in two points on opposite sides of the eye, hence geometrically speaking every point has two projections; of these only the one lying on the half ray from the eye to the point can be used in the picture. But the other has sometimes to be used in constructions, as the projection of a line has to pass through both. Parallel lines have two vanishing points which are found by drawing a line of the given direction through the eye; it cuts the cylinder in the vanishing points required. This operation may be performed by drawing on the ground the plan of the ray through the foot of the axis, and through the point where it cuts the cylinder a vertical, on which the point required must lie. Its height above is easily found by making a drawing of a vertical section on a reduced scale.

Parallel planes have in the same manner a vanishing curve. This will be for horizontal planes a horizontal circle of the height of the eye above the ground. For vertical planes it will be a pair of generators of the cylinder. For other planes the vanishing curves will be ellipses having their centre at the eye.

The projections of vertical lines will be vertical lines on the cylinder. Of all other lines they will be ellipses with the centre at the eye. If the cylinder be developed into a plane, then these ellipses will be changed into curves of sines. Parallel lines are thus represented by curves of sines which have two points in common. There is no difficulty in making all the constructions on a small scale on the drawing board and then transferring them to the cylinder.

§ 60. A variety of instruments have been proposed to facilitate perspective drawings. If the problem is to make a drawing from nature then a camera obscura or, better, Wollaston's camera lucida may be used. Other instruments are made for the construction of perspective drawings. It will often happen that the vanishing point of some direction which would be very useful in the construction falls at a great distance off the paper, and various methods have been proposed of drawing lines through such a point. For some of these see Stanley's *Descriptive Treatise on Mathematical Drawing Instruments*.

Literature.—Descriptive geometry dates from Monge, whose *Géométrie Descriptive* appeared in 1809. Before his time plans and elevations, especially of buildings, had been in use, and rules had been developed to determine by construction from drawings the shapes of the stones required in buildings, especially in vaults and arches. These rules were reduced to a consistent method by Monge.

Perspective was investigated much earlier, as painters felt the need of it. Its beginnings date from the time of the Greek mathematicians, but its modern development from the time of the Renaissance, when the first books on the subject appeared in Italy. Albrecht Dürer also published a treatise on it and constructed a machine for making perspective drawings of objects. Of later writers we mention in the 17th century Desargues, and in the 18th Dr. Brook Taylor, whose *Linear Perspective* appeared first in 1715 and *New Principles of Linear Perspective* in 1719. At present perspective is generally treated as a special case of projection, and included in books on descriptive geometry.

For the literature of projection in general, we refer to the list of books given under GEOMETRY, vol. x. p. 366. For descriptive geometry and perspective, see Monge, *Géométrie Descriptive;* Leroy, *Traité de Géométrie Descriptive;* Fiedler, *Darstellende Geometrie;* Gournerie, *Traité de Perspective;* Mannheim, *Géométrie Descriptive* (1880) and *Éléments de la Géométrie Descriptive* (1882) J. Woolley, *Descriptive Geometry* (1856), which is based on Leroy's work, and is the only scientific publication on the subject in England. A number of other publications with titles such as "Practical Geometry" and "Geometrical Drawing" contain more or less full explanations of the methods of descriptive geometry. These are based generally on Euclidian as opposed to projective geometry, and are therefore in their theoretical part more or less unsatisfactory. We may mention Angel, *Practical Plane Geometry and Projection.* (O. H.)

PROJECTION OF THE SPHERE. See GEOGRAPHY.

PROME, a district in Pegu division, British Burmah, India, between 18° 30′ and 19° 15′ N. lat., and 94° 40′ and 96° E. long., containing an area of 2887 square miles. It occupies the whole breadth of the valley of the Irawadi, between Thayet district on the north and Henzada and Tharawadi districts on the south, and originally extended as far as the frontier of the province of Burmah, but in 1870 Thayet was formed into an independent jurisdiction. There are two mountain ranges in Prome, which form respectively the eastern and western boundaries. The Arakan Yoma extends along the whole of the western side, and that portion of the district lying on the right bank of the Irawadi is broken up by thickly wooded spurs running in a southeasterly direction, the space for cultivation being but limited and confined to the parts adjacent to the river. On the eastern side lies the Pegu Yoma, and north and northeast of the district its forest-covered spurs form numerous valleys and ravines, the torrents from which unite in one large stream called the Na-weng river. The most important of the plains lie in the south and southwest portions of Prome, and extend along the whole length of the railway that runs between the towns of Poungdé and Prome; they are mostly under cultivation, and those in the south are watered by a series of streams forming the Myitma-kha or upper portion of the Hlaing. There are in addition large tracts of land covered by tree-jungle which are available for cultivation. The principal river is the Irawadi, which intersects the district from north to south; next in importance are the Tha-ni and its tributaries and the Na-weng system of rivers. In the hills near the capital the soil is of Tertiary formation, and in the plains it is of alluvial deposit. The climate is much drier than other districts in British Burmah. The total rainfall in 1882 was 49.64 inches.

. In 1881 the population was 322,342 (161,433 males and 160,909 females). Buddhists and Jains numbered 313,261, Mohammedans 1795, Hindus 978, Christians 336, Aborigines 5818, and Parsees 5. More than two-thirds of the population are agriculturists. The chief towns are Prome (see below), and Shwe-doung and Poungdé, with 12,373 and 6727 inhabitants respectively. The chief products are rice, teak, cutch, silk, sugar cane, cotton, tobacco, and sesame oil; but the staple product is rice, which is cultivated mainly in the Poungdé and Shwe-doung townships. The total area under cultivation in 1882 was 234,222 acres. One of the most important manufactures is silk; others are ornamental boxes, coarse brown sugar, and cutch. The gross revenue of the district in 1882 amounted to about £92,000 [$447,120], of which over a third was derived from the land.

The early history of the once flourishing kingdom of Prome, like that of the other states which now form portions of the province of British Burmah, is veiled in obscurity. Fact and fable are so interwoven that it is impossible to disentangle the true from the false. After the conquest of Pegu in 1758 by Aloung-bhúra, the founder of the third and present dynasty of Ava kings, Prome remained a province of the Burman kingdom till the close of the second Burmese war in 1853, when the province of Pegu was annexed to British territory.

PROME, chief town of the above district, on the left bank of the Irawadi, had a population in 1881 of 28,813 (males 14,982, females 13,831). To the south and southeast the town is closed in by low pagoda-topped hills, on one of which stands the conspicuous gilded Shwe Tsan-daw. The town was taken by the British in 1825 and again in 1852, on both occasions with hardly any opposition from the Burmese. In 1862 it was almost entirely destroyed by fire, and was afterwards relaid out in straight and broad streets. It was erected into a municipality in 1874, and since then great improvements have been made. Its principal manufactures are silk cloths and lacquer ware.

PROMETHEUS, son of the Titan Iapetus by the sea nymph Clymene, is the chief "culture hero," and, in some accounts, the Demiurge of Greek mythical legend. As a culture-hero or inventor and teacher of the arts of life, he belongs to a wide and well-known category of imaginary beings. Thus Quat, Quahteaht, Pundjel, Maui, Ioskeha, Cagn, Wainamoinen, and an endless array of others represent the ideal and heroic first teachers of Melanesians, Ahts, Australians, Maoris, Algonquins, Bushmen, and Finns. Among the lowest races the culture-hero commonly wears a bestial guise, is a spider (Melanesia), an eagle hawk (Australia), a coyote (northwest America), a dog or raven (Thlinkeet), a mantis insect (Bushman), and so forth, yet is endowed with human or even superhuman qualities, and often shades off into a permanent and practically deathless god. Prometheus, on the other hand, is purely anthropomorphic. He is the friend and benefactor of mankind. He defends them against Zeus, who, in accordance with a widely diffused mythical theory, desires to destroy the human race and supplant them with a new and better species, or who simply revenges a trick in which men get the better of him. The pedigree and early exploits of Prometheus are given by Hesiod (*Theog.*, 510–616).

On a certain occasion gods and men met at Mecone. The business of the assembly was to decide what portions of slain animals the gods should receive in sacrifice. On one side Prometheus arranged the best parts of the ox covered with offal, on the other the bones covered with fat. Zeus was invited to make his choice, chose the fat, and found only bones beneath. A similar fable of an original choice, in which the chooser is beguiled by appearances, recurs in Africa and North America. The native tribes adapt it to explain the different modes of life among themselves and white men. In wrath at this trick, according to Hesiod, or in other versions for the purpose of exterminating the remnants of people who escaped the deluge of Deucalion, Zeus never bestowed, or later withdrew, the gift of fire. In his "philanthropic fashion," Prometheus stole fire, concealed in a hollow fennel stalk (Hesiod, *Op. et Di.*), and a fennel stalk is still used in the Greek islands as a means of carrying a light (*cf.* Pliny, xiii. 22). According to some legends he gained the fire by holding a rod close to the sun. Probably the hollow fennel stalk in which fire was carried got its place in myth from the very fact of its common use.

We thus find Prometheus in the position of the fire-bringer, or fire-stealer, and so connected with a very wide cycle of similar mythical benefactors. Among the Murri of Gippsland, to begin with a backward people, the fire-stealer was a man, but he became a bird. *Tow-e-ra*, or fire, was in the possession of two women who hated the blacks. A man who loved men cajoled the women, stole fire when their backs were turned, and was metamorphosed into "a little bird with a red mark on its tail, which is the mark of fire." The fire-bringer in Brittany is the golden or fire-crested wren. Myths like this kill two birds with one stone, and at once account for the possession of fire by men and for the marking of certain animals regarded as fire-bringers.[1] In another Australian legend fire was stolen by the hawk from the bandicoot, and given to men. In yet another a man held his spear to the sun, and so got a light. A bird is fire-bringer in an Andaman island tale, and a ghost in another myth of the same island.[2] In New Zealand, Maui stole fire from Mauika, the lord of fire. He used a bird's intervention. Among the Ahts, in North America,[3] fire was stolen by animals from the cuttle-fish. Among the Thlinkeets, Yehl, the raven-god, was the fire-stealer. Among the Cahrocs, the coyote steals fire from "two old women." Among the Aryans of Inda, Soma is stolen by birds, as water is among the Thlinkeets, and mead in the Edda.[4] Fire concealed himself, in the Veda, was dragged from his hiding place by Matariçvan, and was given to the priestly clan of Bhrigu. We also hear that Matariçvan "brought fire from afar" (*R. V.*, iii. 9, 5), and that Bhrigu found fire lurking in the water (*R. V.*, x. 46, 2).[5]

In considering the whole question, one must beware of the hasty analogical method of reasoning too common among mythologists. For example, when a bird is spoken of as the fire-bringer we need not necessarily conclude that, in each case the bird means lightning. On the other hand, the myth often exists to explain the cause of the markings of certain actual species of birds. Again, because a hero is said to have stolen or brought fire, we need not regard that hero as the personification of fire, and explain all his myth as a fire-myth. The legend of Prometheus has too often been treated in this fashion, though he is really a culture hero, of whose exploits, such as making men of clay, fire-stealing is no more than a single example. This tendency to evolve the whole myth of Prometheus from a belief that he is personified fire, or the fire-god, has been intensified by Kuhn's ingenious and plausible etymology of the name Προμηθεύς. The Greeks derived it from προμηθής, "provident," and connected it with such other words as προμηθέομαι, προμήθεια. They had also the proper name 'Επιμηθεύς for the slow-witted brother of Prometheus who turned all the hero's wisdom to foolishness. Against these very natural etymologies the philologists support a theory that Prometheus is really a Greek form of *pramantha* (Skt.), the fire-stick of the Hindus. The process of etymological change, as given by Steinthal, was this. The boring of the perpendicular in the horizontal fire-stick, whereby fire was kindled, was called *manthana*, from *math.* "I shake." The preposition *pra* was prefixed, and you get *pramantha*. But Mataricvan was feigned to have brought Agni, fire, and "the fetching of the god was designated by the same verb *mathnâmi* as the proper earthly boring" of the firestick. "Now this verb, especially when compounded with the preposition *pra*, gained the signification to tear off, snatch to oneself, rob."[6] Steinthal goes on—"Thus the fetching of Agni became a robbery of the fire, and the *pramâtha* (fire-stick) a robber. The gods had intended, for some reason or other, to withhold fire from men; a benefactor of mankind stole it from the gods. This robbery was called *pramâtha*; *pramâthyu-s* is 'he who loves boring or robbery, a borer or robber.' From the latter words, according to the peculiarities of Greek phonology, is formed Προμηθεύ-ς, Prometheus. He is therefore a fire-god," etc. Few things more ingenious than this have ever been done by philologists. It will be observed that "forgetfulness of the meaning of words" is made to account for the Greek belief that fire was *stolen* from the gods. To recapitulate the doctrine more succinctly, men originally said, in Sanskrit (or some Aryan speech more ancient still), "fire is got by rubbing or boring;" nothing could have been more scientific and straightforward. They also said, "fire is brought by Mataricvan;" nothing can be more in accordance with the mythopœic mode of thought. Then the word which means "fetched" is confused with the word which means "bored," and gains the sense of "robbed." Lastly, fire is said (owing to this confusion) to have been stolen, and the term which meant the common savage fire-stick is by a process of delusion conceived to represent, not a stick, but a person, Prometheus, who stole fire. Thus then, according to the philologists, arose the myth that fire was stolen, a myth which, we presume, would not otherwise have occurred to Greeks. Now we have not to decide whether the Greeks were right in thinking that Prometheus only meant "the foresighted wise man," or whether the Germans know better, and are correct when they say the name merely meant "fire-stick." But we may, at least, point out that the myth of the stealing of fire and of the fire-stealer is current among races who are not Aryan, and never heard the word *pramantha*. We have shown that Thlinkeets, Ahts, Andaman Islanders, Australians, Maoris, South Sea Islanders, Cahrocs, and others all believe fire was originally stolen. Is it credible that, in all their languages, the name of the fire-stick should have caused a confusion of thought which ultimately led to the belief that fire was obtained originally by larceny? If such a coincidence appears incredible, we may doubt whether the belief that is common to Greeks and Cahrocs and Ahts was produced, in Greek minds by an etymological confusion, in Australia, America, and so forth by some other cause. What, then, is the origin of the widely-diffused myth that fire was stolen? We offer a purely conjectural suggestion. No race is found without fire, but certain races[7] are said to have no means of artificially reproducing fire; whether this be true or not. certainly even some civilized races have found the artificial reproduction of fire very tedious. Thus we read (*Od.*, v. 488–493), "As when a man hath hidden away a brand in the black embers at an upland farm, one that hath no neighbor nigh, and so saveth the seed of fire that he may not have to seek a light otherwhere.

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[1] For these see Brough Smith, *Aborigines of Victoria*; Kuhn, on bird fire-bringer in Isle of Man, *Die Herabkunft des Feuers*, p. 109.

[2] *Journ. Anthrop. Inst.*, Nov., 1884.

[3] Sproat, *Savage Life.*

[4] Bancroft, iii. 100; *Aitareya Brahmana*, ii. 98, 208; Kuhn, *op. cit.*, 144.

[5] Compare Bergaighe, *La Religion Védique*, i. 52-56, and Kuhn's *Herabkunft*; and see the essays by Steinthal in appendix to English version of Goldziher's *Mythology among the Hebrews.*

[6] *Cf.* Kuhn. *op. cit.*, pp. 16, 17.

[7] Tylor, *Early History of Man.*

even so did Odysseus cover him with the leaves." If, in the Homeric age, men found it so hard to get the seed of fire, what must the difficulty have been in the earliest dawn of the art of fire-making? Suppose, then, that the human groups of early savages are hostile. One group lets its fire go out, the next thing to do would be to borrow a light from the neighbor, perhaps several miles off. But, if the neighbors are hostile, the unlucky group is cut off from fire, *igni interdicitur*. The only way to get fire in such a case is to steal it. Men accustomed to such a precarious condition might readily believe that the first possessors of fire, wherever they were, set a high value on it, and refused to communicate it to others. Hence the belief that fire was originally stolen. This hypothesis at least explains all myths of fire-stealing by the natural needs, passions, and characters of men, "a jealous race," whereas the philological theory explains the Greek myth by an exceptional accident of changing language, and leaves the other widely diffused myths of fire-stealing in the dark. It would occupy too much space to discuss, in the ethnological method, the rest of the legend of Prometheus. Like the Australian Pundjel, and the Maori Tiki, he made men of clay. He it was who, when Zeus had changed his wife into a fly, and swallowed her, broke open the god's head and let out his daughter Athene. He aided Zeus in the struggle with the Titans. He was punished by him on some desolate hill (usually styled Caucasus) for fire-stealing, and was finally released by Heracles.

His career may be studied in Hesiod, in the splendid *Prometheus Vinctus* of Æschylus, with the *scholia*, in Heyne's *Apollodorus*, in the excursus (1) of Schüzius to the Æschylean drama, and in the frequently quoted work of Kuhn. The essay of Steinthal may also be examined (Goldziher, *Myth. Hebr.*, Engl. transl., p. 363–392), where the amused student will discover that "Moses is a Pramanthas," with much else that is learned and convincing. See also Mr. Tylor's *Early History of Man*; Mr. Nesfield in *Calcutta Review*, January, April, 1884; and above, art. Fire, vol. ix. p. 198 *sq*. (A. L.)

PRONGBUCK. See Antelope, vol. ii. p. 91, and Plate I. Fig. 6.

PRONY, Gaspard Clair François Marie Riche de (1755–1839), a celebrated French engineer, was born at Chamelet, in the department of the Rhone, 22d July, 1755, and was educated at the Ecole des Ponts et Chaussées. His *Mémoire sur la poussée des voûtes* published in 1783, in defence of the principles of bridge construction introduced by his master Peronnet, attracted special attention. Under Peronnet he was engaged in restoring the fort of Dunkirk in 1785, and in erecting the bridge of Louis XVI. in 1787. The laborious enterprise of drawing up the famous *Tables du Cadastre* was entrusted to his direction in 1792, and in 1798 he was appointed director at the École des Ponts et Chaussées. He was employed by Napoleon to superintend the engineering operations both for protecting the province of Ferrara against the inundations of the Po and for draining and improving the Pontine Marshes. After the Restoration he was likewise engaged in regulating the course of the Rhone, and in several other important works. He was made a baron in 1828, and a peer in 1835. He was also a member of the principal academies and scientific societies of Europe. He died at Lyons 31st July, 1839.

PROPAGANDA, or Sacred Congregation *de Propaganda Fide*, is the name given to a commission of cardinals appointed for the direction of the missions of the Roman Church. The idea of forming such an institution was conceived by Pope Gregory XIII. and other pontiffs, but it was Gregory XV. (1621–1623) who, after having sought counsel from cardinals and information concerning the state of religion in various countries from apostolic nuncios and superiors of religious orders, published, 22d July, 1622, the bull *Inscrutabile* by which he founded the Congregation of Propaganda and provided means for its continuance. The cardinal vicar and the cardinal secretary of state were amongst its first members. Additional privileges were granted it by other bulls; and all the pontifical colleges founded up to that date as well as those which should afterwards be founded for the propagation of the faith were declared subject to the Propaganda. The deliberations of this body, embracing a great variety of important questions, when formulated in decrees and signed by the cardinal prefect and the secretary were declared by Urban VIII., in 1634, to have the force of apostolic constitutions, which should be inviolably observed. The cardinal prefect is the head of the Congregation, and as such governs the Catholic missions of the world; the secretary is assisted by five subalterns (*minutanti*), who act as heads of departments, and these again are assisted by inferior employes (*scrittori*). The more important acts of the Congregation, which are discussed in weekly meetings by the cardinal prefect and the officials, are submitted to the pope for his supreme decision. The archives of the institution were transferred, in 1660, from the Vatican to the Palazzo Ferrattini in the Piazza di Spagna, Rome, which is the seat of the Congregation. They form a valuable collection of historical, ethnographical, and geographical documents, embracing a period of two hundred and fifty years, and serve as a record of past events and of precedents to be followed in decisions on questions that may arise. The funds of the institution were supplied in the first instance by Gregory XV. and by private bequests. Cardinal Barberini, brother of Urban VIII., provided for eighteen places in perpetuity for students, Mgr. Vives for ten. Pope Innocent XII. bequeathed to it 150,000 crowns in gold; Clement XII. gave it 70,000 crowns. In the second assembly of the Congregation it was proposed and accepted as a rule, that prelates on being raised to the dignity of cardinal should pay for a ring offered them by the pope a sum which was at first fixed at 545 golden *scudi*, and which is now 600 Roman *scudi* [about $630]. Large donations were made to the Propaganda by Catholics in England, Scotland, Ireland, the United States, Spain and Italy. The cardinal prefect administers the property of the institution in the name of the Congregation. To provide for the affairs of the Church of the Oriental Rite, Pius IX., in 1862, appointed a special Congregation with its own secretary, consultors and officials.

The primary purpose of the Propaganda being to secure laborious and pious missionaries, colleges for their education and training were established. Chief amongst these is the Propaganda or Urban College in Rome, so named from Urban VIII. It is a general missionary seminary for the whole world. Here students are received from all foreign nations, and there are special foundations for Georgian, Persian, Chaldæan, Syrian, Coptic, Brahman, Abyssinian, Armenian, Greek and Chinese students, as well as for students from England, Ireland, America and Australia, although these last have special colleges in Rome. After the age of fourteen each student takes an oath to serve the missions during his whole life in the ecclesiastical province or vicariate assigned to him by the Congregation, to which he must send annually an account of himself and of his work. He is maintained and clothed free of expense. His studies embrace the full course of Greek, Latin and Italian letters, some of the chief Oriental languages, as Hebrew, Syriac, Arabic, Armenian, and, when necessary, Chinese. There are also schools for the teaching of rational and natural philosophy, a complete course of theology, and the institutions of canon law. Besides this principal seminary, the Propaganda has colleges dependent on it both in Rome and in other countries, under the direction of regular and secular priests. From its beginning it had at its disposition national colleges—such as the English, founded by Gregory XIII.; the Irish, by Cardinal Ludovisi in 1628; the Scotch, by Clement VIII. in 1600; the German and Hungarian;

the American, of the United States, opened by Pius IX. in 1859; the Greek, founded by Gregory XIII.; the Armenian, recently established by Leo XIII.; and the Bohemian, opened 4th November, 1884. The jurisdiction of the Propaganda extends over the English colleges of Lisbon and Valladolid, the Irish college of Paris, and the American of Louvain. Until recently it had the Chinese college of Naples, transformed by the Italian Government, and the Illyrian college of Loreto, suppressed by the same Government; and it still has the Albanian pontifical college of Scutari. Besides these, other colleges serve for the education of missionaries for the Propaganda, as the college of SS. Peter and Paul in Rome, founded by Pius IX., in Milan the seminary of St. Calocero for all foreign missions, and at Genoa the College Brignole Sale for Italian emigrants to America. The institutions at Verona for central Africa are the support of the missions in the Soudan. Chief of all the seminaries is that of Paris which, for two centuries has supplied missionaries for India and China. To these is committed the vast college of the island of Pulo Penang, where young men from China and neighboring countries are trained to the priesthood. In Paris many missionaries are taken from the French seminary directed by the fathers of the Congregation of the Holy Ghost, who go to French colonies. At Lyons is the college for African missions. In Belgium there are the colleges of Foreign Missions, of the Immaculate Conception, and of St. Francis Xavier for Chinese missions. In Holland there was recently established the college of Stiel, whose students go to China. In All Hallows College, Ireland, the students are educated for the missions in Australia, Canada and the Cape of Good Hope. In England a seminary has grown up within a few years at Mill Hill, which has already supplied priests to the missions of Borneo and Madras. Previous to the late changes in Rome, the Propaganda had dependent upon it the college of Reformed Minors in S. Pietro in Montorio, the Carmelites in S. Pancrazio (suppressed), the Minor Observants of S. Bartolomeo all 'Isola recently re-established, the Conventuals (suppressed), and the Irish Minor Franciscans of St. Isidore. Outside of Rome there were also colleges of regulars for the missions, as Ocaña in Spain, Sernache in Portugal, and others. The Propaganda, in the establishment of vicariates or new episcopal sees, has always encouraged the formation, as soon as circumstances would permit, of seminaries for the education of a native clergy, and frequently these have flourished, as the community of the "Houses of God" (*case di Dio*) in Tongking, the seminaries of Sze-chuen, of Peking, and of Nanking. The first step taken in a new mission is the erection of a chapel, followed by the opening of a school and an orphanage. As numbers increase, and more priests come to the new mission, they are united under a superior invested with special powers by the Propaganda—in fact a prefect apostolic. As churches increase and the faith spreads, a vicar apostolic, who is a bishop *in partibus*, is appointed, and, if the progress made requires it, the mission is erected into an episcopal diocese. Such has been the method of proceeding in the American and Canadian missions; such, in part, what has happened in India, China and Africa. Through these, whether prefects or vicars apostolic or bishops, the orders of the Propaganda, which are those of the head of the church, are transmitted to the faithful, and they are the ordinary centres of its correspondence, although it does not disdain the reports furnished by the humblest members of the Christian flock. The prelates furnish exact reports to the Propaganda of the progress and circumstances of the faith in their various missions.

The material means for the diffusion of the faith are supplied in the first place by special grants from the revenues of the Propaganda and from various associations in Europe. The greatest part is furnished by the society for the propagation of the faith of Paris and Lyons. This society is independent of the Propaganda, relying wholly on the energy of the two central councils of Paris and Lyons and on the charity of the faithful, though it attends to the suggestions of the Propaganda, which indicates to it the needs of new missions. Contributions are also furnished by other associations, as that of the Holy Infancy, or that for the education of Oriental nations. Similar societies, occupied with the support of special missions, exist in Bavaria, Germany, and Austria. The Propaganda likewise takes care that, as soon as a mission is established, pious foundations are constituted by native Christians, and become the local property of the church, and so supply it with a stable and enduring vitality. Subscriptions from Europe are given only to the poorer missions, which, however, are very numerous. One of the most powerful aids adopted by the Propaganda in the diffusion of the faith is the printing-press. The missionaries are required to study the languages of the countries to which they are sent and exhorted to publish books in these languages. Printing-presses are introduced into new missions. In China, what may be described as wooden stereotypes are employed for the printing of Catholic works in the Chinese language. Early in its career the Congregation of Propaganda established at its seat in Rome the celebrated Polyglott Printing Press, and gave it a character of universality. There people of all nations—the Copt, the Armenian, the Arab, the Hebrew, the Japanese, and the native of Malabar—may find books in their native tongue and in their special type. Although great progress has been made by other countries in polyglott printing, the Propaganda press still holds a high position.

The part of the world to which the cardinals of the Congregation of Propaganda first turned their attention was Asia. In no region of the globe has Christianity had greater difficulties to struggle against than in China. An ancient tradition exists, confirmed by documents, that in the early centuries of the Christian era Christianity had penetrated into and left traces in China. It was re-introduced in the 13th century by Franciscan fathers. It flourished at Peking for a time, but died out with the Mongolian dynasty, and China remained closed to Christian influences until 1555, when the Dominican father Gaspare della Croce introduced it into the province of Canton. After he was expelled came the Jesuits Rogeri and Ricci. They established a residence there in 1579, and were followed by Dominicans and Franciscans. These were succeeded a century later by the priests of the Paris seminary of foreign missions, in the last century by Augustinians and Lazarists, and in the present century by the missionaries of the seminary of St. Calocero of Milan. Two bishoprics were created in 1688, one at Nanking, the other at Peking, and the missions of Yun-nan and Sze-chuen founded. At the beginning of the 18th century the number of churches in the northern provinces reached 300, and of Christians 300,000. In 1803 a college for native clergy was opened in Sze-chuen, and the work of the Holy Infancy introduced. In 1837 the Portuguese patronage of Chinese missions was brought to an end, with the exception of that exercised over Macao, a Portuguese colony.

In 1310 B. Odorico di Friuli, a Franciscan, entered Tibet, and made many converts. In 1624 Father D'Andrada penetrated into the same country, but was not allowed to remain. Others followed, and were put to death. In 1847 the Propaganda entrusted to the seminary of foreign missions the task of entering Tibet, and in 1857 a vicariate apostolic was erected on the frontiers. In Mongolia, constituted a vicariate apostolic in 1840, many converts were made and several priests educated in the seminary of Siwang-se. This mission offers great hopes. It was divided into three vicariates in 1883, and is entrusted to the Belgian congregation of the Immaculate Heart of Mary. The Manchuria mission was made a vicariate in 1839; in

1854 a church, S. Maria ad Nives, was erected, and many other churches have since been built for the increasing mission. In 1592 an attempt was made to Christianize Corea; but repeated persecutions crushed out the germs of Christianity. Its first neophyte, its first native priest, its first bishops, and its first European missionaries were martyrs. From 1784 to 1789 4000 Coreans were converted, but their number was greatly reduced by persecution. In 1831 a vicariate was established; in 1835 the number of Christians was 6280; in 1861 they reached 18,000; but in 1866 persecution began anew. Christianity was introduced into Japan in 1549 by S. Francis Xavier. In less than fifty years there were in Japan a bishopric, 380 churches, and 30,000 professing Christians. Persecution broke out in 1601, and in 1614 became so fierce that the priests were put to death and the people dispersed. In 1640 all Europeans, missionaries included, were banished from Japan, this proscription continuing for two centuries. Missionaries were admitted in 1843, but so jealously watched that little good was accomplished. In 1863 a treaty was concluded between the emperor of the French and the Japanese Government permitting the preaching of the gospel. The first church was built after a lapse of two centuries; the number of catechumens soon reached 10,000; other churches were constructed; and the descendants of the old Christians, who had still preserved the faith, came forth from their concealment. A new persecution broke out in 1870; many Christians apostatized; a great number died of hunger, and many were exiled. Peace was established in 1873. The vicariate apostolic was divided in 1876 into two—the northern and southern vicariates. By the treaty of Peking, concluded between the French and Chinese Governments, liberty of religion was granted in the Chinese empire and a new era opened. In 1873, in the eighteen provinces of the Chinese empire, the number of Catholics was 410,644, with 4054 centres, 1220 churches and public chapels, 294 bishops and missionaries, 252 native priests, 137 European female religious and 924 native, 104 orphanages with 6853 orphans, and 947 schools frequented by 10,624 pupils. In spite of popular tumults and persecutions these numbers have increased in late years.

In the year of its foundation the Propaganda established a prefecture apostolic in Burmah. Italian Barnabites penetrated into the country in 1721, and two of them, Fathers Gallizio and Nerici, were put to death. The priests of the seminary of foreign missions continue the work, and three vicariates have been established. Malacca was visited by S. Francis Xavier, and was for a long time under the Portuguese jurisdiction; but a vicariate was established in 1841 and entrusted to the Paris seminary, which has a college in Penang for natives of China and neighboring countries. Jesuits, Dominicans, and Franciscans brought the Catholic faith to Siam in the 16th century. The first vicar apostolic was appointed in 1678. A terrible persecution of Christians, causing great loss, broke out in 1772, and it was not till 1821 that the missions were restored. The vicariate was divided into two in 1841. In the missions of the Anamite empire, comprising Tongking and Cochin China, and the missions to Cambodia and to the Laos people, Christianity may be said to have had its birth and its growth in blood, so fierce and numerous have the persecutions been. In the 14th century the faith was introduced by Dominicans and Franciscans, and the first mission established in 1550 by Gaspare della Croce. The Jesuits came in 1615, and in 1665 the Propaganda established here the priests of the seminary of foreign missions. A few years later the number of Christians in the southern provinces of Cochin China was 17,000, with 60 churches. Persecution followed persecution. The Dominican Father Francesco Gil, after nine years' imprisonment, was martyred in 1745. All foreigners were driven from the kingdom in 1825, and in 1826 an edict was issued against the Christians. What seemed a war of extermination was undertaken in 1833. Missionaries sought refuge in tombs and grottos, whence they issued by night to administer the sacraments. Mgr. Delgado, vicar apostolic of Western Tong-king, Mgr. Henares, his coadjutor, several Chinese priests, Mgr. Barie, vicar apostolic of Eastern Tong-king (about to be consecrated bishop), and an incredible number of lay persons of all ranks were put to death. In 1842 the cause of the beatification and sanctification of the Anamite martyrs was introduced by the Sacred Congregation of Rites. Persecution was renewed in 1844; the exiled missionaries and prelates returned though a price was put upon their heads. Christianity was proscribed throughout all Anam in 1848; native priests were exiled, and European clergy cast into the sea or the nearest river. Nevertheless the vicariate of Cambodia was founded in 1850, and Eastern Cochin China was made a separate vicariate. A new edict appeared in 1851, again enjoining that European priests should be cast into the sea, and natives, unless they trampled upon the cross, severed in two. The missionaries Schaeffler and Bonnard were put to death; the vicars apostolic perished of hunger; the mass of Christians were imprisoned or exiled. In 1856 and 1857 whole Christian villages were burned and their inhabitants dispersed. The edict of 1862 enjoined that Christians should be given in charge to pagans, that their villages should be burned and their property seized, and that on one cheek should be branded the words "false religion." In 1863 the number of martyrs had reached forty thousand, without reckoning those driven into the woods, where they perished. Nevertheless, the Anamite church, steeped in blood, has increased, and is regarded as the brightest gem of the Propaganda missions.

India is one of the most extensive fields in which the missionaries have labored. Previous to the founding of the Propaganda the Jesuits had established several missions in India. The introduction of vicars apostolic consolidated the basis of Christianity, and now twenty-three vicariates apostolic and a delegate apostolic direct the spiritual affairs of this great country. In Africa, Catholic missionaries were the first travellers, two centuries prior to Livingstone and Stanley. The earliest mission was that of Tunis (1624). The missions of the Cape of Good Hope were entrusted to the clergy of Mauritius; the Reformati and the Observants went to Egypt, the Carmelites to Mozambique and Madagascar, the Capuchins and Jesuits to Ethiopia and Abyssinia. The spiritual affairs of Africa are directed by one metropolitan and thirty-six bishops, vicars, and prefects apostolic. The progress of Catholicism in Australia is evident from the fact that two metropolitans, those of Melbourne and Sydney, with twelve suffragans direct its ecclesiastical affairs. While the missionary field of the Propaganda embraces Asia, Africa, Oceania, and both Americas, as well as England, Ireland, Scotland, Holland, Germany, Norway and Sweden, Iceland, Greenland, Switzerland, Albania, Macedonia, Greece, Turkey, etc., perhaps the most splendid results of its work are to be met with in the United States and in Canada. In 1632 many Catholics settled with Lord Baltimore in Maryland. A century and a half later, in 1789, they had so increased that the Congregation of Propaganda withdrew them from the jurisdiction of the vicar apostolic of London and formed a new see in Baltimore, comprising the territory of the United States. In 1808 the sees of New York, Philadelphia, Boston, and Bardstown (Louisville) were erected, and Baltimore was made the metropolitan diocese. At the end of 1884 there were twelve metropolitans and seventy-six bishops and vicars apostolic in the United States. In 1659 Mgr. François de Laval was the first vicar apostolic of Canada; shortly afterwards the episcopal see of Quebec was established. Now Canada has four metropolitan and sixteen suffragan sees.

The Italian Government, in virtue of the laws relating to ecclesiastical property of 1866, 1867, and 19th June, 1873, sold the Villa Montalto, Frascati, belonging to the Propaganda, and placed the price in the Italian funds, paying interest to the Congregation. Other property of the congregation having been sold, a law-suit was entered upon and decided in the court of Cassation at Rome, 31st May, 1881, in favor of the Propaganda. Appeal was made to the tribunal of Ancona, where, 14th December, 1881, decision was given against the Propaganda. Appeal being again made, the Court of Cassation of Rome gave final judgment, 9th February, 1884, against the Propaganda. This sentence empowers the Italian government to sell the landed or immovable property of the Propaganda, place the proceeds in the Italian funds, and pay the interest to the Congregation. Protests against this act have been issued by Pope Leo XIII., by Cardinal Jacobini, secretary of state to the pontiff, by nearly all the Catholic bishops, and by innumerable thousands of lay Catholics and many Protestants. (D. J.)

PROPERTIUS, SEXTUS, the greatest elegiac poet of Rome, was born of a good Umbrian family, who were considerable landed proprietors in the fair and fertile region between Perusia and the river Clitumnus. The seat of the Propertii was at Asisium or Assisi, the birthplace of the famous St. Francis; and here also was Propertius born. The year of his birth is uncertain, and it has been variously placed between 57 and 44 B.C. We learn from one passage of Ovid that Propertius was his senior, but also his friend and companion; from another that he was third in the sequence of elegiac poets, following Gallus, who was born in 69 B. C., and Tibullus, whose birth has been assigned to 54 B. C., and immediately preceding Ovid himself, who, as he tells us elsewhere, was born in 43 B.C. We shall not be far wrong in supposing that he was born about 50 B. C., a date which also agrees well with the indications of the poems themselves. His early life was full of misfortune. He buried his father before his time; and grief was closely followed by poverty. After the battle of Philippi and the return of Octavian to Rome the victorious legions had to be provided for; their clamorous need and cupidity could only be appeased by wholesale agrarian confiscation, and the north of Italy had to be surrendered. In common with his fellow poets Virgil and Horace, Propertius was deprived of his estate; but, unlike these, he had no patrons at court, and he was reduced from opulence to comparative indigence. The widespread disaffection which these measures provoked was turned to account by Lucius Antonius, the brother of the triumvir, and his wife, the notorious Fulvia. The insurrection which is generally known as the *bellum Perusinum* from its only important incident, the fierce and fatal resistence of Perugia, deprived the poet of another of his relations, who was killed by brigands while making his escape from the lines of Octavian. The loss of his patrimony, however, thanks no doubt to his mother's providence, did not prevent Propertius from receiving a superior education. After or, it may be, during its completion he and she left Umbria for Rome; and there, about the year 34 B.C., he assumed the garb of manly freedom. He was urged to take up a pleader's profession; but the serious study went against the grain, and, like Ovid, he found in letters and gallantry a more congenial pursuit. Soon afterwards he made the acquaintance of Lycinna, about whom we know little beyond the fact that she subsequently excited the jealousy of Cynthia, and was subjected to all her powers of persecution (*vexandi*). This passing fancy was succeeded by a serious attachment, the object of which was the famous "Cynthia." Her real name was Hostia, and she was a native of Tibur. She was a courtesan of the superior class, somewhat older than Propertius, and seems to have been a woman of singular beauty and varied accomplishments. Her own predilections led her to literature; and in her society Propertius found the intellectual sympathy and encouragement which were essential for the development of his powers. Her character as depicted in the poems, is not an attractive one; but she seems to have entertained a genuine affection for her lover. The intimacy began in 28 and lasted till 23 B.C. These six years must not, however, be supposed to have been a period of unbroken felicity. Apart from minor disagreements, an infidelity on Propertius's part excited the deepest resentment in Cynthia; and he was banished for a year. The quarrel was made up about the beginning of 25 B.C.; and soon after Propertius published his first book of poems and inscribed it with the name of his mistress. Its publication placed him in the first rank of contemporary poets, and amongst other things procured him admission to the literary circle of Mæcenas. The intimacy was renewed; but the old enchantment was lost. Neither Cynthia nor Propertius was faithful to the other. The mutual ardor gradually cooled; motives of prudence and decorum urged the discontinuance of the connection; and disillusion changed insensibly to disgust. Although this separation might have been expected to be final, it is not certain that it was so. It is true that Cynthia, whose health appears to have been weak, does not seem to have survived the separation long. But a careful study of the seventh poem of the last book. in which Propertius gives an account of a dream of her which he had after her death, leads us to the belief that they were once more reconciled, and that in her last illness Cynthia left to her former lover the duty of carrying out her wishes with regard to the disposal of her effects and the arrangements of her funeral. Almost nothing is known of the subsequent history of the poet. He was certainly alive in 16 B.C., as some of the allusions in the last book testify. And there are two passages in the letters of the younger Pliny in which he speaks of a descendant of the poet, one Passennus Paullus. Now in 18 B.C. Augustus carried the *Leges Juliæ*, which offered inducements to marriage and imposed disabilities upon the celibate. It would seem therefore at least a natural conclusion that Propertius was one of the first to comply with the provisions of the law, and that he married and had at least one child, from whom the contemporary of Pliny was descended.

Propertius appears to have had a large number of friends and acquaintances, chiefly literary, belonging to the circle of Mæcenas. Amongst these may be mentioned Virgil, the epic poet Ponticus, Bassus (probably the iambic poet of the name), and at a later period Ovid. He does not seem to have come across Tibullus; and his relations with Horace were not particularly friendly. Horace may have regarded him as an interloper in the favor of Mæcenas, though there is nothing in the poems of Propertius to warrant the supposition. In person Propertius was pale and thin, as was to be expected in one of a delicate and even sickly constitution. He was very careful about his personal appearance, and paid an almost foppish attention to dress and gait. He was of a somewhat voluptuous and self-indulgent temperament, which shrank from danger and active exertion. He was anxiously sensitive about the opinion of others, eager for their sympathy and regard, and, in general, impressionable to their influence. His over-emotional nature passed rapidly from one phase of feeling to another; but the more melancholy moods predominated. A vein of sadness runs through his poems, sometimes breaking out into querulous exclamation, but more frequently venting itself in gloomy reflections and prognostications. He had fits of superstition which in healthier moments he despised. It must be added that the native weakness of his character was no doubt considerably increased by his infirm and delicate constitution.

The poems of Propertius, as they have come down to us, consist of four books containing 4046 lines of elegiac verse. The unusual length of the second one (1402 lines) has led Lachmann and other critics to suppose that it originally consisted of two books, and they have placed the beginning of the third book at ii. 10, a poem addressed to Augustus. This theory somewhat modified, has been powerfully advocated by Th. Birt (*Das Antike Buchwesen*, pp. 413–426). He divides the poems into two parts,—a single book (lib. i.), published separately and called *Cynthia Monobiblos*, as in the MSS. and the lemma to Martial (xiv. 189), and a *Tetrabiblos Syntaxis*, a collection of four books, published together, consisting of the remainder of his poems. If this view is correct, the greater part of the first book of the *Syntaxis* must have been lost, as ii. 1–9 only contain 354 lines. The first book, or *Cynthia*, was published early in the poet's literary life, and may be assigned to 25 B.C. The date of the publication of the rest is uncertain, but none of them can have been published before 24 B.C., and the last, at any rate, was probably published posthumously. The subjects of the poems are threefold: (1) amatory and personal, mostly regarding Cynthia—seventy-two (sixty Cynthia elegies), of which the last book contains three; (2) political and social, on events of the day—thirteen, including three in the last book; (3) historical and antiquarian—six, of which five are in the last book.

The writings of Propertius are noted for their difficulty; and this has undoubtedly prejudiced his reputation as a poet. His style seems to unite every element by which a reader could be deterred. Not to speak of the unequal quality of his workmanship, in which curtness alternates with redundance, and carelessness with elaboration, the indistinctness and discontinuousness of his thought is a serious strain upon the attention. An apparently desultory sequence of ideas, sudden and often arbitrary changes of subject, frequent vagueness and indirectness of expression, a peculiar and abnormal Latinity, a constant tendency to exaggeration, and an excessive indulgence in learned and literary allusions,—all these are obstacles lying in the way of a study of Propertius. But those who have the will and the patience to surmount them will find their trouble well repaid. In power and compass of imagination, in freshness and vividness of conception, in truth and originality of presentation, few Roman poets can compare with him. If these qualities are seldom eminent for long together, if his flights are rarely steady and sustained, this is matter for regret rather than cavil or even astonishment. Propertius was essentially incapable of self-criticism, constitutionally intolerant of the slow labor of the file. His work is ever best when done under the urgency of a supreme and rapid excitement, and when, so to say, the discordant qualities of his genius are fused together by the electric spark of an immediate inspiration. Two of his merits seem to have impressed the ancients themselves. The first is most obvious in the scenes of quiet description and emotion in whose presentation he particularly excels. Softness of outline, warmth of coloring, a fine and almost voluptuous feeling for beauty of every kind, and a pleading and almost melancholy tenderness—such were the elements of the spell which he threw round the sympathies of his reader, and which his compatriots expressed by the vague but expressive word *blanditia*. His *facundia*, or command of striking and appropriate language, is more noticeable still. Not only is his vocabulary very extensive, but his employment of it extraordinarily bold and unconventional. New settings of use, idiom, and construction continually surprise us, and, in spite of occasional harshness, secure for his style an unusual freshness and freedom. His handling of the elegiac couplet, and especially of its second line, deserves especial recognition. It is vigorous, varied, and even picturesque. In the matter of the rhythms, cæsuras, and elisions which it allows, the metrical treatment is much more severe than that of Catullus, whose elegiacs are comparatively rude and barbarous; but it is not bound hand and foot, like that of the Ovidian distich, in a formal and conventional system. It only now remains to call attention to the elaborate symmetry of construction which is observable in many of his elegies. Often indeed the correspondence between different parts of his poem is so close that critics have endeavored with more or less success to divide them into strophes.

Propertius's poems bear evident marks of the study of his predecessors both Greek and Latin, and of the influence of his contemporaries. He tells us himself that Callimachus and Philetas were his masters, and that it was his ambition to be the Roman Callimachus. We can trace obligations to Theocritus, Apollonius Rhodius, and other Alexandrines, but above all to Meleager, and amongst earlier writers to Homer, Pindar, Æschylus, and others. Amongst Latin writers he had read with more or less care the works of Ennius, Lucretius, the dramatists, and Catullus. We find coincidences too close to be fortuitous between his poems and those of Virgil, Horace, and Tibullus his contemporaries; but it is very possible the influence was reciprocal. Propertius's influence upon his successors was considerable. There is not a page of Ovid which does not show obligations to his poems, whilst other writers made a more modest use of his stores. Amongst these may be mentioned Manilius, Juvenal, Martial, Statius, Claudian, Seneca, and Apuleius.

The works of Propertius have come down to us in a far from perfect condition. Some of the poems have been lost; others are fragmentary; and most are more or less disfigured by corruptions. The manuscripts on which we have to rely are late and in several cases interpolated; and these circumstances, combined with the native difficulty of the poet's writing, make the task of his restoration and interpretation one of peculiar delicacy and difficulty.

Donatus (or Suetonius) in his life of Virgil, 30 (45), is the authority for the full name of Propertius. "Aurelius" and "Nauta," which are added in the MSS., are due to confusion with Prudentius, and a corrupt reading of iii. 19, 22 (Müller), (ii. 24, 22, Palmer). On the Propertii, see Mommsen in *Hermes*, iv, p. 370; Haupt. *Opusc.*, i. p. 282. Besides the Propertius Blæsus (the Passennus Paullus of Pliny), we hear of a C. Propertius who was *triumvir capitalis* and *proconsul* in the time of Augustus, and a Propertius Celer, a poor senator under Tiberius. Inscriptions of the Propertii have been found at Assisi, *cf.* Hertzberg, *Prop.*, i. pp. 10–12. Propertius tell us himself that his family was not "noble," iii. 32 (ii. 34), 55, 6, and iii. 19. *l.c.*—Mevania (Bevagna) and Hispellum (Spello) have been put forward as the birthplace of Propertius, but the poet's own expressions are decisive for Asisium. Apart from the question of reading in v. (iv.) 1, 125 (MSS. Asis.), the climbing walls of his town (scandentes arces, scandens murus v. (iv.) 1, 65 and *l.c.*) its nearness to Perugia, and its position close above the plain (i. 22, 9, 10) are altogether unsuitable to Spello and Bevagna. Ovid thus assigns Propertius his place: successor fuit hic (Tibullus), tibi, Galle: *Propertius illi* (Tibullus): quartus ab his serie temporis ipse fui (*Tr.*, iv. 10, 53, 54);) and again (*ib.*, ii. 467), his (to Tibullus and Propertius) ego successi. For Ovid's friendship with Propertius see below—v. 1, 121 *sq.* is the chief authority for the earlier events of his life. For the premature death of his father and the loss of his property, see 127 *sq*:—ossaque legisti non illa aetate legenda patris et in tenues cogeris ipse Lares, nam tibi cum multi uersarent rura iuuenci abstulit excultas pertica tristis opes. Elsewhere he says that he is non ita diues (iii. 19 (22), *l.c.*). and that he had nulla domi fortuna relicta iii. 32, 55, *l. c.* Indirect evidence such as his living on the Esquiline, iv, (iii), 23, 24, points to a competence. For the death of his kinsman, generally supposed to be the Gallus of i. 21, see i. 22, 5–8. Propertius's mother is mentioned in ii. 8, 39; iii. 13, 15; and in very affectionate terms in i. 11, 21. She was dead when iii. 13 (11) was written, *i. e.*, six months after the publication of the first book. For the quality of Propertius's education, the poems themselves are the only, but a sufficient, testimony. For Lycinna see iv. 14 (iii. 15), 3–10, 43. Cynthia, or Hostia (Apul., *Apol.*, p. 415) of Tibur (v. (iv.) 7, 85), was the granddaughter (iv. 19 (iii. 20), 8), of L. Hostius, who wrote a poem on the Illyrian war of 178 B.C., of which some fragments are preserved. She was much older than Propertius (iii. 10 (ii. 18), 20). That she was a *meretrix* is clear from many indications—her accomplishments, her house in the Subura, the occurrence of scenes like those in i. 3, iii. 27 (ii. 29), the fact that Propertius could not marry her, etc. For descriptions of her beauty see ii. 2, 5, *sq.*, and 3, 9, *sq:* iii. 3, (ii. 13), 23, 24; her poetry, ii. 3, 21; and other accomplishments, i. 2, 27 *sq.*, iv. 19 (20) 7, 8. In character she was fickle (i. 15, ii 6, etc.) greedy (iii. 8 (ii. 16), 11, 12, Cynthia non sequitur fasces, nec curat honores: semper amatorum ponderat una sinus), and fond of finery (ii. 3, 15, 16); her temper was violent, iv. 7, (iii. 8), etc., and led her to slander those who had offended her (i. 4, 18 *sq.*, etc. For the five years, see iv. (iii.) 25, 3, quinque tibi potui seruire fideliter annos; and for the year of separation, iv. 15, 11 (iii. 16), 9, peccaram semel, et totum sum pulsus in annum. The second separation is vouched for by the two last elegies of book iv. The evidence which v. (iv.) 7 furnishes in favor of a reconciliation is analysed by Postgate (*Prop.*, Introd., p. xxv. *sq.*).—v. 6 commemorates the celebration of the *ludi quinquennales*, and v. 11, 66, alludes to the consulship of P. Scipio in 16 B. C. For Passennus Paullus (or as an Assisi inscription calls him C. Passennus Sergius Paullus Propertius Blæsus), see Pliny (*Ep.*, vi. 15), municeps Properti atque etiam inter maiores Propertium numerat; (9, 22), in litteris ueteres aemulatur exprimit reddit: Propertium in primis a quo genus ducit, uera soboles eoque simillima illi in quo ille praecipuus, si elegos eius in manum sumpseris, leges opus tersum molle iucundum et plane in Properti domo scriptum.—ii. 1 and iv. (iii.) 9 are addressed to Mæcenas, iii. 1 (ii. 10) to Augustus. Virgil is spoken of in the highest terms in iii. 32 (ii. 34), 61 *sq.* Other poems are addressed to Ponticus (i. 7, 9), Bassus (i, 4), Lynceus a tragic poet (iii. 32, ii. 34). Volpi conjectured (in his edition of Propertius, i. pp. xv. *sq.*) that he was the inquisitive fellow of Horace, *Sat.*, i. 9; but the conjecture is generally rejected on grounds of chronology. It has recently been re-discussed and rejected by Prof. A. Palmer in his edition of Horace's *Satires*, i. 9 (notes), p. 219. In *Ep.* vi. 87 *sq.*, however, Horace seems to make a direct attack on Propertius. On Propertius's personal appearance, see i. 22, 5. 21; pallorem nostrum. . . cur sim toto corpore nullus ego. A likeness of him has possibly been preserved in a double Hermes in the Villa Albani and the Vatican, which represents a young beardless Roman of a nervous and somewhat sickly appearance, in combination with a Greek poet, possibly Callimachus or Philetas (Visconti, *Iconograph. Romana*, plate 14, 3, 4; see E. Brizio, *Annal. dell' inst. arch.*, 1873, 105; C. Robert, *Arch. Zeit.*, 38, 35, (cited by Teuffel.) Ill health is proved, as well by the specific allusion of i. 15 as by the frequent references to death and burial—i. 19; ii. 1, 71 *sq.;* iii. 5, 1 (ii. 13, 17) *sq.* For his care about dress and the like, see ii. 4. 15, 16, (5, 6), nequiquam perfusa meis unguenta capillis ibat et expenso planta morata gradu. His character is mirrored in his poems. In particular it has had a great deal to do in moulding his vocabulary (Postgate, Introd., p. xxxvi. *sq*). For want of courage and energy, especially, see ii. 7, 14; iii. 12 (ii. 19), 17-24; and for superstitious leanings iii. 23 (ii. 27); ii. 4, 15, (25); v. (iv.) 5, 9, *sq.* The numbering of the books is one of the most vexed questions of Propertius; but it is not unlikely that Birt's conclusions will be ultimately accepted. The dates of the several poems are, where known, some guide towards determining that of the books: i. 8 seems to have been written about 27 B.C; i. 6 not before 27 B. C; ii. 1 in 25 B. C.; i. 8 after 27 B. C.; iii. 1 (ii. 10) in 24 B C.; 29, 31, end of 28; 32 not before 28 B.C; iv. (iii.) 17 (18) in or after 23 B.C.; so 3 (4), 4 (5), 11 (12), but 20 about 28 B.C.; v. (iv.) 6, 11 not before 16 B.C.; 3 in 23 B.C. For the evidence for believing book v. to be posthumous see Postgate, pp. liv., lv. It is beyond our limits to discuss the style and idiom of Propertius in full. For details see Hertzberg, Introduction, pp. 47, *sq.;* Postgate, Introduction, pp. lvii. *sq.* (literary style), lxxxviii. *sq.* (grammar and vocabulary), cxxvi. *sq.* for metre and prosody; also L. Müller's Introduction, pp. xlviii. *sq.* For ancient references to Propertius as a writer see Quint., x. 1. 93, where it is stated that some (not Quintilian) preferred him to Tibullus, Ov., *A. A.*, iii. 333, *Tr.*, iii. 465 (blandus P.) v. 1, 17 (blandus), Mart., xiv. 189 (facundus P.) viii. 73, Pliny, *l.c.* above, Stat., *Silv.*, i. 2, 253, Vmbro Propertius antro.—Prop., iii. (iv.) 1, Callimachi manes et Coi sacra Philetæ, in uestrum, quaeso, me sinite ire nemus; v. (iv.) 1, Vmbria Romani patria Callimachi. But, as is well pointed out by Teuffel in his *History of Roman Literature*, Propertius's debt to Callimachus and Philetas is chiefly a formal one. Even into his mythological learning he breathes a life to which those dry scholars were complete strangers. For a summary account of his relations to his predecessors and contemporaries see Postgate, Introd. ch v., Coincidences with Horace are quoted in Teuffel (§ 246, 2); with Catullus, M. Magnus, *Fleckeisen's Jahrbücher*, 115, p. 418; with Tibullus, A. Zingerle, *Ovid's Verhältniss.* etc., i. 55, 98, 101, etc., with Virgil, Nettleship, *Ancient Lives of Vergil*, p. 63, 64.

There is no existing MS. of Propertius older than the 14th century. Up till the publication of Bährens's edition (1880), the Neapolitanus (N., now often called the Guelferbytanus) was regarded as the best. Bährens, however, maintained its worthlessness as compared with the concurrence of four other MSS. of his own collating: Vossianus, circa 1360 (A); Laurentianus, beginning of the 15th century (F.); Ottoboniano-Vaticanus, end of 14th century (V.); Daventriensis, 1410-20 (D.). Bährens's attack upon the Neapolitan was answered by H. Leo (*Rh. Mus.* xxxi. 431), Ellis (*Amer. Journ. Phil.*, i. 389), Palmer (*Hermathena*, iv. 48-72). The contending merits of these MSS. have been examined by Solbisky (*Comm. Phil. Jenenses*, ii. 1883), with considerable care, and his conclusions as to the independent value both of N. and the consensus of D. V. are likely to be accepted.

The *editio princeps* of Propertius is that of 1472, Venice. Among the chief editions may be mentioned the following, those with notes being marked with an asterisk: *Scaliger (1577, etc.), *Broukhusius (2d ed. 1577), *Passeratius (1608), *Vulpius (1755, 2 vols.), *P. Burmann (and Santen) (1780), *Lachmann (1816; text only, 1829), *Jacob (1827), Hertzberg (1843-45, 2 vols.), *F. A. Paley (2d ed., 1872), L. Müller (1870), Haupt-Vahlen (1879), Bährens (1880), A. Palmer (1880); selections, with introduction, Postgate (1881). Those of Müller and Palmer are the editions cited throughout this article. It is impossible to cite the numerous programmes, dissertations, papers, etc., which have been published on subjects connected with Propertius. For fuller bibliographies it is sufficient to refer to Hertzberg, *Prop.*, i. pp. 248-59; Engelmann's *Bibliotheca Scriptorum Latinorum* (ed. Preuss, 1882); J. E. B. Mayor's *Bibliographical Clue to Latin Literature* (1875); W. Teuffel, *Geschichte d. Röm. Litteratur* (2d ed., 1882; Eng. trans., 1873; sec. 246 gives an excellent account of Propertius); Pauly, *Real-Encyclopädie*, s.v. "Propertius." Reviews of recent Propertian literature are given in Bursian's *Jahresbericht* (1878), pp. 1447-54 (very meagre, and in the *Trans. Camb. Philol. Soc.*, 1880 (i. 372-86), 1881-82 (ii. 226-36).

The following translations into English verse are known: G. F. Nott, Book i. (published anonymously, 1872 [1781?—AM. ED.]); C. A. Elton, selections in his *Specimens of the Classic Poets*, vol. ii. p. 215 *sq.* (1814, reprinted along with the preceding and a prose version by P. J. F. Gantillon, in Bohn's series, 1848, 1883); C. R. Moore (London, 1870); J. Cranston (Edinburgh, 1875); F. A. Paley, verse translations from Book v. with notes (1866); also a few translations by Gray (the poet) first printed in Gosse's edition, vol. i. (1884). (J. P. P.)

PROPHET (προφήτης) is a word taken from the vocabulary of ancient Greek religion, which passed into the language of Christianity, and so into the modern tongues of Europe, because it was adopted by the Hellenistic Jews as the rendering of the Hebrew נביא (*nābî*, pl. *nĕbîîm*). The word therefore as we use it is meant to convey an idea which belongs to Hebrew and not to Hellenic belief; but when it first underwent this change of application the age of the *nebîîm* was long past, and the Jews themselves had a very imperfect conception of what they had been and done. Hence in actual usage the idea conveyed by the word prophet has never quite corresponded with its historical prototype; the prophets of early Christendom, for example, are not by any means exact counterparts of the Old-Testament prophets, and in general very various ideas have prevailed as to what a prophet is or should be, because up to quite a recent date the work of the Hebrew prophets has been habitually approached not in a purely historical spirit but under the influence of preconceived ideas.[1]

In the present article no attempt will be made to follow those speculations about the nature of prophecy which belong to dogmatic theology rather than to history; but a brief sketch will be given (1) of the history of Hebrew prophecy (in supplement to what has been already said in the article ISRAEL or is to be found in the articles devoted to individual prophets), and (2) of prophecy in the early Christian Church. To speak of more recent religious phenomena within Christendom which have claimed to be prophetic would carry us too far; for them the reader is referred to such articles as MONTANISM, ANABAPTISTS. The conception of prophecy on which the Mohammedan religion is built has been sufficiently explained in the life of Mohammed; borrowed, somewhat unintelligently, from later Judaism, it is radically different from that of the Old Testament, and when narrowly looked at lends no countenance to the statement often made, and at first sight plausible, that prophecy is a phenomena characteristic of Semitic religion in general.

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[1] It does not appear that the original Hellenic associations of the word have had any sensible effect on these ideas. According to Plato (*Timæus*, p. 72) the name προφήτης ought properly to be confined to the interpreters employed to put an intelligible sense on the dreams, visions, or enigmatic utterances of the frenzied μάντις. But in ordinary Greek usage the prophet of any god is in general any human instrument through whom the god declares himself; and the tendency was "to reserve the name for unconscious interpreters of the divine thought, and for the ministers of the oracles in general" (Bouché-Leclercq, *Hist. de la Divination* [1880], ii. 11). This probably facilitated the adoption of the term by the Hellenists of Alexandria, for, when Philo distinguishes the prophet from the spurious diviner by saying that the latter applies his own inferences to omens and the like while the true prophet, rapt in ecstasy, speaks nothing of his own, but simply repeats what is given to him by a revelation in which his reason has no part (ed. Mangey, ii. 321 sq. 343; comp. i. 510 *sq.*), he follows the prevalent notion of the later Jews, at least in so far as he makes the function of the prophet that of purely mechanical reproduction; compare John xi. 51. and the whole view of revelation presupposed in the Apocalyptic literature. But in any case the Greek language hardly offered another word for an organ of revelation so colorless as προφήτης, while the condition of etymology among the ancients made it possible to interpret it as having a special reference to prediction (so Eusebius, *Dem. Ev.*, v., deriving it from προφαίνω).

1. *The Prophets of the Old Testament.*—The author of 1 Sam. ix. 9 tells us that "beforetime in Israel, when a man went to inquire of God, thus he spake, Come and let us go to the seer; for that he is now called a prophet (*nâbî*) was beforetime called a seer." This remark is introduced to explain how his contemporaries spoke of Samuel. He was a "seer" (ver. 11), or, as he is also called (ver. 6 *sq.*), a "man of God," that is one who stood in closer relations to God than ordinary men; "all that he said was sure to come to pass," so that he could be consulted with advantage even in private matters like the loss of the asses of Kish. The narrative of 1 Sam. ix. is so vivid and exact that not many generations of oral tradition can have separated the writer from the events he records; it shows us therefore, at least broadly, what the word prophet meant in the early times of the Hebrew kingdom, and it shows us that it had acquired that meaning after the age of Philistine oppression in which Samuel lived, and to which his younger contemporaries Saul and David put an end. That this is the sense of the author, and that we must not suppose that the word prophet had merely become more common in his time and supplanted an older synonym, appears beyond question a few verses further down, where we see there were already in Samuel's time people known as *nebîîm*, but that they were not seers. The seer, with his exceptional insight, is a man of prominent individuality and held in great respect: when Saul asks for the seer every one knows that there is only one person in the town whom he can mean. With the prophets it is quite otherwise; they appear not individually but in bands; their prophesying is a united exercise accompanied by music, and seemingly dance-music; it is marked by strong excitement, which sometimes acts contagiously, and may be so powerful that he who is seized by it is unable to stand,[1] and, though this condition is regarded as produced by a divine afflatus, it is matter of ironical comment when a prominent man like Saul is found to be thus affected. Samuel in his later days appears presiding over the exercises of a group of *nebîîm* at Ramah, where they seem to have had a sort of cœnobium (Naioth), but he was not himself a *nâbî*—that name is never applied to him except in 1 Sam. iii. 21, where it is plainly used in the later sense for the idea which in Samuel's own time was expressed by "seer."[2]

But again the *nebîîm* seem to have been a new thing in Israel in the days of Samuel. Seers there had been of old as in other primitive nations; of the two Hebrew words literally corresponding to our seer, *rôeh* and *ḥôzeh*, the second is found also in Arabic, and seems to belong to the primitive Semitic vocabulary.[3] But the enthusiastic band of prophets are nowhere mentioned before the time of Samuel; and in the whole previous history the word prophet occurs very rarely, never in the very oldest narratives, and always in that sense which we know to be later than the age of Samuel, so that the use of the term is due to writers of the age of the kings, who spoke of ancient things in the language of their own day. The appearance of the *nebîîm* in the time of Samuel was, it would seem, as has been explained in the article ISRAEL, one manifestation ot the deep pulse of suppressed indignant patriotism which began to beat in the hearts of the nation in the age of Philistine oppression, and this fact explains the influence of the movement on Saul and the interest taken in it by Samuel. The ordinary life of ancient Israel gave little room for high-strung religious feeling, and the common acts of worship coincided with the annual harvest and vintage feasts or similar occasions of natural gladness, with which no strain of abnormal enthusiasm could well be combined. It was perhaps only in time of war, when he felt himself to be fighting the battles of Jehovah, that the Hebrew was stirred to the depths of his nature by emotions of a religious color. Thus the deeper feelings of religion were embodied in warlike patriotism, and these feelings the Philistine oppression had raised to extreme tension among all who loved liberty, while yet the want of a captain to lead forth the armies of Jehovah against his foemen deprived them of their natural outlet. It was this tense suppressed excitement, to which the ordinary acts of worship gave no expression, which found vent in the enthusiastic services of the companies of prophets. In its external features the new phenomenon was exceedingly like what is still seen in the East in every *zikr* of dervishes —the enthusiasm of the prophets expressed itself in no artificial form, but in a way natural to the Oriental temperament. Processions with pipe and hand-drum, such as that described in 1 Sam. x., were indeed a customary part of ordinary religious feasts; but there they were an outlet for natural merriment, here they have changed their character to express an emotion more sombre and more intense, by which the prophets, and often mere chance spectators too, were so overpowered that they seemed to lose their old personality and to be swayed by a supernatural influence. More than this hardly lies in the expression "a divine spirit" (רוח אלהים), which is used not only of the prophetic afflatus but of the evil frenzy that afflicted Saul's later days. The Hebrews had a less narrow conception of the spiritual than we are apt to read into their records.

To give a name to this new phenomenon the Israelites, it would seem, had to borrow a word from their Canaanite neighbors. At all events the word *nâbî* is neither part of the old Semitic vocabulary (in Arabic it is a late loan word), nor has it any etymology in Hebrew, the cognate words "to prophesy" and the like being derived from the noun in its technical sense. But we know that there were *nebîîm* among the Canaanites; the "prophets" of Baal appear in the history of Elijah as men who sought to attract their god by wild orgiastic rites. In fact the presence of an orgiastic character is as marked a feature in Canaanite religion as the absence of it is in the oldest religion of Israel; but the new Hebrew enthusiasts had at least an external resemblance to the devotees of the Canaanite sanctuaries, and this would be enough to determine the choice of a name which in the first instance seems hardly to have been a name of honor.[4] In admitting that the name was borrowed, we are not by any means shut up to suppose that the Hebrew *nebîîm* simply copied their Canaanite neighbors. The phenomenon is perfectly intelligible without any such hypothesis. A wave of intense religious feeling passes over the land and finds its expression, according to the ordinary law of Oriental life, in the formation of a sort of enthusiastic religious order. The Nazarites and the Rechabites are parallel phenomena, though of vastly inferior historical importance.

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[1] Sam. x. 5 *sq.*, xix. 20 *sq.* In the latter passage read "they saw the fervor of the prophets as they prophesied, etc." (see Hoffmann in Stade's *Zeitschr.*, 1883, p. 89), after the Syriac.

[2] On grounds of text-criticism indeed both this passage and 1 Sam. xxviii., where at ver. 6 prophets appear as revealers (seers), are held to be no part of the old stock of the history of Samuel.

[3] Hoffman, *ut supra*, p. 92 *sq.*

[4] If this account of the origin of the *nebîîm* is correct (comp. Kuenen, *Prophets*, Eng. tr., p. 554 *sq.*), the etymological sense of the word נביא is comparatively unimportant. The root seems to mean "to start up," "to rise into prominence," and so "to become audible"; but the range of possible explanations of the noun which remains open is too great to give value to any conjecture. The leading views are collected in several of the books cited at the close of this article, and a fresh and interesting investigation is given in G. Hoffman's article quoted above.

The peculiar methods of the prophetic exercises described in 1 Samuel were of little consequence for the future development of prophecy. The heat of a first enthusiasm necessarily cooled when the political conditions that produced it passed away; and, if the prophetic associations had done no more than organize a new form of spiritual excitement, they would have only added one to the many mechanical types of hysterical religion which are found all over the East. Their real importance was that they embodied an intenser vein of feeling than was expressed in the ordinary feasts and sacrifices, and that the greater intensity was not artificial, but due to a revival of national sentiment. The worship of the local sanctuaries did nothing to promote the sense of the religious unity of Israel; Jehovah in the age of the Judges ran no small risk of being divided into a number of local Baals, givers of natural good things each to his own locality. The struggle for freedom called forth a deeper sense of the unity of the people of the one Jehovah, and in so doing raised religion to a loftier plane; for a faith which unites a nation is necessarily a higher moral force than one which only unites a township or a clan. The local worships, which subsisted unchanged during the greater part of the Hebrew kingship, gave no expression to this rise in the religious consciousness of the nation; on the contrary we see from the prophetic books of the 8th century that they lagged more and more behind the progress of religious thought. But the prophetic societies were in their origin one symptom of that upheaval of national life of which the institution of the human sovereign reigning under the divine King was the chief fruit; they preserved the traditions of that great movement; they were, in however imperfect a way, an organ of national religious feeling, and could move forward with the movement of national life. And so, though we cannot follow the steps of the process, we are not surprised to learn that they soon had an established footing in Israel, and that the prophets came to be recognized as a standing sacred element in society. What was their precise place in Hebrew life we hardly know, but they formed at least a religious class which in all its traditions represented the new national and not the old communal and particularistic life. One characteristic point which appears very early is that they felt themselves called upon to vindicate the laws of divine righteousness in national matters, and especially in the conduct of the kings, who were not answerable to human authority. The cases of Nathan and David in the matter of Uriah, of Elijah and Ahab after the judicial murder of Naboth, will occur to every one, and from the Hebrew standpoint the action of Gad in the matter of the census taken by David belongs to the same category. Such interventions with an Eastern king demanded great moral courage, for, though to some extent protected by their sacred character, the persons of the prophets were by no means legally inviolable (1 Kings xix. 2; xxii. 27; 2 Kings vi. 31). Another point of the first importance in the development of the class was the absorption into it of the old seers, which, as we have already seen, must have occurred comparatively early. The great prophecy of Nathan (2 Sam. vii.) is of too disputed a date to be cited in evidence, but already in David's time we find that Gad the *nābī* is also the king's seer (2 Sam. xxiv. 11; comp. 1 Sam. xxii. 5), and by and by it comes to be clearly understood that the prophets are the appointed organ of Jehovah's communications with His people or his king. The rise of this function of the prophets is plainly parallel with the change which took place under the kings in the position of the priestly oracle; the Torah of the priests now dealt rather with permanent and sacred ordinances than with the giving of new divine counsel for special occasions. Jehovah's ever-present kingship in Israel, which was the chief religious idea brought into prominence by the national revival, demanded a more continuous manifestation of His revealing spirit than was given either by the priestly lot or by the rise of occasional seers; and where could this be sought except among the prophets? It does not of course follow that every one who had shared in the divine afflatus of prophetic enthusiasm gave forth oracles; but the prophets as a class stood nearer than other men to the mysterious workings of Jehovah, and it was in their circle that revelation seemed to have its natural home. A most instructive passage in this respect is 1 Kings xxii., where we find some four hundred prophets gathered together round the king, and where it is clear that Jehosaphat was equally convinced, on the one hand that the word of Jehovah could be found among the prophets, and on the other that it was very probable that some or even the mass of them might be no better than liars. And here it is to be observed that Micaiah, who proved the true prophet, does not accuse the others of conscious imposture; he admits that they speak under the influence of a spirit proceeding from Jehovah, but it is a lying spirit sent to deceive. The sublime and solitary figure of Elijah, whom we are apt to take as the typical figure of a prophet in the old kingdom, has little in common with the picture even of the true prophet which we derive from 1 Kings xxii.; and when his history is carefully and critically read it is found to give no reason to think that he stood in any close relation to the prophetic societies of his time. He is a man of God like Moses and Samuel, a man admitted to a strange and awful intimacy with the Most High, and like them he combines functions which in later times were distributed between prophet and priest. The fundamental idea that Jehovah guides His people by the word of revelation is older than the separation of special classes of theocratic organs; Moses indeed is not only prophet and priest but judge and ruler. But as the history goes on the prophet stands out more and more as the typical organ of revelation, the type of the man who is Jehovah's intimate, sharing His secrets (Amos iii. 7; Jer. xxiii. 22), and ministering to Israel the gracious guidance which distinguishes it from all other nations (Amos ii. 11; Hosea xii. 10, 13), and also the sentences of awful judgment by which Jehovah rebukes rebellion (Hos. vi. 5). The full development of this view seems to lie between the time of Elijah and that of Amos and Hosea,—under the dynasty of Jehu, when prophecy, as represented by Elisha and Jonah, stood in the fullest harmony with the patriotic efforts of the age. This growth in the conception of the prophetic function is reflected in parts of the Pentateuch which may be dated with probability as belonging to the period just named; the name of *nābī* is extended to the patriarchs as Jehovah's intimates (Gen. xx. 7), and Moses begins to be chiefly looked at as the greatest of prophets (Num. xi. xii.; Deut. xxxiv. 10), while Aaron and Miriam are also placed in the same class (Exod. xv. 20; Num. xii) because they too are among the divinely favored leaders of Israel (comp. Micah vi. 4).[1]

Elisha, the successor of Elijah, stood in much closer relations to the prophetic societies than his great master had done. As a man of practical aims he required a circle through which to work, and he found this among the prophets, or, as they are now called, the sons of the prophets. According to Semitic idiom "sons of the prophets" most naturally means "members of a prophetic corporation,"[1] which may imply that under the headship of Elisha and the favor of the dynasty of Jehu, which owed much to Elisha and his party, the prophetic societies took a more regular form than before. The accounts we have certainly point in this direction, and it is characteristic that in 2 Kings iv. 42 first fruits are paid to Elisha. But to an institution like prophecy national recognition, royal favor, and fixed organization are dangerous gifts. It has always been the evil fate of the Hebrews to destroy their own highest ideals by attempting to translate them into set forms, and the ideal of a prophetic guidance of the nation of Jehovah could not have been more effectually neutralized than by committing its realization to the kind of state church of professional prophets, "eating bread" by their trade (Amos vii. 12),[2] which claimed to inherit the traditions of Elijah and Elisha. The sons of the prophets appear to have been grouped round the leading sanctuaries, Gilgal, Bethel, and the like (comp. Hos. ix. 8), and to have stood in pretty close relation to the priesthood (Hos. iv. 5), though this comes out more clearly for the southern kingdom, where, down to the last days of Hebrew independence, the official prophets of Jerusalem were connected with the temple and were under the authority of the chief priest (Jer. xxix. 26). Since the absorption of the aborigines in Israel Canaanite ideas had exercised great influence over the sanctuaries—so much so that the reforming prophets of the 8th century regarded the national religion as having become wholly heathenish; and this influence the ordinary prophets, whom a man like Micah regards as mere diviners, had certainly not escaped. They too were, at the beginning of the Assyrian period, not much more different from prophets of Baal than the priests were from priests of Baal. Their God had another name, but it was almost forgotten that He had a different character.

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[1] None of these passages belong to the very oldest thread of Pentateuchal story, and similarly Deborah is called prophetess only in the later account (Jud. iv. 4), not in the song (Jud. v.). It is characteristic that in Num. xi. the elders who receive a share in Moses's task also receive a share of his prophetic spirit (comp. the parallel 2 Kings ii. 9 *sq.*). In the older account (Exod. xviii.) this is not so Again Moses differs from all other prophets in that Jehovah speaks to him face to face, and he sees the similitude of Jehovah. This is in fact the difference between him and Elijah (comp. Exod. xxxiii. 8–11 with 1 Kings xix. 13), but not between him and the great prophets of the 8th century (Isa. vi. 5). That prophecy was generally given in visions, dreams, and obscure sentences is true only of an early period. Amos still has frequent visions of a more or less enigmatic character, as Micaiah had, but there is little trace of this in the great prophets after him. On the psychological reasons for this see W. R. Smith, *Prophets of Israel* (1882), p. 221 *sq.*

The rise and progress of the new school of prophecy, beginning with Amos and continued in the succession of canonical prophets, which broke through this religious stagnation, has already been discussed in the article ISRAEL (vol. xiii. p. 420 *sq.*); for from Amos and still more from Isaiah downwards the prophets and their work make up the chief interest of Hebrew history. From this time, moreover, the prophets appear as authors; and their books, preserved in the Old Testament, form the subject of special articles (AMOS, HOSEA, etc.). A few observations of a general character will therefore suffice in this place.

Amos disclaimed all connection with the mere professional prophets, and in this he was followed by his successors. Formerly the prophets of Jehovah had been all on the same side; their opponents were the prophets of Baal. But henceforth there were two parties among the prophets of Jehovah themselves, the new prophets accusing the old of imposture and disloyalty to Jehovah, and these retaliating with a charge of disloyalty to Israel. We have learned to call the prophets of the new school "true" prophets and their adversaries "false"; and this is perfectly just if we take the appellations to mean that the true prophets maintained a higher and therefore a truer view of Jehovah's character, purpose, and relation to His people. But the false prophets were by no means mere common impostors; they were the accredited exponents of the common orthodoxy of their day—and even of a somewhat progressive orthodoxy, for the prophets who opposed Jeremiah took their stand on the ground of Josiah's reformation, and plainly regarded themselves as conservators of the prophetic traditions of Isaiah, whose doctrine of the inviolability of Jehovah's seat on Zion was the starting point of their opposition to Jeremiah's predictions of captivity. No doubt there were many conscious hypocrites and impostors among the professional prophets, as there always will be among the professional representatives of a religious standpoint which is intrinsically untenable, and yet has on its side the prestige of tradition and popular acceptance. But on the whole the false prophets deserve that name, not for their conscious impostures, but because they were content to handle religious formulas which they had learned by rote as if they were intuitive principles, the fruit of direct spiritual experience, to enforce a conventional morality, shutting their eyes to glaring national sins, after the manner of professional orthodoxy, and in brief to treat the religious *status quo* as if it could be accepted without question as fully embodying the unchanging principles of all religion. The popular faith was full of heathenish superstition strangely blended with the higher ideas which were the inheritance left to Israel by men like Moses and Elijah; but the common prophets accepted all alike, and combined heathen arts of divination and practices of mere physical enthusiasm with a not altogether insincere pretension that through their professional oracles the ideal was being maintained of a continuous divine guidance of the people of Jehovah.

Amos and his successors accepted the old ideal of prophecy if they disowned the class which pretended to embody it. "The Lord Jehovah will do nothing, but He revealeth his secret to His servants the prophets." "By a prophet Jehovah brought Israel out of Egypt, and by a prophet" in each successive age Israel had been watched over and preserved. But in point of fact the function of the new prophecy was not to preserve but to destroy Israel, if Israel still meant the actual Hebrew nation with its traditional national life. Till Amos prophecy was optimist—even Elijah, if he denounced the destruction of a dynasty and the annihilation of all who had bowed the knee to Baal, never doubted of the future of the nation when only the faithful remained; but the new prophecy is pessimist—it knows that Israel is rotten to the core, and that the whole fabric of society must be dissolved before reconstruction is possible. And this it knows, not by a mere ethical judgment on the visible state of society, but because it has read Jehovah's secret written in the signs of the times and knows that He has condemned His people. To the mass these signs are unintelligible, because they deem it impossible that Jehovah should utterly cast off His chosen nation; but to those who know His absolute righteousness, and confront it with the people's sin, the impending approach of the Assyrian can have only one meaning and can point to only one issue, viz., the total ruin of the nation which has denied its divine head. It is sometimes proposed to view the canonical prophets as simple preachers of righteousness; their predictions of woe, we are told, are conditional, and tell what Israel must suffer if it does not repent. But this is an incomplete view; the peculiarity of their position is that they know that Israel as it exists is beyond repentance. Only, while they are hopeless about their nation they have absolute faith in Jehovah and his purpose. That cannot be frustrated, and, as it includes the choice of Israel as His people, it is certain that, though the present commonwealth must perish, a new and better Israel will rise from its grave. Not the reformation but the resurrection of Israel is the goal of the prophet's hope (Hos. vi. 1 *sq.*).

This of course is only the broadest possible statement of a position which undergoes many modifications in the hands of individual seers, but on the whole governs all prophecy from Amos to Jeremiah. The position has, we see, two sides: on the one side the prophets are heralds of an inexorable judgment based on the demands of absolute righteousness; on the other they represent an assured conviction of Jehovah's invincible and gracious love. The current theological formula for this two-sided position is that the prophets are at once preachers of the law and forerunners of the gospel; and, as it is generally assumed that they found the law already written, their originality and real importance is made to lie wholly in their evangelical function. But in reality, as has been shown in **Israel** and **Pentateuch**, the prophets are older than the law, and the part of their work which was really epoch-making for Israel is just the part which is usually passed over as unimportant. By emphasizing the purely moral character of Jehovah's demands from Israel, by teaching that the mere payment of service and worship at Jehovah's shrines did not entitle Israel's sins to be treated one whit more lightly than the sins of other nations, and by enforcing these doctrines through the conception that the approach of the all-destroying empire before which Israel must fall equally with all its neighbors was the proof of Jehovah's impartial righteousness, they gave for the first time a really broad and fruitful conception of the moral government of the whole earth by the one true God.[1]

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[1] See G. Hoffmann, *Kirchenversammlung zu Ephesus* (1873), p. 89.

[2] Those who consulted the old seers were expected to make a present, 1 Sam. ix. 7 (Arabic *ḥolwânu-'l-kâhin*; comp. Bokhari, iv. 219). Similar presents were brought to the older prophets (1 Kings xiv. 3), and first fruits were sometimes paid to a man of God; but the successors of Amos share his contempt for those who traded on their oracles (Mic. iii. 5 *sq.*).

It is impossible to read the books of the older prophets, and especially of their protagonist Amos, without seeing that the new thing which they are compelled to speak is not Jehovah's grace but His inexorable and righteous wrath. That that wrath must be followed by fresh mercies is not in itself a new thought, but only the necessary expression of the inherited conviction that Jehovah, whom they preach as the judge of all the earth, is nevertheless, as past history has proved, the God who has chosen Israel as His people. That this is so appears most clearly in the fact that with Amos the prophecy of restoration appears only in a few verses at the end of his book, and in the still more instructive fact that neither he nor Hosea attempts to explain how the restoration which they accept as a postulate of faith is to be historically realized.[2] One point only in their picture of the great restoration appears to present the germ of an historical principle. The Israel of the future is to be one united nation as in the days of David. The Davidic kingdom is accepted by both prophets, and by Hosea even more explicitly than by Amos, as the type of the future kingdom of Jehovah. But one sees from the way in which this thought is handled that it is the idea of that kingdom as it was in days of old which is before the prophet's mind; the actual state of Judah, which was not religiously better than the greater Israel, though it perhaps still possessed elements of greater political and social stability, was not such as to suggest the thought that when Samaria fell the continuity of Jehovah's relations with His people could be preserved at Jerusalem. It was in the great northern kingdom—still Israel *par excellence*—not in the petty region that had remained loyal to David, that the drama of divine justice and mercy was to be acted to its end: to Hosea, at least in his later prophecies, the fate of Judah does not appear separable from that of the northern realm—when Israel and Ephraim fall by their iniquity Judah must fall with them (Hos. v. 5). Thus even on this side there is no real bridge over the chasm that separates the total ruin impending over the Israel of the present from the glorious restoration of the Israel of the future. There is a unity in the divine purpose, of which judgment and mercy are the two poles, but there is as yet no conception of an historical continuity in the execution of that purpose, and therefore no foundation laid for the maintenance of a continuous community of faith in the impending fall of the nation.

From this we can see the enormous importance of the work of Isaiah as it has been exhibited in the article **Israel**, vol. xiii. p. 423 *sq.*; his doctrine of the remnant, the holy seed, never lost to the nation in the worst times, never destroyed by the most fiery judgments, supplies the lacking element of continuity between the Israel of the present and of the future. Jehovah's kingdom cannot perish even for a time; nay, Isaiah argues that it must remain visible, and visible not merely in the circle of the like-minded whom he had gathered round him and who formed the first germ of the notion of the church, but in the political form of a kingdom also. Zion at least, the sacred hearth of Jehovah, the visible centre of his kingdom, must remain inviolable; it can never be delivered into the hands of the Assyrian. Thus, with Isaiah in the days of Sennacherib's invasion, the prophetic word became again, as it had been in the days of the Syrian wars, "the chariots and horsemen of Israel," the stay and strength of all patriotic hope.

Yet even at this crisis the resemblance between Isaiah and Elisha, between the new prophecy and the old, is more apparent than real. Elisha still stands firmly planted on the old national conception of the religion of Jehovah; his ideals are such as do not lie beyond the range of practical politics. In doing battle against the Tyrian Baal he is content with a reformation for which the whole nation can be heartily won, because it makes no radical change in their inherited faith and practices of worship. And in stimulating resistance to Syria he is still the prophet of the old "God of the hosts of Israel"—a God who works deliverance by the thews and sinews of his earthly warriors. But Isaiah's ideal of religion was one which could never have been realized by a political movement; to root out all idols, all superstitions inconsistent with his lofty conception of the just King of Israel, who cares not for sacrifice and oblation, who can be acceptably approached through no religion of rote, whose sovereignty can receive practical recognition only by a thoroughgoing reformation of all parts of social life—this was an ideal which could not be carried out by the mere education and concentration of any forces inherent in the nation. The true Israel of Isaiah is not an historical possibility; it is a transcendental ideal for which he himself demands as a preliminary condition an outpouring of Jehovah's spirit on king (Isa. xi. 2) and people (Isa. xxxii. 15), working an entire moral regeneration. And so too it is not through the material organization of the Judæan kingdom that Isaiah looks for deliverance from Assyria. He sees with absolute clearness the powerlessness of the little realm against that great empire: the Assyrian must fall, and fall before Jerusalem, that Jehovah alone may appear to all the earth as the one true God, while all the idols appear as vain to help their worshippers; but he falls by no earthly sword, but before the direct interposition of Jehovah Himself. These conceptions break through the old particularistic idea of Jehovah and His religion at every point. Zion is now not the centre of a mere national cult, but the centre of all true religion for the whole world; and more than once the prophet indicates not obscurely that the necessary issue of the great conflict between Jehovah and the gods of the heathen must be the conversion of all nations, the disappearance of every other religion before the faith of the God of Israel. But this all-conquering religion is not the popular Jehovah worship; why then can the prophet still hold that the one true God is yet the God of Israel, and that the vindication of His Godhead involves the preservation of Israel? Not because His providence is confined to Israel—it embraces all nations; not because he shows any favoritism to Israel—He judges all nations by the same strict rule. If Israel alone among nations can meet the Assyrian with the boast "with us is God," the reason is that in Zion the true God is known[1]—not indeed to the mass, but to the prophet and to the "holy seed" which forms the salt of the nation. The interpretation which Isaiah puts on this fact depends on the circumstance that at that date religion had never been conceived as a relation between God and individuals, or as a relation between God and a purely spiritual society, but always as a relation between a deity and some natural social group—a stock, a tribe, a nation. It was therefore only as the God of Israel that the true God could be known within Israel; and so on the one hand the little society of faith—which had not in reality the least tinge of political coherence—is thought of as yet forming the true kernel of the nation *qua* nation, while on the other hand the state of Judah profits by the prophetic religion inasmuch as the nation must be saved from destruction in order that the prophetic faith—which is still bound up with the idea of the nation—may not be dissolved. This connection of ideas was not of course explicitly before the prophet's mind, for the distinctive features of a national religion could not be formulated so long as no other kind of religion had ever been heard of. When we put down in black and white the explicit details of what is involved in Isaiah's conclusion of faith we see that it has no absolute validity. True religion can exist without having a particular nation as its subject as soon as the idea of a spiritual community of faith has been realized. But till this idea was realized Isaiah was right in teaching that the law of continuity demanded that the nation within which Jehovah had made Himself known to His spiritual prophets must be maintained as a nation for the sake of the glory of God and the preservation of the "holy seed."

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[1] It must not be supposed that this conception necessarily came into force as soon as it was recognized that Jehovah was the creator of the universe. That the national or tribal god is the creator is an idea often found in very low religions. To us God's sovereignty over nature often seems the hardest thing to conceive: but to primitive peoples who know nothing of laws of nature His moral sovereignty is a much more difficult conception. In the older literature of the Hebrews the nearest approach to the thought of Amos and Hosea is not Gen. ii., iii., but Gen. xviii. 25.

[2] Hosea ii. 14 *sq.*, xi. 10 *sq.* are not solutions of this difficulty, as appears from their metaphorical form. They tell us that Jehovah will call His people and that they will answer; but this is only putting in another form the axiom that the gifts and calling of God are without repentance.

The catastrophe of Sennacherib's army, in which the doctrine of the inviolability of Zion received the most striking practical confirmation, was welcomed by Isaiah and his disciples as an earnest of the speedy inbringing of the new spiritual era. But these hopes were not fulfilled. The prophetic teaching had indeed produced a profound effect; to the party of reaction, as the persecution under Manasseh shows, it seemed to threaten to subvert all society; and we can still measure the range and depth of its influence in the literary remains of the period from Isaiah to the captivity, which include Micah vi. 1-8, and that noble essay to build a complete national code on the principle of love to God, righteousness, and humanity—the legislation of Deuteronomy. Nay more, the reception of the book of Deuteronomy by king and people in the eighteenth year of Josiah shows what a hold the prophetic teaching had on the popular conscience; it was no small triumph that there was even a passing attempt to introduce such a code as the law of the land. But it was one thing to touch the conscience of the nation and another to change its heart and renew its whole life. That no code could do, and, as every practical government must adapt itself to actualities and not to a purely ideal standard, it must have appeared at once that the attempt to govern by prophetic ideas was only sewing a new piece on an old garment. The immediate result of Josiah's reformation was the complete dissolution of anything that could be called a political party of prophetic ideas; the priests and the ordinary prophets were satisfied with what had been accomplished; the old abuses began again, but the nation had received a reformed constitution and there was nothing more to be said.

Thus it was that, though beyond question there had been a real advance in the average ethical and spiritual ideas of the people since the time of Isaiah, Jeremiah found himself more isolated than Isaiah had ever been. Even in that earliest part of his book which is mainly a recapitulation of his experiences and work in the reign of Josiah, his tone is one of absolute hopelessness as to the future of the nation. But we should quite misunderstand this pessimism if we held it to mean that Jeremiah saw no signs of private morality and individual spiritual convictions among his people. To him as a prophet the question was whether Israel as a nation could be saved. In Isaiah's days the answer had been affirmative; there appeared to be at least a potentiality of national regeneration in the holy seed when once it should be cleansed from the chaff by a work of judgment. But, now a century of respite had been granted, the Chaldæans were at the gates, and there was no sign of valid national repentance. The harvest was past, the season of ripe fruits was over, and still Israel was not saved (Jer. viii. 20). The time of respite had been wasted, all attempts at national reformation had failed; how should Jehovah spare a nation which had shown no tokens of fitness to discharge the vocation of Jehovah's people? The question was not whether there was still a faithful remnant but whether that remnant was able to save the state as a state, and this Jeremiah was forced to deny. Nay every attempt at genuine amendment was frustrated by the dead weight of a powerful opposition, and when the first captivity came it was precisely the best elements of Judah that went into captivity and were scattered among the nations (xxiv. 5; xxiii. 2 *sq.*). And so the prophet was compelled to teach that the immediate future of Israel was a blank, that the state as a state was doomed. He did not even dare to intercede for such a nation (vii. 16); though Moses and Samuel stood pleading for it before Jehovah, He could not but cast it out of His sight (xv. 1). It was the death-struggle of the idea of a national religion (vi. 8); the continuity of true faith refused to be longer bound up with the continuity of the nation. Still indeed the New Testament idea of a purely spiritual kingdom of God, in this world but not of it, is beyond the prophet's horizon, and he can think of no other vindication of the divine purpose than that the true Israel shall be gathered again from its dispersion. But the condition of this restoration is now changed. To gather the dispersed implies a call of God to individuals, and in the restored Israel the covenant of Jehovah shall be not merely with the nation but with men one by one, and "they shall no more teach everyone his neighbor saying, Know the Lord, for all shall know Me from the least of them even to the greatest of them" (xxxi. 33 *sq.*). In a word, when the nation is dissolved into its individual elements the continuity and ultimate victory of true faith depends on the relation of Jehovah to individual souls, out of which the new state shall be built up (Jer. iii. 14).

Thus, for the first time in the world's history, the ultimate problem of faith is based on the relation of God to the individual believer; and this problem Jeremiah is compelled to face mainly in relation to his own personality, to assure himself that his own faith is a true possession and lifts him above all the calamities that assail him, in spite of the hopeless ruin of his nation. The struggle is a sore one; his very life is bitter to him; and yet he emerges victorious. To know that God is with him is enough though all else fail him. Now as soon as the relation of God to a single soul has thus been set free from all earthly conditions the work of prophecy is really complete, for what God has done for one soul He can do for all, but only by speaking to each believer as directly as He does to Jeremiah. Henceforth revelation is not a word to the nation spoken through an individual, but a word spoken to one which is equally valid for every one who receives it with like faith. The New Testament joins on not to the post-exile prophets, who are only faint echoes of earlier seers, but to Jeremiah's great idea of the new covenant in which God's law is written on the individual heart, and the community of faith is the fellowship of all to whom He has thus spoken. The prophets of the restoration are only the last waves beating on the shore after the storm which destroyed the old nation, but created in its room a fellowship of spiritual religion, had passed over; they resemble the old prophets in the same imperfect way in which the restored community of Jerusalem resembled a real nation. It was only in so far as the community of faith still possessed certain external features of nationality that post-exile prophecy was possible at all, and very soon the care of the national or quasi-national aspects of religion passed altogether out of their hands into those of the scribes, of whom Ezekiel was the first father, and whose Torah was not the living word of prophecy but the Pentateuchal code. From the time of Jeremiah downwards the perennial interest of Old Testament thought lies in the working out of the problems of personal religion and of the idea of a spiritual fellowship of faith transcending all national limitation; and these are the motives not only of the lyrics of the Psalter but of the greater theodiceas of Isa. xl.-lxvi. and of the book of Job. The theodicea of the prophets is national; they see Jehovah's righteousness working itself out with unmistakable clearness in the present, and know that all that He brings upon Israel is manifestly just; but from the days of Jeremiah[1] the fortunes of Israel as a nation are no longer the one thing which religion has to explain; the greater question arises of a theory of the divine purpose which shall justify the ways of God with individual men or with His "righteous servant"—that is, with the ideal community of true faith as distinct from the natural Israel. The discussion of these problems constitutes a quite distinct type of Old Testament literature beginning with the book of the Great Unknown, which is now appended to the writings of Isaiah; but this is an accident of arrangement that ought not to lead us to include among the prophetic writings proper a work so entirely different in origin and scope, and addressed not to an actual nation but to the ideal Israel, whose vocation is no longer political but purely religious.

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[1] We should be apt to say "the true idea of God," but that is a way of putting it which does not correspond with prophetic thought. To the prophets knowledge of God is concrete knowledge of the divine character as shown in acts—knowledge of a person, not of an idea.

It will be evident even from this rapid sketch, necessarily confined to a few of the most cardinal points, that Hebrew prophecy is not a thing that can be defined and reduced to a formula, but was a living institution which can only be understood by studying its growth and observing its connection with the historical movements with which its various manifestations were bound up. Throughout the great age of prophecy the most obvious formal character that distinguished it was that the prophet did not speak in his own name but in the name of Jehovah. But the claim to speak in the name of God is one which has often been made—and made sincerely—by others than the prophets of Israel, and which is susceptible of a great variety of meanings, according to the idea of God and His relation to man which is presupposed. Every early religion seeks to realize such an intercourse with the object of worship as shall be two-sided; when the worshipper approaches the deity he desires to have an answer assuring him of acceptance and divine aid. The revelation thus looked for may be found in natural omens, in the priestly lot or some similar sacral oracle, or, finally, in the words of a seer who is held to be in closer contact with the deity than common men. Broadly speaking these methods of revelation are found in all ancient religions, but no other religion presents anything precisely analogous to prophecy. It is true that the prophets absorbed the old seers, and that the Israelites, as we see in the case of the asses of Kish, went to their seers on the same kind of occasions as sent heathen nations to seers or diviners. There is sufficient evidence that down to the last age of the Judæan monarchy practices not essentially different from divination were current in all classes of society, and were often in the hands of men who claimed to speak as prophets in the name of Jehovah. But the great prophets disallowed this claim, and the distinction which they draw between true prophecy and divination is recognized not only in the prophetical law of Deuteronomy but in earlier parts of the Pentateuch and historical books. "There is no augury in Jacob and no divination in Israel; in due time it is told to Jacob and to Israel what God doth work" (Num. xxiii. 23). The seer, in the sense in which all antiquity believed in seers, is simply a man who sees what others cannot see, no matter whether the thing seen be of public or of mere private interest; but the prophet is an organ of Jehovah's kingship over His people—he sees and tells so much of the secret purpose of Jehovah as is needful for His people to know. We have already seen how Amos and Hosea put this (*supra*, p. 839), and it does not appear that they were introducing a conception of prophecy formally novel—the new thing was their conception of Jehovah's purpose. And so too with the following great prophets; the important thing in their work was not their moral earnestness and not their specific predictions of future events, but the clearness of spiritual insight with which they read the spiritual significance of the signs of the time and interpreted the movements of history as proofs of Jehovah's actual moral sovereignty exercised over Israel. So long as the great problems of religion could be envisaged as problems of the relation of Jehovah to Israel as a nation the prophets continued to speak and to bring forth new truths; but the ultimate result was that it became apparent that the idea of moral government involved the destruction of Israel, and then the function of prophecy was gone because it was essentially national in its objects. But meantime the relation of God to the prophet had acquired an independent significance; the inner life of Isaiah during the long years when his teaching seemed lost, or of Jeremiah through the whole course of his seemingly fruitless ministry, was rich in experiences of faith triumphing over temptations and trials, of personal converse with God sustaining the soul in the face of difficulties hopeless to the eye of sense, which formed the pattern of a new and higher stage of religion in which the relation of the individual soul to God should be set free from those limitations which had been imposed by the conception that the primary subject of religion is the nation. But the religion of the Old Testament did not become merely individualistic in becoming individual, and now the problem was to realize a new conception of the society of faith, the true Israel, the collective servant of Jehovah—in a word to form the idea of a spiritual commonwealth and to show how it was possible for faith to hold fast, in spite of all seeming contradiction, to the truth that Jehovah had chosen for Himself a spiritual people, every member of which was in truth the object of His saving and unfailing love, and which should ultimately in very deed inherit that glory of which the carnal Israel was unworthy. This is the post-prophetic problem which occupies the more profound of the later Old Testament books, but first received its true solution in the gospel, when the last shreds of the old nationalism disappeared and the spiritual kingdom found its centre in the person of Christ.

Old Testament prophecy therefore forms only one stage in a larger development, and its true significance and value can only be realized when it is looked at in this light. In this as in all other matters of transcendental truth "wisdom is justified of her children";

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[1] One might say from the days of Habakkuk.

the conclusive vindication of the prophets as true messengers of God is that their work forms an integral part in the progress of spiritual religion, and there are many things in their teaching the profundity and importance of which are much clearer to us than they could possibly have been to their contemporaries, because they are mere flashes of spiritual insight lighting up for a moment some corner of a region on which the steady sun of the gospel had not yet risen.

A less complete but yet most powerful vindication of the spiritual prophets was furnished by the course and event of Israel's history. After the captivity it was no longer a question that the prophetic conception of Jehovah was the only possible one. Thenceforth the religion of Jehovah and the religion of the prophets are synonymous; no other reading of Israel's past was possible, and in fact the whole history of the Hebrews in Canaan, as it was finally shaped in the exile, is written from this point of view, and has come down to us, along with the remains of actual prophetic books, under the collective title of "The Prophets."

To some extent this historical vindication of the prophetic insight went on during the activity of the prophets themselves. From the time of Amos downwards the prophets spoke mainly at great historical crises, when events were moving fast and a few years were often sufficient to show that they were right and their opponents wrong in their reading of the signs of times. And here the controversy did not turn on the exact fulfilment of detailed predictions; detailed prediction occupies a very secondary place in the writings of the prophets; or rather indeed what seem to be predictions in detail are usually only free poetical illustrations of historical principles which neither received nor demanded exact fulfilment. Isaiah, for example, in the time of Ahaz sketches the fatal results of Assyrian intervention, and pictures the sufferings of Judah when it should become the battlefield of the rival empires of the Tigris and the Nile, in a way that was by no means realized in detail; but this does not affect the fact that he alone in Judah had correctly appreciated the historical situation, and that he did so not because he was a better statesman than his opponents, but because he had a different conception of the religious significance of the crisis. All through the prophetic period it was plain that the true prophets differed from the mere professional prophets and statesmen in their view of the political duties and prospects of the nation because they had a different idea, or, as they themselves would have said, a truer knowledge, of God, and so the prophets and their successors—notably Isa. xl.-lxvi.—look on the event of Israel's history, not so much as proving that Isaiah or Jeremiah was a true prophet, but as proving that the Jehovah of the prophets is the true God, whose word cannot return to Him void, but must surely accomplish that which He pleaseth (Isa. lv. 11).

The prophets themselves required no historical verification of their word to assure them that it was indeed the word of God, nor do they for a moment admit that their contemporaries are entitled to treat its authority as unproved till such verification is offered. The word of God carries its own evidence with it in its searching force and fire: "Is not my word like as a fire, saith Jehovah, and like a hammer that breaketh the rock in pieces?" (Jer. xxiii. 29). To the prophet himself it comes with imperious force; it constrains him to speak (Amos iii. 8), seizes him with a strong hand (Isa. viii. 11), burns like a fire within his bones till it finds utterance (Jer. xx. 9); and it is this force of moral conviction which ought also to commend it to the conscience of his hearers. The word is true because it is worthy of the true God. When Deut. xviii. 21, 22 seeks the legal criterion of true prophecy in the fulfilment of prediction, the writer is no doubt guided by the remembrance of the remarkable confirmation which the doctrines of spiritual prophecy had received in history then recent, but his criterion would have appeared inadequate to the prophets themselves, and indeed this passage is one of the most striking proofs that to formulate the principles of prophetic religion in a legal code was an impossible task.

The mass of the nation, of course, was always much more struck by the "signs" and predictions of the prophets than by their spiritual ideas; we see how the idea of supernatural insight and power in everyday matters dominates the popular conception of Elijah and Elisha in the books of Kings. At a very early date the great prophets became a kind of saints or *welis*, and the respect paid to the tombs of the prophets, which ultimately took in almost every particular the place of the old local shrines (Mat. xxiii. 29; Jerome, *Epit. Paulæ*, § 13; see OBADIAH), can be traced back to the time before the exile.[1]

After the extinction of the prophetic voice, an ever-increasing weight was not unnaturally laid on the predictive element in their writings. Their creative religious ideas had become the common property of religious-minded Jews, at least in the somewhat imperfect shape in which they were embodied in the law, and their work on this side was carried on by the great religious poets. But the restored community which was still making a sort of faint attempt to be a religious nation as well as a church felt very painfully the want of a direct message from God in critical times such as the prophets of old had been wont to bring. And in this need men began to look at the prophetic books, mainly in the hope that there might be found in them predictions which still awaited fulfilment, and might be taken as referring to the latter days of Persian or Greek oppression. By ignoring the free poetical form of prophecy, and still more by ignoring the fact that the prophetic pictures of the ideal future of Israel could not be literally fulfilled after the fall of the ancient state had entirely changed the sphere in which the problems of true religion had to be worked out, it was possible to find a great mass of unfulfilled prophecy which might form the basis of eschatological constructions. To use this material for the purpose in hand it was necessary to symbolize what was literal, and to literalize what was figurative, to harmonize and to rearrange, above all to introduce some sort of prophetical chronology of future events. But all this was quite in the vein of later Judaism, and so at length the unfulfilled predictions of the prophets served as the raw material for the elaborate eschatology of the apocalypses. See APOCALYPTIC LITERATURE and MESSIAH. In spite of superficial resemblances, mainly due to the unavoidable influence of current exegetical methods, the New Testament conception of prophecy as fulfilled in Christ is fundamentally different from the Jewish apocalyptic view of unfulfilled prophecy. Not external details but the spiritual ideas of the prophets find their fulfilment in the new dispensation, and they do so under forms entirely diverse from those of the old national kingdom of Jehovah.

Literature.—In the ancient and mediæval church and in the dogmatic period of Protestantism there was little or no attempt at historical study of prophecy, and the prophetical books were found instructive only through the application of allegorical or typical exegesis. For details the reader may refer to Diestel, *Geschichte des Alten Testaments*, Jena, 1869, and for the final form of orthodox Protestant views to Witsius, *De Prophetis et Prophetia*. The growing sense of the insufficiency of this treatment towards the close of the period of dogmatism showed itself in various ways. On the one hand we have the revival of apocalyptic exegesis by Coccelus and his school, which has continued to influence certain circles down to the present day, and has led to the most varied attempts to find in prophecy a history, written before the event, of all the chief vicissitudes of the Christian church down to the end of the world. On the other hand Lowth's *Lectures on Hebrew Poetry*, and the same author's *Commentary on Isaiah*, (1778), show the beginnings of a tendency to look mainly at the æsthetic aspects of the prophetical books, and to view the prophets as enlightened religious poets. This tendency culminates in Eichhorn, *Die Hebräischen Propheten*, 1816. Neither of these methods could do much for the historical understanding of the phenomena of prophecy as a whole, and the more liberal students of the Old Testament were long blinded by the moralizing unhistorical rationalism which succeeded the old orthodoxy. The first requisite of real progress, after dogmatic prejudices had been broken through, was to get a living conception of the history in which the prophets moved; and this again called for a revision of all traditional notions as to the age of the various parts of Hebrew literature—criticism of the sources of the history, among which the prophetical books themselves take the first place. In recent times therefore advance in the understanding of the prophets has moved on *pari passu* with the higher criticism, especially the criticism of the Pentateuch, and with the general study of Hebrew history; and most works on the subject prior to Ewald must be regarded as quite antiquated except for the light they cast on detailed points of exegesis. On the prophets and their works in general the best book is still Ewald's *Propheten des Alten Bundes* (1st ed. 1840–41, 2d ed. 1867–68, Eng. tr. 1876–77). The subject is treated in all works on Old Testament introduction (among which Kuenen's *Onderzoek*, vol. ii., claims the first place), and on Old Testament theology (see especially Vatke, *Religion des A. T.*, 1835). On the theology of the prophets there is a separate work by Duhm, Bonn, 1875, and Knobel's *Prophetismus der Hebräer.*, 1837, is a separate introduction to the prophetical books. Kuenen's *Prophets and Prophecy in Israel* (1875, Eng. tr. 1877) is in form mainly a criticism of the traditional view of prophecy, and should therefore be compared with his *Onderzoek* and *Godsdienst van Israel*. Most English books on the subject are more theological than historical, but a sketch of Hebrew prophecy in connection with the history down to the close of the 8th century is given by W. R. Smith, *The Prophets of Israel*, Edinburgh, 1882. A useful commentary on the prophetical books in general forms two volumes of Reuss, *La Bible* (Paris, 1876); the special literature is referred to in the articles on the several prophets. The literature of the theological questions connected with prophecy is much too copious to be cited here; lists will be found in several of the books already referred to. (W. R. S.)

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[1] See 2 Kings xxiii. 21, and also Deut. xxxiv. 6. So too all the old national heroes and heroines ultimately became prophets; in the case of Deborah there is even a fusion in local tradition between an old heroine and an historical seer.

2. *Prophets in the Christian Church.*—The appearance of prophets in the first Christian communities is one proof of the strength of faith and hope by which these bodies were animated. An old prophecy (Joel ii. 28) had foretold that in the Messianic age the spirit of God would be poured out on every member of the religious community, and in point of fact it was the universal conviction of those who believed in Christ that they all possessed the Spirit of God. This Spirit, manifesting His presence in a variety of ways and through a variety of gifts, was to be the only ruling authority in the church. He raised up for Himself particular individuals, into whose mouths He put the word of God, and these were at first regarded as the true leaders of the congregations. We find accordingly that there were prophets in the oldest church, that of Jerusalem (Acts xi. 27; xv. 32), and again that there were "prophets and teachers" in the church at Antioch (Acts xiii. 1). These were not office-bearers chosen by the congregation, but preachers raised up by the Spirit and conferred as gifts on the church. When Paul says (1 Cor. xii. 28; *cf.* Eph. iv. 11), "God has set some in the church, first as apostles, second as prophets, third as teachers," he points to a state of things which in his time prevailed in all the churches both of Jewish and heathen origin. We here learn from Paul that the prophets occupied the second position in point of dignity; and we see from another passage (1 Cor. xiv.) that they were distinguished from the teachers by their speaking under the influence of inspiration—not, however, like the "speakers in tongues," in unintelligible ejaculations and disconnected words, but in articulate, rational, edifying speech. Until recently it was impossible to form any distinct idea of the Christian prophets in the post-apostolic age, not so much from want of materials as because what evidence existed was not sufficiently clear and connected. It was understood, indeed, that they had maintained their place in the churches till the end of the 2d century, and that the great conflict with what is known as Montanism had first proved fatal to them; but a clear conception of their position and influence in the churches was not to be had. But the discovery, by Bryennios, of the ancient Christian work called *Διδαχὴ τῶν δώδεκα ἀποστόλων* has immensely extended the range of our knowledge, and has at the same time thrown a clear light on many notices in other sources which for want of proper interpretation had been previously neglected or incorrectly understood.

The most important facts known at present about the manner of life, the influence and the history of the early Christian prophets are the following. (1) Down to the close of the 2d century the prophets (or prophetesses) were regarded as an essential element in a church possessing the Holy Ghost. Their existence was believed in, and they did actually exist, not only in the catholic congregations—if the expression may be used—but also in the Marcionite Church and the Gnostic societies. Not a few Christian prophets are known to us by name; as Agabus, Judas and Silas in Jerusalem; Barnabas, Simon Niger, etc., in Antioch; in Asia Minor, the daughters of Philip, Quadratus, Ammia, Polycarp, Melito, Montanus, Maximilla and Priscilla; in Rome, Hermas; among the followers of Basilides, Barkabbas and Barkoph; in the community of Apelles, Philumene, etc. Lucian tells us that the impostor Peregrinus Proteus, in the time of Antoninus Pius, figured as a prophet in the Christian churches of Syria. (2) Till the middle of the 2d century the prophets were the regular preachers of the churches, without being attached to any particular congregation. While the "apostles" (*i.e.*, itinerating missionaries) were obliged to preach from place to place, the prophets were at liberty either, like the teachers, to settle in a certain church or to travel from one to another. (3) In the time of Paul the form of prophecy was reasoned exhortation in a state of inspiration; but very frequently the inspiration took the form of ecstasy—the prophet lost control of himself, so that he did not remember afterwards what he had said. In the Gentile-Christian churches, under the influence of pagan associations, ecstasy was the rule. (4) With regard to the matter of prophecy, it might embrace anything that was necessary or for the edification of the church. The prophets not only consoled and exhorted by the recital of what God had done and predictions of the future, but they uttered extempore thanksgivings in the congregational assemblies, and delivered special directions, which might extend to the most minute details, as, for example, the disposal of the church funds. (5) It was the duty of the prophets to follow in all respects the example of the Lord (*ἔχειν τοὺς τρόπους τοῦ Κυρίου*), and to put in practice what they preached. But an ascetic life was expected of them only when, like the apostles, they went about as missionaries, in which case the rules in Mat. x. applied to them. Whenever, on the contrary, they settled in a place they had a claim to a liberal maintenance at the hands of the congregation. The author of the *Διδαχή* even compares them to the high priests of the Old Testament, and considers them entitled to the first-fruits of the Levitical law. In reality, they might justly be compared to the priests in so far as they were the mouthpieces of the congregation in public thanksgiving. (6) Since prophets were regarded as a gift of God and as moved by the Holy Spirit, the individual congregation had no right of control over them. When anyone was approved as a prophet and exhibited the "conversation of the Lord," no one was permitted to put him to the test or to criticise him. The author of the *Διδαχή* goes so far as to assert that whoever does this is guilty of the sin against the Holy Ghost. (7) This unique position of the prophets could only be maintained so long as the original enthusiasm remained fresh and vigorous. From three quarters primitive Christian prophecy was exposed to danger—first, from the permanent officials of the congregation, who, in the interests of order, peace, and security could not but look with suspicion on the activity of excited prophets; second, from the prophets themselves, in so far as an increasing number of dishonest characters was found amongst them, whose object was to levy contributions on the churches;[1] third, from those prophets who were filled with the stern spirit of primitive Christianity and imposed on churches, now becoming assimilated to the world, obligations which these were neither able nor willing to fulfil. It is from this point of view that we must seek to understand the so-called montanistic crisis. Even the author of the *Διδαχή* finds it necessary to defend the prophets who practiced celibacy and strict asceticism against the depreciatory criticism of church members. In Asia Minor there was already in the year 160 a party, called by Epiphanius "Alogi," who rejected all Christian prophecy. On the other hand, it was also in Asia Minor that there appeared along with Montanus those energetic prophetesses who charged the churches and their bishops and deacons with becoming secularized, and endeavored to prevent Christianity from being naturalized in the world, and to bring the churches once more under the exclusive guidance of the Spirit and His charismata. The critical situation thus arising spread in the course of a few decades over most of the provincial churches. The necessity of resisting the inexorable demands of the prophets led to the introduction of new rules for distinguishing true and false prophets. No prophet, it was declared, could speak in ecstasy,—that was devilish; further, only false prophets accepted gifts. Both canons were innovations, designed to strike a fatal blow at prophecy and the church organization re-established by the prophets in Asia,—the bishops not being quite prepared to declare boldly that the church had no further need of prophets. But the prophets would not have been suppressed by their new methods of judging them alone. A much more important circumstance was the rise of a new theory, according to which all divine revelations were summed up in the apostles or in their writings. It was now taught that prophecy in general was a peculiarity of the Old Testament ("lex et prophetæ usque ad Johannem"); that in the new covenant God had spoken only through apostles; that the whole word of God so far as binding on the church was contained in the apostolic record—the New Testament;[1] and that, consequently, the church neither required nor could acknowledge new revelations, or even instructions, through prophets. The revolution which this theory gradually brought about is shown in the transformation of the religious, enthusiastic organization of the church into a legal and political constitution. A great many things had to be sacrificed to this, and amongst others the old prophets. The strictly enforced episcopal constitution, the creation of a clerical order, and the formation of the New Testament canon accomplished the overthrow of the prophets. Instead of the old formula, "God continually confers on the church apostles, prophets, and teachers," the word now was—"The church is founded in the (written) word of the prophets (*i. e.*, the Old Testament prophets) and the apostles (*viz.*, the twelve and Paul)." After the beginning of the 3d century there were still no doubt men under the control of the hierarchy who experienced the prophetic ecstasy, or clerics like Cyprian who professed to have received special directions from God; but prophets by vocation no longer existed, and these sporadic utterances were in no sense placed on a level with the contents of the sacred Scriptures.

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[1] See Lucian's story about Peregrinus, and that chapter of the *Διδαχή* where the author labors to establish criteria for distinguishing false prophets from true.

See Bückmann, "Ueber die Wunderkräfte bei den ersten Christen und ihr Erlöschen," in the *Ztschr. f. d. ges. luther. Theol. u. Kirche*, 1878, p. 216–255 (learned but utterly uncritical); Bonwetsch, "Die Prophetie im apostol. und nachapostol. Zeitalter," in the *Ztschr. f. kirchl. Wissensch. u. kirchl. Leben*, 1884, part 8, p. 408 *sq.*, part 9, p. 460 *sq.*; Harnack, *Die Lehre der zwölf Apostel*, 1884, p. 93–137. (A. HA.)

PROSELYTE (*προσήλυτος*) is the term most frequently adopted by the Septuagint, especially in legal passages, to represent the Hebrew גר. The *gēr*, or more fully *gēr w'tōshāb*, is not any "stranger" but a stranger dwelling in a Hebrew community and enjoying a certain measure of protection. In old time at least the position of such a stranger was no doubt very insecure, for he had no strong kinsmen to take his part, and so, like the widow and orphan, with whom many passages of the Old Testament associate him, he was liable to oppression. The law as well as the prophets commend him to the humane regard of his neighbors, but it would have been quite foreign to antique ideas to grant him equal rights (see Lev. xxv. 45; Deut. xxiii. 20). Like the Arabic *jār*, therefore (whose name is at bottom the same), he must have generally sought to attach himself as a client to some individual or community able to protect him, and so we must understand the metaphor in passages like Ps. xv. 1, xxxix. 12.

In the old Hebrew kingdom the word *gēr* had a civil not a religious significance, and it would almost seem that a poor Israelite without inheritance might sink to this position, which indeed is scarcely distinguishable from that of the Levite in Jud. xvii. 8, who went forth to sojourn (*gūr*) where he might find a place. The exile and the restoration made a change in this as in all other aspects of Hebrew society. On the one hand Ezekiel xlvii. 22 and Isa. xiv. 1 contemplate that the restored nation shall be recruited by strangers who are received on equal terms; but, as the Jews returned not as an independent nation but as a distinct religious community, this implies especially that the sons of the stranger, by joining Israel, observing the Sabbath, and holding fast to Jehovah's covenant, may gain admission to all the privileges of the temple and its worship. So it is put in Isa. lvi. 6, 7 in marked contrast to the restrictions laid down in Deut. xxiii. 3, 7 *sq.* That the views of the prophets had practical issue cannot be doubted; even the foreign Nethinim in the second temple were rapidly transformed not merely into good Israelites but into Levites. The condition of admission to the full privileges of an Israelite, in particular to the passover, is, according to the Priestly Code (Exod. xii. 48; Numb. ix. 14), circumcision,—to which the later Jewish usage adds lustration by immersion in water (baptism, *ṭ'bīlā*) and the presentation of a sacrifice (*ḳorbān*). The immersion, about which there has been a good deal of controversy, some maintaining that it came into use later than Christian baptism, was really a necessary act for one who had been previously unclean, and may be held to be involved in the general Pentateuchal law of ceremonial washings. The later technical name for a heathen who thus joined the theocracy was גר הצדק, "proselyte of righteousness."

The free admission of foreigners to the Jewish church is a mark of the universalistic tendency which, in spite of all the narrownesses of Judaism under the law, accompanied the break-up of the old national system. On the other hand the so-called Law of Holiness (later than Ezekiel but earlier than the Priestly Code), which is contained in Lev. xvii. *sq.*, presents a different line of transition from the purely civil to the religious meaning of *gēr*. In these laws, which proceed throughout on the principle that Israel, and all that has to do with Israel, must be regulated by regard to formal holiness, it is demanded that certain rules shall be enforced not only on Israelites proper but on strangers sojourning in their land. They are not to eat blood (xvii. 10), commit incest (xviii. 26), sacrifice to Moloch (xx. 2), or blaspheme Jehovah (xxiv. 16); and for murder and other crimes they are to be answerable to the Hebrew authorities according to Hebrew law (xxiv. 22). These rules are in substance—the third being extended to a prohibition of idolatry generally—the "Noachic laws" to which in later usage a man or woman might promise to conform and thereby, without becoming a regular member of the theocracy, be recognized as a "proselyte of the gate," *i. e.*, "within the gates of Israel." What the Law of Holiness proposed to enforce became in fact—the theocracy not possessing political power over strangers—a voluntary obligation assumed by those "who worshipped God" (*σεβόμενοι τὸν θεόν*, Acts xiii. 50, xvi. 14, xvii. 4, 17, xviii. 7—in E. V. often rendered "devout").

The proselytizing zeal of the Jews is spoken of in Mat. xxiii. 15, and by many Greek and Latin writers. Up to the time of Hadrian it was facilitated by the favor generally extended to the Jews by the Roman emperors; and not only on Semitic soil, as at Damascus, where Josephus tells us that most of the women were proselytes, but throughout the Roman world many converts were made, especially among women. The most noted conversion was that of the royal house of Adiabene (Josephus, *Ant.*, xx. 2), of which the splendid tomb of Queen Helena, a little way outside of Jerusalem, still remains a monument.

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[1] The Apocalypse of John was received into it, not as the work of a prophet, but as that of an apostle.

PROSERPINE (*Proserpina*) is the Latin form of PERSEPHONE,[1] a Greek goddess, daughter of Zeus and the earth-goddess Demeter. In Greek mythology Demeter and Proserpine were closely associated, being known together as the two goddesses, the venerable or august goddesses, sometimes as the great goddesses. Proserpine herself was commonly known as the daughter (Core), sometimes as the first-born. As she was gathering flowers with her playmates in a meadow, the earth opened, and Pluto, god of the dead, appeared and carried her off to be his queen in the world below. This legend was localized in various places, as at Eleusis, Lerna, and "that fair field of Enna" in Sicily. Torch in hand, her sorrowing mother sought her through the wide world, and finding her not she forbade the earth to put forth its increase. So all that year not a blade of corn grew on the earth, and men would have died of hunger if Zeus had not persuaded Pluto to let Proserpine go. But before he let her go Pluto made her eat the seed of a pomegranate, and thus she could not stay away from him forever.[2] So it was arranged that she should spend two-thirds (according to later authors, one-half) of every year with her mother and the heavenly gods, and should pass the rest of the year with Pluto beneath the earth. There can be little doubt that this is a mythological expression for the growth of vegetation in spring and its disappearance in Autumn. According to Theopompus there was a Western people who actually called the spring Proserpine. As wife of Pluto, she sent spectres, ruled the ghosts, and carried into effect the curses of men. The lake of Avernus, as an entrance to the infernal regions, was sacred to her. From the head of a dying person Proserpine was supposed to cut a lock of hair which had been kept sacred and unshorn through life.[3] She was sometimes identified with Hecate. On the other hand in her character of goddess of the spring she was honored with flower festivals in Sicily and at Hipponium in Italy. Sicily was a favorite haunt of the two goddesses, and ancient tradition affirmed that the whole island was sacred to them. The Sicilians claimed to be the first on whom Demeter had bestowed the gift of corn and hence they honored the two goddesses with many festivals. They celebrated the festival of Demeter when the corn began to shoot, and the descent of Proserpine when it was ripe. At Cyane, a fountain near Syracuse which Pluto made to spring up when he carried off his bride, the Syracusians held an annual festival in the course of which bulls were sacrificed by being drowned in the water. At Cyzicus also, in Asia Minor, bulls were sacrificed to Proserpine. Demeter and Proserpine were worshipped together by the Athenians at the greater and less Eleusinian festivals, held in Autumn and spring respectively. In the Eleusinian mysteries Proserpine no doubt played an important part (see ELEUSINIA and MYSTERIES). One Greek writer, Achemachus, identified Proserpine with the Egyptian Isis. At Rome Proserpine was associated with Ceres (the Roman representative of Demeter) in the festival of the Cerealia (April 12 to 19), she was represented as the wife of Dis Pater (the Roman Pluto), and was sometimes identified with the native Latin goddess Libera. The pomegranate was Proserpine's symbol, and the pigeon and cock were sacred to her. Her votaries abstained from the flesh of domestic fowls, fish, beans, pomegranates, and apples. In works of art she appears with a cornucopia or with ears of corn and a cock. The regular form of her name in Greek was Persephone, but various other forms occur, Phersephone, Persephassa, Phersephassa, Pherrephatta, etc., to explain which different etymologies were invented. Corresponding to Proserpine as goddess of the dead is the old Norse goddess *Hel* (Gothic *Halja*), whom Saxo Grammaticus calls Proserpine. (J. G. FR.)

PROSKUROFF, a district town of the government of Podolia, Russia, situated on the railway from Odessa to Lemberg, 62 miles to the northwest of Schmerinka junction, and on the highway from Zhitomir to Kieff. It is poorly built, mostly of wood, on a low marshy plain surrounded by hills, at the junction of the Ploskaya with the Bug. Its old castle has been destroyed, the site being occupied by a Catholic church. The Orthodox cathedral (1839) contains a very ancient and highly venerated icon of the Virgin. The manufactures are insignificant but the Jewish merchants carry on an active export trade in corn and sugar, while the imports consist of salt and various manufactured wares. Agriculture and market-gardening are the chief occupations of its Little-Russian inhabitants. Of the population (11,750 in 1880) more than one-half are Jews.

PROSPER OF AQUITAINE (AQUITANUS, OR AQUITANICUS), a Christian prose and verse writer of the first half of the 5th century. Of his personal history almost nothing is known; his surname seems to imply that he was a native of Aquitania, and there are various indications that he was educated as a "rhetorician." While still comparatively young he gave himself to a religious and ascetic life, and at Marseilles soon made himself prominent as a champion of orthodoxy in the controversy with the Massilians or Semi-Pelagians. In this connection he opened a correspondence with Augustine, along with his friend Hilarius (*c.* 429 A. D.), and about the same time (*c.* 430) he composed an hexameter poem of upwards of one thousand lines, *Adversus Ingratos*, a glowing polemic against the Pelagians. After Augustine's death he wrote *Pro Augustino Responsiones*, and about 431 he visited Rome, still in the interest of Augustianism, eliciting from Pope Celestine his *Epistola ad Episcopos Gallorum* against Cassianus. There are some indications that the latter years of his life were spent in Rome, and that he wrote his *Chronicon* there. The year of his death is unknown; the chronicle is brought down to 455.

Prosper's enthusiastic admiration for Augustine (to whom however, he was not personally known) led him to make an abridgment of that author's commentary on the Psalms, as well as a collection of sentences for his works,—probably the first dogmatic compilation of the class in which the

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[1] Some, however, regard *Proserpina* as a native Latin form, not borrowed from the Greek.

[2] The idea that persons who have made their way to the abode of the dead can return to the upper world if they have not tasted the food of the dead appears elsewhere, as in New Zealand (R. Taylor, *New Zealand*, pp. 233, 271).

[3] *Æn.*, iv. 698 *sq.* It appears to have been a Greek custom to cut a lock of hair from a dead man's head, and hang it outside of the house door, in token that there was a corpse in the house. At least this seems a fair inference from Eurip., *Alc.*, 75, 76, 101-4. The lock so cut may have been that which was kept sacred to the gods and unshorn (*Etym. Mag.*, *s. v.*, ἀπεσκαλυμμένος). For examples of hair dedicated to gods, see *Il.*, xxiii. 141 *sq.*; Plut., *Thes.*, 5; Paus., viii. 20, 3. In Tibet a lama (priest) is called in to cut off some hairs from the head of a dying person, in order that his soul may escape through the top of his head, which is deemed an essential condition of a good transmigration (Horace de la Penna, in Bogle and Manning's *Travels in Tibet*). We can hardly doubt that the intention of the Græco-Roman custom was similar. In modern Greece the god of death, Charos, is supposed to draw the soul out of the body, and if a man resists the Arachobites believe that Charos slits open his breast (B. Schmidt, *Volksleben der Neugriechen*, p. 228). There are other instances of incisions made in the body of a dying person to allow his soul to escape (cp. Bastian, *Mensch*, ii. 342). The custom probably dates from the times when death in battle was the usual death. In the legend of Nisus and Scylla there is a trace of the custom which was still observed in classical times in the sacrifice of animals. The practice of cutting off the hair of the dead prevailed in India, though it does not appear in the Vedas (Monier Williams, *Religious Thought and Life in India*, p. 281). We are reminded of the practice of the Pawnees and other North American Indians, who shaved the head with the exception of one lock (the scalp-lock), which was removed by a victorious enemy (Catlin, *North American Indians*, vol. ii. p. 24). The Sandwich Islanders also cut a lock from a slain foe (Ellis, *Pol. Res.*, vol. iv. p. 159).

Liber Sententiarum is the best known example. Some of Augustine's theological dicta he also put into elegiac metre (one hundred and six epigrams). Prosper's *Chronicon* is of value from the year 29 A.D. onwards, some of the sources which he used for that period being no longer extant. The best edition of the *Opera* is the Benedictine by Le Brun and Mangeant (Paris, 1711), reprinted in Migne's collection.

PROSSNITZ (Slavonic, *Prostejov*), the chief place in the fertile district of the Hanna, in Moravia, Austria, is situated on the small river Rumza, 11 miles south-west of Olmütz. It carries on manufactures of sugar, cotton, and linen, and is an important centre for the sale of the barley and other produce of the Hanna. It is a town of ancient origin, and in the 16th century was one of the chief seats of the Moravian Brethren. Population in 1880, 16,751.

PROTAGORAS of Abdera, the first of the so-called Sophists,—who, about the middle of the 5th century B.C., asserted throughout Greece the claims of education or culture in opposition on the one hand to technical instruction and on the other to physical research,—was an older contemporary of Socrates. At the age of seventy, having been accused and convicted of atheism, Protagoras fled from Athens, and on his way to Sicily was lost at sea. His birth has been plausibly assigned to 481 and his death to 411 B.C. Forty years of his life were spent in the exercise of his popular and lucrative profession in the principal cities of Greece and Sicily. According to Plato (*Prot.*, 318 E), he endeavored to communicate to his pupils "good counsel or prudence (εὐβουλία), which should fit them to manage their households, and to take part by word and deed in civic affairs." In short, he professed not to "instruct" but to "educate." Further, the education which he provided was of a literary sort,—oratory, grammar, style, and the interpretation of the poets being among the subjects which he used as instruments. His formal lectures were supplemented by discussions amongst his pupils. He left behind him several treatises, of which only two or three sentences have survived. In *Truth*, by way of justifying his rejection of philosophy or science, he maintained that "man is the measure of all things—of what is, that it is, and of what is not, that it is not."[1] Besides *Truth*, and the book *Of the Gods* which caused his condemnation at Athens, Diogenes Laertius attributes to him treatises on political, ethical, educational, and rhetorical subjects.

On the significance of the Sophistical movement, and the part which Protagoras took in promoting it, as well as for bibliographical information, see SOPHISTS.

PROTECTION. See FREE TRADE and POLITICAL ECONOMY.

PROTESTANTENVEREIN is the name of a society in Germany the general object of which is to promote the union and the progress of the various established Protestant churches of the country in harmony with the advance of culture and on the basis of Christianity. It was founded at Frankfort-on-the-Main in 1863 by a number of distinguished clergymen and laymen of liberal tendencies, representing the freer parties of the Lutheran and Reformed churches of the various German states, amongst whom were the statesmen Bluntschli and Von Bennigsen and the professors Rothe, Ewald, Schenkel, Hilgenfeld, and Hitzig. The more special objects of the association are the following: the development of the churches on the basis of a representative parochial and synodal system of government in which the laity shall enjoy their full rights; the promotion of a federation of all the churches in one national church; resistance to all hierarchical tendencies both within and without the Protestant churches; the promotion of Christian toleration and mutual respect amongst the various confessions; the rousing and nurture of the Christian life and of all Christian works necessary for the moral strength and prosperity of the nation. These objects include opposition to the claims of Rome and to autocratic interference with the church on the part of either political or ecclesiastical authorities, efforts to induce the laity to claim and exercise their privileges as members of the church, the assertion of the right of the clergy, laity, and both lay and clerical professors to search for and proclaim freely the truth in independence of the creeds and the letter of Scripture. When the association was first formed the necessity for it was felt to be great. The separation between the Calvinistic and the Lutheran churches on the one hand, and between the churches of the various states on the other, even when the former separation had been bridged over by the Prussian Union; the entire absence of any satisfactory system of church government, the autocratic authority of either the monarch or his ministers, or of the clergy, being supreme; the increasing encroachments of the papal power upon the rights of the individual and the state; the growing estrangement of the educated classes from the church on the one hand, with the manifestation of either ignorance of the fact or a determination to meet it with bitter denunciation on the part of the orthodox clergy on the other, were regarded as urgent calls to action by the liberals. Membership in the association is open to all Germans who are Protestants and declare their willingness to cooperate in promoting its objects. To facilitate its operations, the general association is broken up into a few groups or societies confined to certain geographical areas. Every second year (at first every year) general meetings of the entire association are held at some convenient place. At first the governing committee had its permanent seat at Heidelberg, but in 1874 Berlin, as the new capital of the empire, was chosen. The means used to promote the objects aimed at are mainly (1) the formation of local branch associations throughout the country, the duty of which is by lectures, meetings, and the distribution of suitable literature to make known and advocate its principles, and (2) the holding of great annual or biennial meetings of the whole association, at which its objects and principles are expounded and applied to the circumstances of the church at the moment. The "theses" accepted by the general meetings of the association as the result of the discussions on the papers read indicate the theological position of its members. The following may serve as illustrations:

> The creeds of the Protestant church shut the doors on the past only, but open them for advance in the future; it is immoral and contrary to true Protestantism to require subscription to them. The limits of the freedom of teaching are not prescribed by the letter of Scripture, but a fundamental requirement of Protestantism is free inquiry in and about the Scriptures. The attempt to limit the freedom of theological inquiry and teaching in the universities is a violation of the vital principle of Protestantism. Only such conceptions of the person of Jesus can satisfy the religious necessities of this age as fully recognize the idea of his humanity and place in history. The higher reason only has unconditional authority, and the Bible must justify itself before its tribunal; we find the history of divine revelation and its fulfilment in the Bible alone, and reason bids us regard the Bible as the only authority and canon in matters of religious belief.

The formation of the association at once provoked fierce and determined opposition on the part of the orthodox sections of the church, particularly in Berlin. Attempts more or less successful have been made from the first to exclude clergymen and professors identified with it from the pulpits and chairs of Berlin and elsewhere, though membership in it involves no legal disqualification for either. One of the objects of the association was to some extent obtained by the reorganization of the Prussian Church when Dr. Falk was cultus minister, on the basis of parochial and synodal representation, which came into full operation in 1879. But the election for the general synod turned out very unfavorable to the liberal party, and the large orthodox majority endeavored to use their power against the principles and the members of the association. The members of the association elected to the general synod were nine only, while the party of the decidedly orthodox numbered upwards of seventy. In 1882 the position of the association was rendered still more difficult by the agitation in Berlin of Dr. Kalthoff and other members of it in favor of a "people's church" on purely dissenting and extremely advanced theological principles. The turn of the political tide in the direction of conservatism in Berlin indicated by the retirement of the cultus minister Dr. Falk increased the difficulties and the work of the association, far as Dr. Falk was from sanctioning its theological principles. Moreover, it had sustained severe losses in its membership by death and other causes.

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[1] The exposition of this maxim contained in Plato's *Theætetus*, 152 C sq., is plainly not to be ascribed to Protagoras.

At the end of the twelfth year of its existence (1877) the association had 7500 members, its annual income was nearly £350 [$1701], and it had distributed in the same year 10,000 copies of its publications. In 1880 the number of members had risen to 26,000, and of local associations to 80.

See Schenkel, *Der Deutsche Protestantenverein und seine Bedeutung für die Gegenwart* (Wiesbaden, 1868, 2d ed. 1871); *Der Deutsche Protestantenverein in seinen Statuten und den Thesen seiner Hauptversammlungen*, 1865–82 (Berlin, 1883), and the annual reports in the *Allgemeine Kirchliche Kronik*, 1865–82, and *Theological Review*, July, 1869, pp. 289–96.

PROTESTANTS is the generic term for members of the churches which owe their origin directly or indirectly to the **Reformation** (*q. v.*). The name is derived from the Protest of Spires in 1529 (see **Luther**, vol. xv. p. 82). Certain small communities of Christians older than the Reformation, but agreeing with it in rejecting the authority of Rome, are generally and quite logically grouped as Protestants; and popularly the name is considered to include all Christians who do not belong to the Greek and Roman Catholic communions, though members of the Anglican Church, for example, frequently protest against such a classification as historically false and personally obnoxious. Protestantism has flourished best among the Teutonic peoples of Northern Europe, and has always found it difficult to make its way among the Latin peoples of the South.

The following table shows approximately the number of Protestants in the world :

I. Europe:			
Great Britain and Ireland (Anglicans, 18,800,000; Presbyterians, 3,900,000; Methodists, 3,500,000; Independents, 1,200,000; Baptists, 1,000,000)	28,400,000	(estimate)	
German Empire (Lutherans, Reformed, and United, 28,318,280; Mennonites, and other Baptists, 38,744)	28,357,024	(1880)	
Norway and Sweden (Norway, 1,805,076; Sweden, 4,561,759, mostly Lutheran)	6,366,835	(1875 and 1880)	
Denmark and Iceland (Denmark, 1,960,844; Iceland, 72,000, mostly Lutheran)	2,032,844	(1880)	
Holland (Reformed, 2,346,568—including Remonstrants 9678; Lutherans, 73,696; Mennonites, 50,705)	2,472,680	(1879)	
Switzerland (mainly Reformed)	1,667,109	(1880)	
(Making a total in countries of the Teutonic race of 69,296,492.)			
France (Reformed or Calvinists, 467,531; Lutherans, 80,117; others, 33,109)	580,757	(1872)	
Belgium, Spain and Portugal, Luxemburg, and Monaco (respectively 15,000, 10,500, 963, and 626	27,089	(various)	
Italy (Waldensians, Free Church of Italy, Methodists, Baptists, etc.)	62,000	(estimate)	
Roumania	13,800	(estimate)	
(Total in countries of the Latin race, 683,646.)			
Austria (Lutherans, 289,005; Reformed, 110,525; Unitarians, 169, etc.)	401,479	(1880)	
Hungary (Lutherans, 1,130,150; Reformed, 2,043,280; Unitarians, 56,190)	3,229,620	(1880)	
Russia in Europe (Lutherans in Finland, 2,019,727	4,504,000	(partly estimate)	
Turkey, Greece, Servia (respectively 10,200, 20,000, and 500)	30,700	(estimate)	
Total in countries of Slavonic, non-Aryan, and mixed race, 8,165,799.)			
			78,145,937
II. America—			
United States (Methodists, 3,686,114 church members; Baptists, 2,424,878; Lutherans, 950,868; Disciples of Christ, 591,821; Congregationalists, 381,697; Episcopalians, 347,781)	30,000,000[1]		
Canada	2,422,285	(1881)	
West Indies	160,500	(estimate)	
Central and South America	180,000	(partly estimate)	
			32,762,785
III. Asia and Australasia—			
India (Anglicans, etc., 373,848; Baptists, Presbyterians, etc., 128,794; Lutherans, 29,577)	532,219	(1881)	
Dutch Possessions	170,000	(partly estimate)	
China and Corea (73,000), Japan (13,000), and Siam (2000)	88,000	(estimate)	
Turkey in Asia (100,000) and Persia (5000)	105,000	(estimate)	
New South Wales (516,512), Victoria (618,392), Queensland (139,380)	1,274,284	(1881)	
South Australia (216,626) and West Australia (20,613)	237,239	(1881)	
New Zealand	393,971	(1881)	
Polynesia, Micronesia, and Melanesia (260,000, 8000, and 16,000)	284,000	(estimate)	
			3,084,713
IV. Africa—			
Egypt and North Africa (10,000) and West Africa (110,000)	120,000	(estimate)	
Cape Colony, etc.	400,000	(estimate)	
East and Central Africa (2000) and Madagascar (300,000)	302,000	(estimate)	
			822,000
Total number of Protestants thus ascertained			114,815,435

This total of 115,000,000 is for obvious reasons considerably within the truth. Making allowance for increase of population since some of the census returns, it will probably be not beyond the mark to state the Protestants of Europe at 81,000,000, of America at 34,000,000, of Asia and Australasia at 3.300,000, and of Africa at 850,000, and the total in round numbers at 120,000,000. As regards Europe, compare Brachelli, *Die Staaten Europa's*, 1884. Juraschek, in his edition of Otto Hübner's *Geograph.-statistische Tabellen*, 1884, gives 123,000,000 Protestants, or 8.5 per cent. of the total population of the world, which he states at 1,435,000,000.

[1] This estimate of the Protestant population is based on the details of church membership (partly given above) obtained at the census of 1880.

PROTEUS, a Greek sea-god, spoken of by Homer as the Old Man of the Sea. In the *Odyssey* he dwells in the sea near Pharos, an island said to be a day's sail from the mouth of the Nile; in Virgil his home is the Carpathian Sea between Crete and Rhodes. He knew all things past, present and future, but was very loth to tell what he knew. Those who would consult him had first to surprise and bind him during his noon-day slumber in a cave by the sea, where he was wont to pass the heat of the day surrounded by his seals. Even when caught he would try to escape by assuming all sorts of shapes; now he was a lion, now a serpent, a leopard, a boar, a tree, fire, water. But if his captor held him fast, the god at last returned to his proper shape, gave the wished-for answer and then plunged into the sea. He was subject to Poseidon, whose finny droves he shepherded under the billows. In post-Homeric times some thought that Proteus was a king of Egypt, at whose court the fair Helen tarried after she had been carried off by Paris, while the Greeks fondly deemed she was in Troy. This is the story followed, with variations, by Herodotus, who got it from Egyptian priests, and by Euripides in his play of *Helen*.

The fairy tale of Proteus has been interpreted in various fanciful ways. Proteus's leading features—his knowledge of the future and his power of assuming any shape at pleasure—are characteristic of the "medicine-men" of savages in many parts of the world. As late as the beginning of our era there was a class of wizards at Rhodes who possessed two at least of the chief marks of "medicine-men"—the powers of transforming themselves and of making rain (*Diod. Sic.*, v. 55). There were rain-makers also at Rome (Festus, *s.v.* "aquælicium," where see commentary).

PROTEUS ANGUINUS, a blind, newt-like perenni-branchiate Amphibian, about a foot long, found in the Adelsberg, Maddalena and other limestone caverns of Carinthia and Carniola. The creature is white or flesh-colored and the transparent gills appear blood red; the skin passes uninterruptedly over the rudimentary eyes. The animal's body is cylindrical; the snout is long and blunt; the fore-feet have three toes and the hind (which are set very far back) two. There are three gill-arches and two gill-slits on each side. The absence of the fourth branchial arch is a feature that *Proteus* has in common with *Menobranchus* and also with *Spelerpes*. The skull is of an elongated form and presents several remarkable characters. The trabeculæ cranii are persistent, as in the snake. The membrane bones are singularly few, the maxillæ being rudimentary and the nasals and supra-occipital absent. In the lower jaw the splenial is said to be absent, but a mento-Meckelian cartilage element is present, as in *Batrachia*. The palatines have a row of teeth and are anchylosed with the pterygoids; the premaxillæ, dentaries and vomers carry teeth. The absence of a cartilage roof to the nasal cavity is one of the many characters in which *Proteus* agrees with *Menobranchus*, but differs from *Siren* and *Menopoma*. The suspensorium has only a simple pedicle, as in *Batrachia* and the hyoid arch is remarkable for the enormous hyo-mandibular element which is larger even than in many sharks. The notochord is scarcely constricted by the amphicœlous vertebræ and the intervertebral cartilages are at a minimum of development. There are twenty-nine trunk vertebræ, one sacral and twenty-eight caudal. The pectoral arch contains a long, thin, ossified scapula, a suprascapula and a long precoracoid separated by a deep notch from the main coracoid; a fissure exists in the glenoid region. There is no sternum. The pectoral girdle is almost identical with that of *Menobranchus*. The pelvis has a narrow, tapering ischial region, well-marked prepubes and (?) a pointed epipubis; this girdle also is extremely like that of *Menobranchus*, but notably different from that of the Axolotl, which is only a pseudo-perennibranchiate, and whose real affinities are with *Salamander* and *Triton*. The bones of the fore-arm and leg are unanchylosed. There are three unossified carpal and tarsal elements, which Gegenbaur identifies as a radiale, ulnare and a fused distal row; such a carpus has no resemblance to either the embryonic or adult stage of any other amphibian. In the heart the auricular septum is incomplete; the truncus arteriosus bifurcates into two trunks; each divides into two, and the posterior of these again into two, thus forming the three aortic arches on each side. The pulmonary vein sends part only of its blood into the heart and part into the systemic veins. The blood-corpuscles are the largest known among vertebrates and are comparable to the exceedingly large corpuscles of the *Dipnoi*. The brain is very small, straight and embryonic in character. The gut is straight and the stomach is a scarcely perceptible dilatation. The thyroid (alone among amphibians) is unpaired. The lungs are long simple sacs, expanded distally, as in *Menobranchus;* the trachea is excessively short and the two cartilages which bound the glottis are continued into long processes which pass to the base of the lungs. As in *Siren*, *Siredon* and others, the lateral branch of the vagus nerve is connected with a series of sense-organs forming a "lateral line." These characters together indicate the exceedingly low position of *Proteus* among *Amphibia;* it and its close relative the American *Menobranchus* are the lowest of living *Amphibia*. The creature seems to be abundant within its limited habitat; it feeds on worms and small fishes, which, in spite of its blindness, it catches dexterously. It has bred in captivity and lays round, isolated eggs about a third of an inch in diameter. It changes color slightly in the breeding season and two rows of reddish spots make their appearance on the hinder part of the body. Such a change seems to indicate that the creature has not always lived in the absolute darkness in which it now spends its life. Individuals differ in some minor characters, and Cope (*Journ. Acad. Philadelphia*, v. p. 103, 1866) has based four new species on Hyrtl's specimens *P. zoisii*, *carraræ*, *xanthostichus*, *schreitersii*). Merrem altered the name of the genus to *Hypochthon* (*Gesch. der Amphibien*, 1790–1820).

Authorities.—*Proteus* was first described by Laurenti in his *Synopsis Reptilium* (Vienna, 1768, p. 37); his locality, Lake Zirknitz, was erroneous. It was next mentioned by Scopoli (*Annus V. Hist. Nat.*, 1772). A full description, with plates, is given by Configliachi and Rusconi (*Del proteo anguino di Laurenti*, 4to, Pavia, 1819). The brain has been described by Treviranus (*P. anguini encephalon*, 4to, Göttingen, 1820), the spinal cord by Klaussner (*Rückenmark des P.*, 4to, Munich, 1883), the skull by Parker (*Phil. Trans.*, clxvii. pp. 568–573, 1877), the pectoral arch by Parker (*Shoulder-girdle*, p. 58, pl. iv.), the pelvis by Hoffmann (*Nederl. Arch.* iii. p. 144, 1877), the vertebral column by Mivart (*P. Z. S.*, 1870), the lateral line, etc., by Bugnion (*Bull. Soc. Vaud.*, xii. pp. 259–316, 1873), the eye by Desfosses (*Comptes rendus*, xciv. p. 1729, 1882), the kidney by Solger (*Abh. Ges. Halle*, xv. p. 405, 1882), the reproduction by Schultze (*Zeits. f. wiss. Zool.*, xxvi. p. 350, 1876) and M. V. Chauvin (*Zeits f. wiss. Zool.*, xxxviii. 671–685, 1883), and the affinities with *Menobranchus* by Van d. Hoeven (*Arch. Neerl.*, i. p. 305, 1866; *Ann. and Mag. N. H.*, xviii. p. 363, 1866). See also anatomical details by Valentin (*Repert. f. Anat.*, i. p. 282, 1837, vi. p. 353, 1841), and many smaller papers.

PROTOGENES, a Greek painter, born in Caunus on the coast of Caria, but resident in Rhodes during the latter half of the 4th century B.C., was celebrated for the minute and laborious finish which he bestowed on his pictures, both in drawing and in color. Apelles, his great rival, standing astonished in presence of one of these works, could only console himself that he knew when to stop, whereas Protogenes did not. So also Petronius (*Satyr*, 83) experienced a sensation of horror at the too vivid realization of nature in which Protogenes indulged. On one picture, the Ialysus, he spent seven years; on another, the Satyr, he worked continuously during the siege of Rhodes by Demetrius Poliorcetes (305–4 B.C.) notwithstanding that the garden in which he painted was in the middle of the enemy's camp. Demetrius unsolicited took measures for his safety; more than that, when told that the Ialysus just mentioned was in a part of the town exposed to assault, Demetrius changed his plan of operations. Possibly the slowness and laboriousness of the work of Protogenes was due partly to a want of training in his youth. He appears to have been self-taught; some said that he had begun life as a ship-painter, and, though the painting of certain small figures of ships in a picture of his in Athens, however excellent it may have been, can hardly be held to confirm this account of his youth, it does not on the other hand render the account unreliable. It may have been due also to a want of early training that he found so much difficulty in rendering the foam at the mouth of a dog which occurred in the picture of Ialysus. Angry at his many failures, he dashed the sponge wet with the white color which he had just wiped off at the mouth of the dog. The result was a perfectly successful foam. Ialysus was a local hero, the founder of the town of the same name in the island of Rhodes, and probably he was represented as a huntsman. The picture was still in Rhodes in the time of Cicero, but was afterwards removed to Rome, where it perished in the burning of the temple of Peace. On another occasion Protogenes seems to have used his sponge with a different effect. The picture painted during the seige of Rhodes consisted of a satyr leaning idly against a pillar on which was a figure of a partridge so life-like that ordinary spectators saw nothing but it. Enraged on this account, the painter wiped out the partridge. The Satyr must have been one of his last works. He would then be about seventy years of age, and had enjoyed for about twenty years a reputation next only to that of Apelles, his friend and benefactor. Both were finished colorists so far as the fresco-painting of their day permitted, and both were laborious in the practice of drawing, doubtless with the view to obtaining bold effects of perspective as well as fineness of outline. It was an illustration of this practice when Apelles, finding in the house of Protogenes a large panel ready prepared for a picture, drew upon it with a brush a very fine line which he said would tell sufficiently who had called. Protogenes on his return home took a brush with a different color and drew a still finer line along that of Apelles dividing it in two. Apelles called again; and, thus challenged, drew with a third color another line within that of Protogenes, who then admitted himself surpassed. This panel was seen by Pliny (*N. H.*, xxxv. 83) in Rome, where it was much admired, and where it perished by fire. In the gallery of the Propylæa at Athens was to be seen the panel by Protogenes in which occurred the figures of ships already mentioned. The subject consisted of two figures representing personifications of the coast of Attica, Paralus and Hammonias, to whom the presence of ships would be the more appropriate as the Athenians actually possessed two ships so named. For the council chamber at Athens he painted figures of the Thesmothetæ, but in what form or character is not known. Probably these works were executed in Athens, and it may have been then that he met Aristotle, who recommended him to take for subjects the deeds of Alexander the Great. In his Alexander and Pan he may have followed that advice in the idealizing spirit to which he was accustomed. To this spirit must be traced also his Cydippe and Tlepolemus, legendary personages of Rhodes. Among his portraits are mentioned those of the mother of Aristotle, Philiscus the tragic poet, and King Antigonus. But Protogenes was also a sculptor to some extent, and made several bronze statutes of athletes, armed figures, huntsmen, and persons in the act of offering sacrifices.

PROTOPLASM. In most of the biological articles already before the reader, whether concerned with general questions, as BIOLOGY, ANATOMY, BOTANY, EMBRYOLOGY, EVOLUTION, HISTOLOGY, MORPHOLOGY, PHYSIOLOGY, etc., or even with special groups of living beings, as ANIMAL KINGDOM, FORAMINIFERA, FUNGUS, PROTOZOA, etc., special reference has been made to protoplasm as the living matter from which all kinds of living beings are formed and developed, and to the properties of which all their functions are ultimately referred. Fundamentally important then as this substance is, whether we occupy the standpoint of morphology, physiology, or ætiology, an attempt must be made to outline the way in which our knowledge of it has been reached, to bring together by the aid of a short summary the statements of such preceding articles, and to supply means of extending the general idea thus obtained by reference to the original literature of the subject.

§ 1. *History.*—Among the varied and fruitful observations of the early microscopists, Rösel v. Rosenhof's excellent account (1755) of his "Proteus animalcule" (the familiar *Amœba*) is especially noteworthy as the earliest description of the form and movements of what we now know as a mass of living protoplasm. Such discoveries as those of rotation in the cell of *Chara* (Corti, 1772), and of similar movements in other plant cells (*Vallisneria*, Meyen, 1827; *Tradescantia*, R. Brown, 1831), are also memorable,—more so indeed in this relation than is the great contemporaneous movement in general histology, since this, though aided by the rapid improvement of the microscope, eagerly carried on by the united labors of zoologists and botanists, headed by Johannes Müller and Robert Brown, and culminating in the hands of Schleiden and Schwann (1838–39) in the fundamental morphological generalisation of the cell theory (see MORPHOLOGY), included views of the structure, origin, and function of the cell-substance alike erroneous and misleading. Knowledge had in fact to start afresh from the level of the unappreciated discovery of Rosenhof; and it is accordingly from the observations of Dujardin on *Foraminifera* (1835) that our modern knowledge of protoplasm dates. His main account is still worth reading in his own words. In proposing the term "sarcode," he says, "je propose de nommer ainsi ce que d'autres observateurs ont appelé une gelée vivante, cette substance glutineuse, diaphane, insoluble dans l'eau, se contractant en masses globuleuses, s'attachant aux aiguilles de dissection, et se laissant étirer comme du mucus, enfin se trouvant dans tous les animaux inférieurs interposée aux autres éléments de structure." Though thus dissipating many errors, and placing the study of the lowest forms of life on its true basis, Dujardin unfortunately did not see the full bearing of his discovery. He recognized his sarcode, however, in the polyps, and noted that the ova of the slug exhibited similar movements. The next important step was not taken until 1846, when the botanist Hugo von Mohl, working on quite independent lines, reached a clearly defined conception of the vegetable cell, not only, as usual hitherto, distinguishing the cell-wall and the nucleus from the cell contents (*Zellsaft*), but also the "tough, slimy, granular, semi-fluid" constituent from the watery cell-sap hitherto generally confused with it under the common name. For this substance (which Schleiden had already vaguely mentioned as "Schleim") he proposed the term "protoplasma" (*πρῶτος*, first, *πλάσμα*, formed substance). The discovery of the amœboid movements of colorless blood corpuscles dates from the same year, and the basis was thus prepared for Ecker's acute comparison (1849) of the "formed contractile substance" of muscle with the "unformed contractile substance" of the lowest types of animal life. This speculation, so profoundly anticipatory of our present standpoint (see PHYSIOLOGY), was greatly strengthened when Donders shortly afterwards succeeded in referring contractility from the cell-membrane to the cell-substance. Cohn's researches among microscopic plants and animals, and particularly his study of the transition, which at that time seemed so marvellous and so perplexing, from plant-like quiescence to animal-like activity, exhibited by the protoplasm of such an alga as *Protococcus* on escaping from its cell-wall, led him to suggest that vegetable protoplasm and animal sarcode, "if not identical, must be at any rate in the highest degree analogous substances." This speculation again ran too far in advance of current conceptions, dominated as these were by the errors which accompanied the cell-theory, and another decade of research was needed for its establishment. This was effected on several simultaneous and convergent lines. The botanical evidence culminated in De Bary's classical monograph of the *Myxomycetes* (1859); the study of the segmentation of the ovum, and the rapid advance of animal histology, both largely due to Kölliker, were of marked importance; while the clear identification of the vegetable "protoplasm" with the animal "sarcode," requiring, as it did, a mastery of all these lines and results of inquiry, was finally effected by M. Schultze (*q.v.*), whose researches on *Foraminifera* (1854), and subsequent admirable studies in animal histology, prepared him to accomplish the definite reform of the cell-theory. This he did by fully and finally replacing (1861–63) the early conception of the cell as an all-important membrane enclosing a nucleus surrounded by fluid by that of a unit-mass of living matter of protoplasm (the nucleus alone being viewed as essential, the wall or membrane no longer so). Our present usage of the term protoplasm for the living substance of the animal as well as of the plant dates from Schultze's paper ("Ueber Muskelkörperchen und das was man eine Zelle zu nennen habe," *Arch. f. Anat. u. Physiol.*, 1861); and the term sarcode, notwithstanding Dujardin's priority, has since lapsed into disuse, save to some extent among French authors.

This rejuvenescence of the cell theory, in a form pointing to a far deeper unity of the forms and processes of organic nature than its founders had ventured to dream, marks the commencement of a new epoch of detailed investigation of all the forms, aspects, conditions, and products of protoplasmic life; but in this movement the workers are too numerous for mention save in so far as may be incidental in the following scanty reference to some of their main results (1).[1]

§ 2. *Appearance and Properties of Protoplasm.*—To obtain a notion of the appearance and physical properties of protoplasm, it is expedient as it were to repeat the process of discovery, and acquire concrete ideas by actual observation as far as possible, or at least from good figures. The *Amœba* (see Protozoa) and the Foraminifera (*q.v.*) thus afford convenient and classical examples of the protoplasm of the lowest animal forms; the colorless corpuscles of blood should also be examined, and the structure of the higher tissues (see Anatomy and Histology) inquired into, and the segmentation of an ovum (see Reproduction) observed,—most conveniently perhaps in frog spawn. Vegetable examples are readily obtained from the cells of a growing shoot (see Botany, vol. iv. pp. 73 *sq.*, Figs. 1 and 6); while the living cells of *Chara* (Botany, Fig. 7) and other examples of protoplasmic movement should be observed. Thus, with the aid of the descriptive passages to be found in the articles referred to at the outset, a tolerably clear idea of a mass of protoplasm, with its contained granules of various kinds and its sap-vacuoles, will be obtained; and its frequent differentiation into an outer layer or ectoplasm, clearer and denser, passing into an inner layer or endoplasm, usually more fluid and granular, will be noted. A finely reticulated structure of the protoplasm may also be made out in many cases; the nucleus (inconspicuous since equally refracting with the protoplasm during life, but brought out clearly after death by the process of internal digestion of the surrounding protoplasm, or by the application of dyes and other reagents), and its contained nucleolus, as well as the cell-wall when present, will be observed. Wide variations of consistency will thus be noted from the comparatively solid, almost brittle, state of the quiescent protoplasm of some seeds to its thin, syrupy, and largely vacuolated state in a growing vegetable tissue (*cf.* Botany, Fig. 6). Such structural inquiries are now in active progress, especially in connection with the process of cell division (see Histology, Reproduction), and many questions of detail are more or less under active dispute, *e.g.*, the relation of the nucleus to the protoplasm the existence or constancy of an internal network (the "stroma") in both, the conditions of occurrence of that continuity of protoplasm lately shown to exist through the cell walls of many vegetable tissues, and so on (2).

§ 3. *Manifestations of Life* (*Functions*).—The vital properties or "functions" exhibited by undifferentiated living protoplasm (*e.g.*, *Amœba*) are usually enumerated as contractility, irritability and automatism, reception and assimilation of food, metabolism with secretion and excretion, respiration, and reproduction. Thus we have represented all those functions which in higher animals seem to be confined to special tissues—which we accordingly recognize as muscular or nervous, secretory or excretory, respiratory, reproductive or the like. Yet in these organs, however apparently specialized to one function only, a residue of all or nearly all the other fundamental properties of protoplasm remains and may be redeveloped; and thus those functional changes (necessarily accompanying morphological evolution or change of environment) which we call "adaptation" and those pathological disturbances which we term "disease" are alike provided for. See Biology, Pathology, Selection and Variation, also (3).

§ 4. *External Conditions of Life.*—See Biology.

§ 5. *Experimental Modification of the Conditions of Life.*—The behavior of protoplasm under various modifications of physical conditions has been investigated by Schultze, Kühne, Strasburger, Engelmann, and others, while not a few researches are also extant as to the behavior of living cells under various chemical stimuli, among which those of Darwin (see Insectivorous Plants) and Frommann may be mentioned as especially suggestive. See also Schizomycetes, Nutrition, and (4).

§ 6. *Chemical Composition and Processes.*—This aspect of protoplasm is of constantly increasing importance, since for the chemist all functions alike can only be viewed in terms of those specific anabolic or katabolic changes which to the physiologist, on the other hand, seem mere accompaniments of them (see Physiology, Nutrition, Reproduction). The determination of the chemical nature of protoplasm is thus the supreme problem of physiological chemistry; and, while, thanks to the labors of Reinke, E. Schultze, and others, there has been a rapidly increasing knowledge of its anastates, but more especially of its katastates, and of many cases of the unity of metabolic processes throughout nature, several daring general hypotheses are already in the field. Of these that of Schützenberger, who views proteid bodies as complex ureides, and that of Loew and Bokorny, who regard them as a complex mixture of aldehyde groups, are examples. See (5).

§ 7. *Molecular Constitution.*—Many hypotheses as to the minute structure of protoplasm have been proposed; thus Spencer resolves protoplasm into "physiological units," Haeckel into "plastitules," while Darwin accounts for heredity by reference to the properties of supposed "gemmules," Engelmann suggests the existence of "contractile units" (*isotagmen*), etc.; but those various hypotheses, framed mostly for special purposes, still await more general criticism. See (6).

§ 8. *Origin of Protoplasm.*—See Abiogenesis, Biology, Reproduction, and (7).

Bibliography.—In addition to the articles above referred to, the reader may with advantage consult the following works, from which complete bibliographical details can be obtained. (1) For general history see Sachs, *Geschichte d. Botanik*; Carus, *Geschichte d. Zoologie*; Engelmann, "Physiol. d. Protoplasma u. Flimmerbewegung," in Hermann's *Handb. d. Physiologie*, i., Leipsic, 1879; and for special his-

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(P. GE)

PROTOZOA

PROTOZOA is the name applied to the lowest grade of the animal kingdom, and originated as a translation of the German term "Urthiere." Whilst at first used some forty years ago in a vague sense, without any strict definition, so as to include on the one hand some simple organisms which are now regarded as plants and on the other some animals which are now assigned a higher place in the animal series, the term has within the last twenty years acquired a very clear signification.

The Protozoa are sharply and definitely distinguished from all the rest of the animal kingdom, which are known by the names "Metazoa" or "Enterozoa." They are those animals which are structurally single "cells" or single corpuscles of protoplasm, whereas the Enterozoa consist of many such units arranged definitely (in the first instance) in two layers —an endoderm on enteric cell-layer and an ectoderm or dermic cell-layer—around a central cavity, the enteron or common digestive cavity, which is in open communication with the exterior by a mouth.

The Protozoa are then essentially unicellular animals. The individual or person in this grade of the animal kingdom is a single cell; and, although we find Protozoa which consists of aggregates of such cells, and are entitled to be called "multicellular," yet an examination of the details of structure of these cell-aggregates and of their life-history establishes the fact that the cohesion of the cells in these instances is not an essential feature of the life of such multicellular Protozoa but a secondary and non-essential arrangement. Like the budded "persons" forming, when coherent to one another, undifferentiated "colonies" among the Polyps and Corals, the coherent cells of a compound Protozoon can be separated from one another and live independently; their cohesion has no economic significance. Each cell is precisely the counterpart of its neighbor; there is no common life, no distribution of function among special groups of the associated cells, and no corresponding differentiation of structure. As a contrast to this we find even in the simplest Enterozoa that the cells are functionally and structurally distinguishable in two groups—those which line the enteron or digestive cavity and those which form the outer body wall. The cells of these two layers are not interchangeable; they are fundamentally different in properties and structure from one another. The individual Enterozoon is not a single cell; it is an aggregate of a higher order consisting essentially of a digestive cavity around which two layers of cells are disposed. The individual Protozoon is a single cell; a number of these individuals may, as the result of the process of fission (cell-division), remain in contact with one another, but the compound individual which they thus originate has not a strong character. The constituent cells are still the more important individualities; they never become differentiated and grouped in distinct layers differing from one another in properties and structure; they never become subordinated to the individuality of the aggregate produced by their cohesion; hence we are justified in calling even these exceptional aggregated Protozoa unicellular.

By far the larger number of Protozoa are absolutely single isolated cells, which, whenever they duplicate themselves by that process of division common to these units of structure (whether existing as isolated organisms or as constituents of the tissues of plants or of animals), separate at once into two distinct individuals which move away from one another and are thenceforward strangers.

Whilst it is easy to draw the line between the Protozoa and the Enterozoa or Metazoa which lie above them, on account of the perfectly definite differentiation of the cells of the latter into two primary tissues, it is more difficult to separate the Protozoa from the parallel group of unicellular plants.

Theoretically there is no difficulty about this distinction. There is no doubt that organisms present themselves to us in two great series starting in both cases from simple unicellular forms. The one series, the plants, can take up the carbon, hydrogen, oxygen, and nitrogen necessary to build up their growing protoplasm from mineral compounds soluble in water, compounds which constitute the resting stage of those elements in the present physical conditions of our planet. Plants can take their nitrogen in the form of ammonia or in the form of nitrates and their carbon in the form of carbonic acid. Accordingly they require no mouths, no digestive apparatus; their food being soluble in water and diffusible, they absorb at all or many points of their surface. The spreading diffuse form of plants is definitely related to this fact. On the other hand the series of organisms which we distinguish as animals cannot take the nitrogen, necessary to build up their protoplasm, in a lower state of combination than it presents in the class of compounds known as albumens; nor can they take carbon in a lower state of combination than it presents when united with hydrogen or with hydrogen and oxygen to form fat, sugar, and starch. Albumens and fats are not soluble in water and diffusible; they have to be seized by the animal in the condition of more or less solid particles, and by chemical processes superinduced in the living protoplasm of the animal by the contact of these particles they are acted upon, chemically modified, and rendered diffusible. Hence the animal is provided with a mouth and a digestive cavity, and with organs of locomotion and prehension by which it may search out and appropriate its scattered nutriment. Further the albumens, fats, sugars, and starch which are the necessary food of an animal are not found in nature excepting as the products of the life of plants or of animals; accordingly all animals are in a certain sense parasitic upon either plants or other animals. It would therefore seem to be easy to draw the line between even the most minute unicellular plants, and the similarly minute unicellular animals—assigning those which feed on the albumens, etc., of other organisms by means of a mouth and digestive apparatus to the animal series, and those which can appropriate the elements of ammonia, nitrates, and carbonates to the plants.

Such absolute distinctions lending themselves to sharp definitions have, however, no place in the organic world; and this is found to be equally true whether we attempt to categorically define smaller groups in the classification of plants and animals or to indicate the boundaries of the great primary division which those familiar names imply. Closely allied to plants which are highly and specially developed as plants, and feed exclusively upon ammonia, nitrates, and carbonates, we find exceptionally modified kinds which are known as "insectivorous plants" and are provided with digestive cavities (the pitchers of pitcher-plants, etc.), and actually feed by acting chemically upon the albumens of insects which they catch in these digestive receptacles. No one would entertain for a moment the notion that these insectivorous plants should be considered as animals. The physiological definition separating plant from animal breaks down in their case; but the consideration of the probable history of their evolution as indicated by their various details of structure suffices at once to convince the most skeptical observer that they actually belong to the vegetable line of descent or family tree, though they have lost the leading physiological characteristic which has dominated the structure of other plants. In this extreme case it is made very obvious that in grouping organisms as plants or as animals we are not called upon to apply a definition but to consider the multifarious evidences of historical evolution. And we find in the case of the Protozoa and the Protophyta that the same principle holds good, although, when dealing with extremely simple forms, it becomes much more difficult to judge of the genetic relationship of an organism in proportion as the number of detailed points of possible agreement with and divergence from other forms to which it may be supposed to be related are few.

The feeding of plants upon carbonic acid is invariably accompanied by the presence of a peculiar green-coloring matter—chlorophyll. In virtue of some direct or indirect action of this chlorophyll the protoplasm of the plant is enabled to seize the carbon of the mineral world—the carbon which has sunk to the lowest resting stage of combination—and to raise it into combination with hydrogen and oxygen and ultimately with nitrogen. There are plants which have no chlorophyll and are thus unable to feed upon carbonic acid. They are none the less plants since they agree closely with particular chlorophyll-bearing plants in details of form and structure, mode of growth and reproduction. A large series of these are termed Fungi. Though unable to feed on carbonic acid, they do not feed as do animals. They can take their carbon from acetates and tartrates, which animals cannot do, and their nitrogen from ammonia. Even when it is admitted that some of these colorless plants, such as the Bacteria (Schizomycetes), can act upon albumens so as to digest them and thus nourish themselves, it is not reasonable to place the Bacteria among animals, any more than it would be reasonable so to place Nepenthes, Sarracenia, and Drosera (insectivorous Phanerogams). For the structure and mode of growth of the Bacteria is like that of well-known chlorophylligerous minute Algæ from which they undoubtedly differ only in having secondarily acquired this peculiar mode of nutrition, distinct from that which has dominated and determined the typical structure of plants.

So we find in a less striking series of instances amongst animals that here and there the nutritional arrangements which we have no hesitation in affirming to be the leading characteristic of animals, and to have directly and perhaps solely determined the great structural features of the animal line of descent, are largely modified or even altogether revolutionized. The green Hydra, the fresh-water Sponge, and some Planarian worms produce chlorophyll corpuscles in the protoplasm of their tissues just as green plants do, and are able in consequence to do what animals usually cannot do—namely, feed upon carbonic acid. The possibilities of the protoplasm of the plant and of the animal are, we are thus reminded, the same. The fact that characteristically and typically plant protoplasm exhibits one mode of activity and animal protoplasm another does not prevent the protoplasm of even a highly developed plant from asserting itself in the animal direction, or of a thoroughly characterized animal, such as the green Hydra, from putting forth its chlorophylligenous powers as though it belonged to a plant.

Hence it is not surprising that we find among the Protozoa, notwithstanding that they are characterized by the animal method of nutrition and their forms determined by the exigencies of that method, occasional instances of partial vegetable nutrition such as is implied by the development of chlorophyll in the protoplasm of a few members of the group. It would not be inconsistent with what is observed in other groups should we find that there are some unicellular organisms which must, on account of their structural resemblances to other organisms, be considered as Protozoa and yet have absolutely given up altogether the animal mode of nutrition (by the ingestion of solid albumens) and have acquired the vegetable mode of absorbing ammonia, nitrates, and carbonic acid. Experiment in this matter is extremely difficult, but such "vegetable" or "holophytic nutrition" appears to obtain in the case of many of the green Flagellata, of the Dinoflagellata, and possibly of other Protozoa.

On the other hand there is no doubt that we may fall into an error in including in the animal line of descent all unicellular organisms which nourish themselves by the inception of solid nutriment. It is conceivable that some of these are exceptional creophagous Protophytes parallel at a lower level of structure to the insectivorous Phanerogams. In all cases we have to balance the whole of the evidence and to consider probabilities as indicated by a widely-reaching consideration of numerous facts.

The mere automatic motility of unicellular organisms was at one time considered sufficient indication that such organisms were animals rather than plants. We now know that not only are the male reproductive cells of ferns and similar plants propelled by vibratile protoplasm, but such locomotive particles are recognized as common products ("swarm-spores" and "zoospores") of the lowest plants.

The danger of dogmatizing erroneously in distinguishing Protozoa from Protophyta, and the insuperable difficulty in really accomplishing the feat satisfactorily, has led at various times to the suggestion that the effort should be abandoned and a group constituted confessedly containing both unicellular plants and unicellular animals and those organisms which may be one or the other. Haeckel has proposed to call this group the Protista (1).[1] On the whole, it is more satisfactory to make the attempt to discriminate those unicellular forms which belong to the animal line of descent from those belonging to the vegetable line. It is, after all, not a matter of much consequence if the botanist should mistakenly claim a few Protozoa as plants and the zoologist a few Protophyta as animals. The evil which we have to avoid is that some small group of unattractive character should be rejected both by botanist and zoologist and thus our knowledge of it should unduly lag. Bearing this in mind the zoologist should accord recognition as Protozoa to as wide a range of unicellular organisms as he can without doing violence to his conceptions of probability.

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[1] These numbers refer to the bibliography at p. 89

A very interesting and very difficult subject of speculation forces itself on our attention when we attempt to draw the line between the lowest plants and the lowest animals, and even comes again before us when we pass in review the different forms of Protozoa.

That subject is the nature of the first protoplasm which was evolved from not-living matter on the earth's surface. Was that first protoplasm more like animal or more like vegetable protoplasm as we know it to-day? By what steps was it brought into existence?

Briefly stated the present writer's view is that the earliest protoplasm did not possess chlorophyll and therefore did *not* possess the power of feeding on carbonic acid. A conceivable state of things is that a vast amount of albuminoids and other such compounds had been brought into existence by those processes which culminated in the development of the first protoplasm, and it seems therefore likely enough that the first protoplasm fed upon these antecedent steps in its own evolution just as animals feed on organic compounds at the present day, more especially as the large creeping plasmodia of some Mycetozoa feed on vegetable refuse. It indeed seems not at all improbable that, apart from their elaborate fructification, the Mycetozoa represent more closely than any other living forms the original ancestors of the whole organic world. At subsequent stages in the history of this archaic living matter chlorophyll was evolved and the power of taking carbon from carbonic acid. The "green" plants were rendered possible by the evolution of chlorophyll, but through what ancestral forms they took origin or whether more than once, *i.e.*, by more than one branch, it is difficult even to guess. The green Flagellate Protozoa (Volvocineæ) certainly furnish a connecting point by which it is possible to link on the pedigree of green plants to the primitive protoplasm; it is noteworthy that they cannot be considered as very primitive and are indeed highly specialized forms as compared with the naked protoplasm of the Mycetozoon's plasmodium.

Thus then we are led to entertain the paradox that though the animal is dependent on the plant for its food yet the animal preceded the plant in evolution, and we look among the lower Protozoa and not among the lower Protophyta for the nearest representatives of that first protoplasm which was the result of a long and gradual evolution of chemical structure and the starting point of the development of organic form.

The Protozoon Cell-Individual compared with the Typical Cell of Animal and Vegetable Tissues.

MORPHOLOGY.

The Protozoon individual is a single corpuscle of protoplasm, varying in size when adult from less than the $\frac{1}{1000}$th of an inch in diameter (some Sporozoa and Flagellata) up to a diameter of an inch (Nummulites), and even much larger size in the plasmodia of Mycetozoa. The substance of the Protozoa exhibits the same general properties—irritability, movement, assimilation, growth, and division—and the same irremediable chemical alteration as the result of exposure to a moderate heat, which are observed in the protoplasm constituting the corpuscles known as cells which build up the tissues of the larger animals and plants. There is therefore no longer any occasion to make use of the word "sarcode" which before this identity was established was very usefully applied by Dujardin (2) to the substance which mainly forms the bodies of the Protozoa. Like the protoplasm which constitutes the "cells" of the Enterozoa and of the higher plants, that of the Protozoon body is capable of producing, by chemical processes which take place in its substance (over and above those related merely to its nutrition), a variety of distinct chemical compounds, which may form a deposit in or beyond the superficial protoplasm of the corpuscle or may accumulate centrally. These products are therefore either ectoplastic or entoplastic. The chemical capacities of protoplasm thus exhibited are very diverse, ranging from the production of a denser variety of protoplasm, probably as the result of dehydration, such as we see in the nucleus and in the cortical substance of many cells, to the chemical separation and deposition of membranes of pure chitin or of cellulose or of shells of pure calcium carbonate or quasi-crystalline needles of silica.

NUCLEUS.—The nucleus is probably universally present in the Protozoon cell, although it may have a very simple structure and be of very small size in some cases. The presence of a nucleus has recently been demonstated by means of appropriate staining reagents in some Protozoa (shell-bearing Reticularia or Foraminifera and many Mycetozoa) where it had been supposed to be wanting, but we are not yet justified in concluding absolutely that there are not some few Protozoa in which this central differentiation of the protoplasm does not exist; it is also a fact that in the young forms of some Protozoa which result from the breaking up of the body of the parent into many small "spores" there is often no nucleus present.

In contrast to this it is the fact that the cells which build up the tissues of the Enterozoa are all derived from the division of a nucleated egg-cell and the repeated division of its *nucleated* products, and are invariably nucleated. The same is true of tissue-forming plants, though there are a few of the lowest plants, such as the Bacteria. the protoplasm of which presents no nucleus. In spite of recent statements (3) it cannot be asserted that the cells or protoplasmic corpuscles of the yeast-plant (Saccharomyces) and of the hyphæ of many simple moulds contain a true nucleus. We are here brought to the question "What is a true nucleus?" The nucleus which is handed on from the egg-cell of higher plants and Enterozoa to the cells derived from it by fission has lately been shown to possess in a wide variety of instances such very striking characteristics that we may well question whether every more or less distinctly outlined mass or spherule of protoplasm which can be brought into view by coloring or other reagents, within the protoplasmic body of a Protozoon or a Protophyte, is necessarily to be considered as quite the same thing as the nucleus of tissue-forming egg-cell-derived cells.

Researches, chiefly due to Flemming (4), have shown that the nucleus in very many tissues of higher plants and animals consists of a capsule containing a plasma of "achromatin" not deeply stained by reagents, ramifying in which is a reticulum of "chromatin" consisting of fibres which readily take a deep stain (Fig. I., A). Further it is demonstrated that, when the cell is about to divide into two, definite and very remarkable movements take place in the nucleus, resulting in the disappearance of the capsule and in an arrangement of its fibres first in the form of a wreath (Fig. I., D) and subsequently (by the breaking of the loops formed by the fibres) in the form of a star (E). A further movement within the nucleus leads to an arrangement of the broken loops in two groups (F), the position of the open ends of the broken loops being reversed as compared with what previously obtained. Now the two groups diverge, and in many cases a striated appearance of the achromatin substance between the two groups of loops of chromatin is observable (H). In some cases (especially egg-cells) this striated arrangement of the achromatin substance precedes the separation of the loops (G). The striated achromatin is then termed a "nucleus-spindle," and the group of chromatin loops (Fig. I., G. *a*) is known as "the equatorial plate." At each end of the nucleus-spindle in these cases there is often seen a star consisting of granules belonging to the general protoplasm of the cell (G, *c*). These are known as "polar stars." After the separation of the two sets of loops (H) the protoplasm of the general substance of the cell becomes constricted, and division occurs, so as to include a group of chromatin loops in each of the two fission products. Each of these then rearranges itself together with the associated achromatin into a nucleus such as was present in the mother-cell to commence with. This phenomenon is termed "karyokinesis," and has been observed, as stated above, in a large variety of cells constituting tissues in the higher animals and plants.

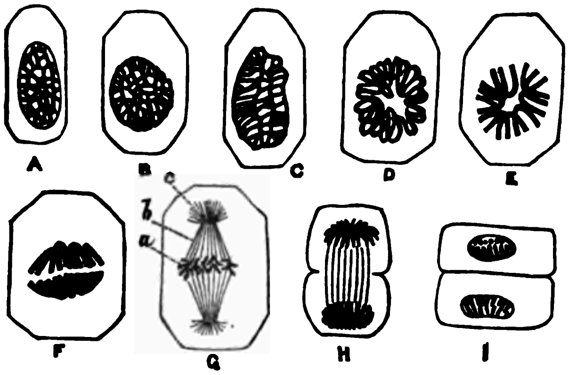

Fig. I.—Karyokinesis of a typical tissue-cell (epithelium of Salamander) after Flemming and Klein. The series from A to I represent the successive stages in the movement of the chromatin fibres during division, excepting G, which represents the "nucleus-spindle" of an egg-cell. A, resting nucleus; D, wreath-form; E, single star, the loops of the wreath being broken; F, separation of the star into two groups of U-shaped fibres; H, diaster or double star; I, completion of the cell-division and formation of two resting nuclei. In G the chromatin fibres are marked *a*, and correspond to the phase shown in F; they are in this case called the "equatorial plate"; *b*, achromatin fibres forming the nucleus-spindle; *c*, granules of the cell-protoplasm forming a "polar star." Such a polar star is seen at each end of the nucleus-spindle, and is not to be confused with the diaster H.

There is a tendency among histologists to assume that this process is carried out in all its details in the division of all cells in the higher plants and animals, and accordingly to assume that the structural differentiation of achromatin plasma and chromatin nucleus-fibres exists in the normal nucleus of every such cell. If this be true, it is necessary to note very distinctly that the nucleus of the Protozoon cell-individual by no means conforms universally to this model. As will be seen in the sequel, we find cases in which a close approach is made by the nucleus of Protozoa to this structure and to this definite series of movements during division (Fig. VIII. 3 to 12, and Fig. XXV.); and a knowledge of these phenomena has thrown light upon some appearances (conjugation of the Ciliata) which were previously misinterpreted. But there are Protozoa with a deeply-placed nucleus-like structure which does not present the typical structure above described nor the typical changes during division, but in which on the contrary the nucleus is a very simple homogeneous corpuscle or vesicle of more readily stainable protoplasm.

The difficulties of observation in this matter are great and it is proportionately rash to generalize; but it appears that we are justified at the present moment in asserting that not all the cells even of higher plants and animals exhibit in full detail the structure and movement of the typical cell-nucleus above figured and described; and accordingly the fact that such structure and movement cannot always be detected in the protozoon cell-nucleus must not be regarded as either an isolated phenomenon peculiar to such Protozoon cells, nor must it be concluded that we have only to improve our means of analysis and observation in order to detect this particular structure in all nuclei. It seems quite possible and even probable that nuclei may vary in these details and yet be true nuclei. Some nuclei which are observed in Protozoon cell-bodies may be regarded as being at a lower stage of differentiation and specialization than are those of the epithelial and embryonic cells of higher animals which exhibit typical karyokinesis. Others on the contrary, such as the nuclei of some Radiolaria (*vide infra*), are probably to be regarded as more highly developed than any tissue cell-nuclei, and will be found by further study to present special phenomena peculiar to themselves. In some of the highest Protozoa (the Ciliata) it has lately been shown that the nucleus may have no existence as such, but is actually dispersed throughout the protoplasm in the form of fine particles of chromatin-substance which stain on treatment with carmine but are in life invisible (**84**). This diffuse condition of the nuclear matter has no parallel, at present known, in tissue cells, and curiously enough occurs in certain genera of Ciliata whilst in others closely allied to them a solid single nucleus is found. The new results of histological research have necessitated a careful study of the nucleus in its various stages of growth and division in the cell-bodies of Protozoa and a comparison of the features there observed with those established as "typical" in tissue-cells. Accordingly we have placed the figure and explanation of the typical cell-nucleus in the first place in this article for subsequent reference and comparison.

Cortical Substance.—The superficial protoplasm of an embryonic cell of an Enterozoon in the course of its development into a muscular cell undergoes a change which is paralleled in many Protozoa. The cortical layer becomes dense and highly refringent as compared with the more liquid and granular medullary substance. Probably this is essentially a change in the degree of hydration of the protoplasm itself, although it may be accompanied by the deposition of metamorphic products of the protoplasm which are not chemically to be regarded as protoplasm. The differentiation of this cortical substance (which is not a frequent or striking phenomenon in tissue-cells) may be regarded as an ectoplastic (*i.e.*, peripheral) modification of the protoplasm, comparable to the entoplastic (central) modification which produces a nucleus.

The formation of "cortical substance" in the Protozoa furnishes the basis for the most important division into lower and higher forms, in this assemblage of simplest animals. A large number (the Gymnomyxa) form no cortical substance; their protoplasm is practically (excepting the nucleus) of the same character throughout. A nearly equally large number (the Corticata) develop a complete cortical layer of denser protoplasm which is distinct from the deeper medullary protoplasm. This layer is permanent, and gives to the body a definite shape and entails physiological consequences of great moment. The cortical protoplasm may exhibit further specialization of structure in connection with contractile functions (muscular).

Ectoplastic Products chemically distinct from Protoplasm.—The protoplasm of all cells may throw down as a molecular precipitate distinct from itself chemical compounds, such as chitin and horny matter and other nitrogenized bodies, or again non-nitrogenous compounds, such as cellulose. Very usually these substances are deposited not external to but *in* the superficial protoplasm. They are then spoken of as cell-cuticle if the cell bounds the free surface of a tissue, or as matrix or cell-wall in other cases. The Protozoon cell-body frequently forms such "cuticles," sometimes of the most delicate and evanescent character (as in some Amœbæ), at other times thicker and more permanent. They may give indications (though proper chemical examination is difficult) of being allied in composition to chitin or gelatin, in other instances to cellulose, which is rare in animals and usual in plants. These cuticular deposits may be absent, or may form thin envelopes or in other cases jelly-like substance intimately mixed with the protoplasm (Radiolaria). They may take the form of hooks, tubercles, or long spines, in their older and more peripheral parts free from permeation by protoplasm, though deeply formed in and interpenetrated by it. Such pellicles and cuticles, the deeper layers (if not the whole) of which are permeated by protoplasm, lead insensibly to another category of ectoplastic products in which the material produced by the protoplasm is separated from it and can be detached from or deserted by the protoplasm without any rupture of the latter. These are—

Shells and Cysts.—Such separable investments are formed by the cell-bodies of many Protozoa, a phenomenon not exhibited by tissue-cells. Even the cell-walls of the protoplasmic corpuscles of plant tissues are permeated by that protoplasm, and could not be stripped off without rupture of the protoplasm. The shell and the cyst of the Protozoon are, on the contrary, quite free from the cell-protoplasm. The shell may be of soft chitin-like substance (Gromia, etc.), of cellulose (Labyrinthula, Dinoflagellata), of calcium carbonate (Globigerina, etc.), or of silica (Clathrulina, Codonella). The term "cyst" is applied to completely closed investments ("shells" having one or more apertures), which are temporarily produced either as a protection against adverse external conditions or during the breaking up of the parent-cell into spores. Such cysts are usually horny.

Stalks.—By a localization of the products of ectoplastic activity the Protozoon cell can produce a fibre or stalk of ever-increasing length, comparable to the seta of a Chætopod worm produced on the surface of a single cell.

Entoplastic Products distinct from Protoplasm.—Without pausing here to discuss the nature of the finest granules which are embedded as a dust-cloud in the hyaline matrix of the purest protoplasm alike of Protozoa and of the cells of higher animals and plants, and leaving aside the discussion of the generalization that all protoplasm presents a reticular structure, denser trabeculæ of extreme minuteness traversing more liquid material, it is intended here merely to point to some of the coarser features of structure and chemical differentiation, characteristic of the cell-body of Protozoa.

With regard to the ultimate reticular structure of protoplasm it will suffice to state that such structure has been shown to obtain in not a few instances (*e.g.*, Lithamœba, Fig.. V.), whilst in most Protozoa the methods of microscopy at present applied have not yielded evidence of it, although it is not improbable that a recticular differentiation of the general protoplasm similar to that of the nucleus may be found to exist in all cells.

Most vegetable cells and many cells of animal tissues exhibit vacuolation of the protoplasm; *i.e.*, large spaces are present in the protoplasm occupied by a liquid which is not protoplasm and is little more than water with diffusible salts in solution. Such vacuoles are common in Protozoa. They are either permanent, gastric, or contractile.

Permanent vacuoles containing a watery fluid are sometimes so abundant as to give the protoplasm a "bubbly" structure (Thalamophora, Radiolaria, etc.), or may merely give to it a trabecular character (Trachelius, Fig. XXIV. 14, and Noctiluca, Fig. XXVI. 18). Such vacuoles may contain other matters than water, namely, special chemical secretions of the protoplasm. Of this nature are oil-drops, and from these we are led to those deposits within the cell-protoplasm which are of solid consistence (see below).

Gastric vacuoles occur in the protoplasm of most Protozoa in consequence of the taking in of a certain quantity of water with each solid particle of food, such ingestion of solid food-particles being a characteristic process bound up with their animal nature.

Contractile vacuoles are frequently but not universally observed in the protoplasm of Protozoa. They are not observed in the protoplasm of tissue-cells. The contractile vacuole whilst under observation may be seen to burst, breaking the surface of the Protozoon and discharging its liquid contents to the exterior; its walls, formed of undifferentiated protoplasm, then collapse and fuse. After a short interval it re-forms by slow accumulation of liquid at the same or a neighboring spot in the protoplasm. The liquid is separated at this point by an active process taking place in the protoplasm which probably is of an excretory nature, the separated water carrying with it nitrogenous waste-products. A similar active formation of vacuoles containing fluid is observed in a few instances (Arcella, some Amœbæ) where the protoplasm separates a gas instead of liquid, and the gas vacuole so produced appears to serve a hydrostatic function.

Corpuscular and Amorphous Entoplastic Solids.—Concretions of undetermined nature are occasionally formed within the protoplasm of Protozoon cells, as are starch and nitrogenized concretions in tissue-cells (Lithamœba, Fig. V. *conc.*). But the most important corpuscular products after the nucleus, which we have already discussed, are chlorophyll corpuscles. These are (as in plants) concavo-convex or spherical corpuscles of dense protoplasm resembling that of the nucleus, which are impregnated superficially with the green-colored substance known as chlorophyll. They multiply by fission, usually tetraschistic, independently of the general protoplasm. They occur in representatives of many different groups of Protozoa (Proteomyxa, Heliozoa, Labyrinthulidea, Flagellata, Ciliata), but are confined to a few species. Similar corpuscles or band-like structures colored by other pigments are occasionally met with (Dinoflagellata).

Recently it has been maintained (Brandt, 5) that the chlorophyll corpuscles of Protozoa and other animals are parasitic Algæ. But, though it is true that parasitic Algæ occur in animal tissues, and that probably this is the nature of the yellow cells of Radiolaria, yet there seems to be no more justification for regarding the chlorophyll corpuscles of animal tissue-cells and of Protozoa as parasites than there is for so regarding the chlorophyll corpuscles of the leaves of an ordinary green plant.

Corpuscles of starch, paramylum, and other amyloid substances are commonly formed in the Flagellata, whose nutrition is to a large extent plant-like.

Entoplastic Fibres.—A fibrillation of the protoplasm of the Protozoon cell-body may be produced by differentiation of less and more dense tracts of the protoplasm itself. But as distinct from this we find horny fibres occasionally produced within the protoplasm (Heliozoa) having definite skeletal functions. The threads produced in little cavities in the superficial protoplasm of many Ciliate Protozoa, known as trichocysts, may be mentioned here.

Entoplastic Spicules.—Needle-like bodies consisting either of silica or of a horny substance (acanthin) are produced in the protoplasm of many Protozoa (Heliozoa, Radiolaria). These are known as spicules; they may be free or held together in groups and arranged either radially or tangentially in reference to the more or less spherical body of the Protozoon. A similar production of silicious spicules is observed in the tissue-cells of Sponges. Crystals of various chemical nature (silica, calcium carbonate, oxalate, etc.) are also frequently deposited in the protoplasm of the Protozoa, differing essentially from spicules in that their shape is due purely to crystallization.

General Form of the Protozoon Cell.—Those Protozoa which have not a differentiated cortical substance, and are known as Gymnomyxa, present very generally an extreme irregularity of contour. Their protoplasm, being liquid rather than viscous, flows into the most irregular shapes. Their fundamental form when at rest is in many cases that of the sphere; others are discoidal or may be monaxial, that is to say, show a differentiation of one region or "end" of the body from the other. Frequently the protoplasm is drawn out into long threads or filaments which radiate uniformly from all parts of the spherical or discoidal cell-body or originate from one region to the exclusion of other parts of the surface.

These non-corticate Protozoa can take solid particles of food into their protoplasm, there to be digested in an extemporized "gastric vacuole," at any part or most parts of their superficies. They have no permanent cell-mouth leading into the soft protoplasm since that soft protoplasm is everywhere freely exposed.

The corticate Protozoa have (with the exception of some parasites) one, and in the Acinetaria more than one, definite aperture in the cortical substance leading into the softer medullary protoplasm. This is the cell-mouth,—morphologically as distinct from the mouth of an Enterozoon as is the hole in a drain-pipe from the front door of a house, but physiologically subserving the same distinctively animal function as does the mouth of multicellular animals. The general form of the body is in these Protozoa oblong, with either monaxial symmetry, when the mouth is terminal, or bilateral symmetry, when the body is oblong and flattened and the mouth is towards one end of what becomes by its presence the "ventral" surface. Though the protoplasm is not nakedly exposed in irregular lobes and long filaments in these corticate Protozoa so as to pick up at all points such food particles as may fall in its way, yet the protoplasm does in most Corticata project in one or more peculiarly modified fine hair-like processes from the otherwise smooth surface of the cell-body. These processes are *vibratile cilia*, identical in character with the vibratile cilia of epithelial tissue-cells of Enterozoa. They are essentially locomotor and current-producing (therefore prehensile) organs, and, whilst unable to ingest solid food-particles themselves, serve to propel the organism in search of food and to bring food into the cell-mouth by the currents which they excite. Either a single vibratile filament is present, when it is called a flagellum, or a row or many rows of cilia are developed.

Constituent cells of the Enterozoa are well known which closely resemble some of the Gymnomyxa or non-corticate Protozoa in their general form. These are the colorless blood corpuscles or lymph corpuscles or phagocytes (Mecznikow, 6) which float freely in the blood and ingest solid particles at any part of their surface as do non-corticated Protozoa; they exhibit a similar irregularity and mutability of outline, and actually digest the particles which they take in. The endodermal digestive cells of some Enterozoa (Cœlentera and Planarians) are also naked protoplasmic corpuscles and can take in solid food-particles.

No tissue-cells are known which present any close parallel to the mouth-bearing corticate Protozoa. The differentiation of the structure of a single cell has in these forms reached a very high degree, which it is not surprising to find without parallel among the units which build up the individual of a higher order known as an Enterozoon. Cilia are developed on such cell-units (ciliated epithelium), but not used for the introduction of food-particles into the cell. In rare cases (the ciliated "pots" of the vascular fluid of Sipunculus) they act so as to freely propel the ciliated cell through the liquid "blood" of the Enterozoon, as the cilia of a Protozoon propel it through water. An aperture in the cortical substance (or in the cuticular product) of a tissue-cell is sometimes to be observed, but is never (?) used for the ingestion of food particles. Such an aperture occurs in unicellular glands, where it serves as the outlet of the secretion.

PHYSIOLOGY.

Motion.—As has just been hinted, the movement of protoplasm, which in the tissue-cells of Enterozoa and higher plants is combined and directed so as to produce effects in relation to the whole organism built up of countless cells, is seen in the Protozoa in a different relation, namely, as subserving the needs of the individual cell of which the moving protoplasm is the main substance. The phenomena known in tissue-cells as "streaming" (*e.g.*, in the cells of the hairs of Tradescantia), as local contraction and change of form (*e.g.*, in the corpuscles of the cornea), as muscular contraction, and as ciliary movement are all exhibited by the protoplasm of the cell-body of Protozoa, with more or less constancy, and are intimately related to the processes of hunting, seizing, and ingesting food, and of the intercourse of the individuals of a species with one another and their evasion of hostile agencies. Granule streaming and the implied movement of currents in the protoplasm are seen in the filamentous protoplasm of the Heliozoa, Radiolaria, Reticularia, and Noctiluca, and in the cyclosis of the gastric vacuoles of Ciliata. Local contraction and change of form is seen best in the Amœbæ and some Flagellata, where it results in locomotion. Definite muscular contraction is exhibited by the protoplasmic band in the stalk of Vorticella, by the leg-like processes of the Hypotrichous Ciliata, and by the cortical substance of some large Ciliata. Ciliary movement ranging from the vibration of filaments of protoplasm temporarily evolved, up to the rhythmic beat of groups of specialized cilia, is observed in all groups of Protozoa in the young condition if not in the adult, and special varieties of ciliary movement and of cilia-like organs will be noted below. For an account of the conditions and character of protoplasmic movement generally which cannot be discussed in the present article the reader is referred to Engelmann (7).

The protoplasm of the cell-body of the Protozoa is drawn out into lobes and threads which are motile and are used as locomotive and prehensile organs. These processes are of two kinds, which are not present on the same cell and are not capable of transmutation, though there are exceptions to both of these statements. The one kind are termed "pseudopodia," and are either lobose or filamentous or branched and even reticular (Figs. IV. and IX.). The Protozoa which exhibit them are sometimes termed Myxopods. The other kind are cilia and flagella, and are simple threads which are alternately bent and straightened almost incessantly during the life of the organism. These Protozoa are termed Mastigopods. Whilst the cilia and flagella are permanent organs, the pseudopodia vary greatly in character; they are in some cases rapidly expanded and withdrawn in irregular form, and can hardly be said to be more than lobose protuberances of the flowing moving mass of protoplasm. In other cases they are comparatively permanent stiff threads of protoplasm which can be contracted and can fuse with one another but rarely do so (Heliozoa, Radiolaria). Between these extreme forms of "pseudopodia" there are numerous intermediate varieties, and the whole protoplasmic body of the Protozoon may even assume the form of a slowly changing network of threads of greater or less tenuity (Chlamydomyxa, Fig. VI.).

Nutrition.—Typically—that is to say, by determinate hereditary tendency—the Protozoa take solid food particles into their protoplasm which form and occupy with the water surrounding them "gastric vacuoles" in the protoplasm. The food-particle is digested in this vacuole, by what chemical processes is not ascertained. It has been shown that the contents of the gastric vacuole give in some cases an acid reaction, and it is not improbable that free acid is secreted by the surrounding protoplasm. It is not known whether any ferment[1] is separated by the protoplasm, but it is probable from observations made on the digestive process of Cœlentera (Actiniæ) that the ferment is not separated, but that actual contact of the food-particle with the protoplasm is necessary for a "ferment influence" to be exerted. The digestion of a food-particle by a Protozoon is intra-cellular, and has been contrasted with the cavitary digestion of higher animals. In the latter, ferments and acids are poured out by the cells bounding the enteric cavity into that space, and digestion is extra-cellular. In the lowest Enterozoa

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[1] The digestive ferment pepsin has been detected by Krukenberg in the plasmodium of the Mycetozoon Fuligo (flowers of tan). See on this subject Zopf (13), p. 88.

(many Cœlentera and some Planarian worms) it has been shown that food-particles are actually taken up in a solid state by the soft protoplasm of the enteric cells and thus subjected to intra-cellular digestion. There appears to be a gradual transition from this process, in which close contact with living protoplasm is necessary that the solution of an albuminous food-particle may be effected, onwards to the perfectly free cavitary digestion by means of secretions accumulated in the enteron.

We have not yet any satisfactory observations on the chemistry of intra-cellular digestion either of Protozoa or of Cœlentera.

Certain Protozoa which are parasitic do not take solid food particles; they (like higher parasites, such as the Tapeworms) live in the nutritious juices of other animals and absorb these by their general surface in a liquid state. The Gregarinæ (Sporozoa), many Ciliata, etc., are in this case. Other Protozoa are known which are provided with chlorophyll corpuscles and do not take in solid food, but, apparently as a result of exceptional adaptation in which they differ from closely-allied forms, nourish themselves as do green plants. Such are the Volvocinean Flagellata and some of the Dinoflagellata. It has also been asserted that other Protozoa (viz., some Ciliata)—even some which possess a well-developed mouth—can (and experimentally have been made to) nourish themselves on nitrogenous compounds of a lower grade than albumens—such, for instance, as ammonium tartrate. Any such assertions must be viewed with the keenest skepticism, since experimental demonstrations of the absence of minute albuminous particles (*e.g.*, Bacteria) from a solution of ammonium tartrate in which Ciliate Protozoa are flourishing is a matter of extreme difficulty and has not yet been effected.

Undigested food-remnants are expelled by the protoplasm of the Protozoon cell either at any point of the surface or by the cell-mouth or by a special cell-anus (some Ciliata, see Fig. XXIV. 22).

Respiration and Excretion.—The protoplasm of the Protozoa respires, that is, takes up oxygen and liberates carbonic acid, and can readily be shown experimentally to require a supply of oxygen for the manifestation of its activity. No special respiratory structures are developed in any Protozoa, and as a rule also the products of oxidation appear to be washed out and removed from the protoplasm without the existence of any special apparatus. The contractile vacuole which exists in so many Protozoa appears, however, to be an excretory organ. It has been shown to rapidly excrete in a state of solution coloring matters (anilin blue) which have been administered with food particles (**8**). No evidence has been adduced to show whether traces of nitrogenous waste-products are present in the water expelled by the contractile vacuole.

Chemical Metamorphosis.—The form which the various products of the activity of the Protozoon's protoplasm may assume has been noted above. It will be sufficient here to point out that the range of chemical capacities is quite as great as in the cells of the higher Enterozoa. Chitin, cellulose, silicon, calcium carbonate, fats, pigments, and gases can be both deposited and absorbed by it. Owing to the minuteness of the Protozoa, we are at present unable to recognize and do justice to the variety of chemical bodies which undoubtedly must play a part in their economy as the the result of the manufacturing activity of their protoplasm. See, however, Zopf (**13**), p. 71.

Growth and Reproduction.—The Protozoon cell follows the same course as tissue-cells, in that by assimilation of nutriment its protoplasm increases in volume and reaches a certain bulk, when its cohesion fails and the viscid droplet divides into two. The coefficient of cohesion varies in different genera and species, but sooner or later the disrupting forces lead to division, and thus to multiplication of individuals or reproduction. The phenomena connected with the division of the nucleus (already alluded to) will be noticed in particular cases below.

Whilst simple binary division is almost without exception a chief method of reproduction among the Protozoa, it is also very usual, and probably this would be found if our knowledge were complete to have few exceptions, that under given conditions the Protozoon breaks up rapidly into many (from ten to a hundred or more) little pieces, each of which leads an independent life and grows to the form and size of its parent. It will then multiply by binary division, some of the products of which division will in their turn divide into small fragments. The small fragments are called "spores." Usually the Protozoon before breaking up into spores forms a "cyst" (see above) around itself. Frequently, but not as a necessary rule, two (rarely three or more) Protozoon cell-individuals come together and fuse into one mass before breaking up into spores. This process is known as "conjugation;" and there can be no doubt that the physiological significance of the process is similar to that of sexual fertilization, namely that the new spores are not merely fragments of an old individual but are something totally new inasmuch as they consist of a combination of the substance of individuals who have had different life experiences.

Whilst spore-formation is not necessarily preceded by conjugation, conjugation is not necessarily followed by spore-formation. Among the Mycetozoa the young individuals produced from spores conjugate at a very early period of growth in numbers and form "plasmodia," and after a considerable interval of feeding and growth the formation of spores takes place. Still more remarkable is the fact observed among the Ciliata where two individuals conjugate and after a brief fusion and mixture of their respective protoplasm separate, neither individual (as far as certain genera at least are concerned) breaking up into spores, but simply resuming the process of growth and recurrent binary division with increased vigor.

There is certainly no marked line to be drawn between reproduction by simple fission and reproduction by spore-formation; both are a more or less complete dividing of the parent protoplasm into separate masses; whether the products of the first fission are allowed to nourish themselves and grow before further fission is carried out or not does not constitute an essential difference. The fission of the Ciliate Protozoon, Opalina (see below Fig. XXIV. 4–8), is a step from the ordinary process of delayed binary division towards spore-formation. In some Protozoa spores are produced after encystation by a perfectly regular process of cleavage (comparable to the cleavage of the egg-cell of Enterozoa)—first two, then four, then eight, sixteen, and thirty-two fission products being the result (see Fig. XX. 24, 25, etc.).

But more usually there is a hastening of the process, and in these cases it is by no means clear what part the parent cell-nucleus takes. An encysted Gregarina (or two conjugated Gregarinæ) suddenly breaks up into a number of equal-sized spores, which do not increase in number by binary division and have not been formed by any such process. This multicentral segregation of the parent protoplasm is a marked development of the phenomenon of sporulation and remote from ordinary cell-division. How it is related to ordinary cell-division is not known, inasmuch as the changes undergone by the nucleus in this rapid multicentral segregation of the parent protoplasm have not been determined. The spores of Protozoa may be naked or encased singly or in groups in little envelopes, usually of a firm horny substance (see Fig. XX. 23 to 26, and Fig. XXIV. 15 to 18). Whenever the whole or a part of a Protozoon cell divides rapidly into a number of equal-sized pieces which are simultaneously set free and are destined to reproduce the adult form, the term spore is applied to such pieces, but the details of their formation may vary and also those of their subsequent history.

In typical cases each spore produced as the result of the fission of an encysted Protozoon (conjugated or single) has its own protective envelope, as in the Mycetozoa (Fig. III.) and the Sporozoa (Fig. XVIII.), from which the contained protoplasm escapes by "germination" as a naked corpuscle either flagellate or amœbiform. In some terminologies the word "spore" is limited to such a "coated" spore, but usually the naked protoplasmic particles which issue from such "coated" spores, or are formed directly by the rapid fission of the parent Protozoon, are also called "spores." The former condition is distinguished as a "chlamydospore," whilst the latter are termed "gymnospores." Many Protozoa produce gymnospores directly by the breaking up of their protoplasm, and these are either "flagellulæ" (swarm-spores) or "amœbulæ" (creeping spores). The production of coated spores is more usual among the lower plants than it is among Protozoa, but is nevertheless a characteristic feature of the Gregarinæ (Sporozoa) and of the Mycetozoa. The term "gemma" or "bud-spore" is applied to cases, few in number, where (as in Acinetaria, Fig. XXVI., Spirochona, Fig. XXIII. 10, and Reticularia, Fig. X. 8) the spores are gradually nipped off from the parent-cell one or more at a time.. This process differs from ordinary cell-division only in the facts (1) that the products of division are of unequal size—the parent-cell being distinguishable as the larger and more complete in structure, and (2) that usually the division is not binary, but more than one bud-spore is produced at a time.

Whilst in the binary cell-division of the Protozoa the two products are usually complete in structure at the period of separation, spores and spore-buds are not only of small size and therefore subject to growth before attaining the likeness of the parent, but they are also very often of simple and incomplete structure. The gap in this respect between the young spore and its parent necessarily varies according to the complexity of the parental form.

In the case of the Radiolaria, of the Gregarinæ, of Noctiluca, and of the Acinetaria, for instance, the spore has before it a considerable process of development in structure and not merely of growth, before attaining the adult characters. Hence there is a possible embryology of the Protozoa, to the study of which the same principles are applicable as are recognized in the study of the embryology of Enterozoa. Embryonic forms of great simplicity of structure, often devoid of nucleus, and consisting of simple elongate particles of protoplasm, are hatched from the spore-cases of the Gregarinæ (Fig. XVII. 13, 14). These gradually acquire a differentiated cortical protoplasm and a nucleus. A very large number of Gymnomyxa produce spores which are termed "monadiform," that is, have a single or sometimes two filaments of vibratile protoplasm extended from their otherwise structureless bodies. By the lashing of these flagella the spores (swarm-spores or zoospores) are propelled through the water. The resemblance of these monadiform young (best-called "flagellulæ") to the adult forms known as Flagellata has led to the suggestion that we have in them a case of recapitulative development, and that the ancestors of the Gymnomyxa were Protozoa similar to the Flagellata. Again the Acinetaria produce spores which are uniformly clothed with numerous vibratile cilia (Fig. XXVI.), although the adults are entirely devoid of such structures; this is accounted for by the supposition that the Acinetaria have been developed from ancestors like the Ciliata, whose characters are thus perpetuated in their embryonic stages. There can be little doubt that these embryological suggestions are on the whole justified and that the nucleated Protozoa are the descendants of non-nucleated forms similar to the spores of Gymnomyxa and Sporozoa, whilst it seems also extremely probable that the ancestral Protozoa were neither exclusively amœboid in the movement of their protoplasm nor provided with permanent vibratile filaments (flagella and cilia); they were neither Myxopods nor Mastigopods (to use the terms which have been introduced to express this difference in the character of the locomotor processes), but the same individuals were capable of throwing out their protoplasm sometimes in the form of flowing lobes and networks, sometimes in the form of vibratile flagella. A few such indifferentiated forms exist at the present day among the Proteomyxa and in a little more advanced condition among the lowest Flagellata, *e.g.*, Ciliophrys.

Death.—It results from the constitution of the Protozoon body as a single cell and its method of multiplication by fission that death has no place as a natural recurrent phenomenon among these organisms. Among the Enterozoa certain cells are separated from the rest of the constituent units of the body as egg-cells and sperm-cells; these conjugate and continue to live, whilst the remaining cells, the mere carriers as it were of the immortal reproductive cells, die and disintegrate. There being no carrying cells which surround, feed, and nurse the reproductive cells of Protozoa, but the reproductive cell being itself and alone the individual Protozoon, there is nothing to die, nothing to be cast off by the reproductive cell when entering on a new career of fission. The bodies of the higher animals which die may from this point of view be regarded as something temporary and non-essential, destined merely to carry for a time, to nurse, and to nourish the more important and deathless fission products of the unicellular egg. Some of these fission-products of the new individual developed from an egg-cell—namely, the egg-cells and sperm-cells—are as immortal as the unicellular Protozoon. This method of comparing the unicellular and the multicellular organism is exceedingly suggestive, and the conception we thus gain of the individuality of the Enterozoon throws light upon the phenomena of reproduction and heredity in those higher organisms.

Experiment and observation in this matter are extremely difficult; but we have no reason to suppose that there is any inherent limit to the process of nutrition, growth, and fission, by which continuously the Protozoa are propagated. The act of conjugation from time to time confers upon the protoplasm of a given line of descent new properties, and apparently new vigor. Where it is not followed by a breaking up of the conjugated cells into spores, but by separation and renewed binary fission (Ciliata), the result is described simply as "rejuvenescence." The protoplasm originated by the successive division of substance traceable to one parent cell has become specialized, and in fact too closely adapted to one series of life-conditions; a fusion of substance with another mass of protoplasm equally specialized, but by experience of a somewhat differing character, imparts to the resulting mixture a new combination of properties, and the conjugated individuals on separation start once more on their deathless career with renewed youth.

CLASSIFICATION OF THE PROTOZOA.

In attempting a scheme of classification it would be most in accordance with the accepted probabilities of the ancestral history of the Protozoa to separate altogether those forms devoid of a nucleus from those which possess one, and to regard them as a lower "grade" of evolution or differentiation of structure.

By some systematists, notably Bütschli (9), the presence or absence of a nucleus has not been admitted as a basis of classificatory distinction, whilst on the other hand both Haeckel (1) and Huxley (10) have insisted on its importance.

The fact is that during recent years many of those Protozoa which were at one time supposed to be devoid of nucleus even in a rudimentary form, and furnished therefore the tangible basis for a lowest group of "Protozoa Homogenea" or "Monera," have been shown by the application of improved methods of microscopic investigation to possess a nucleus, that is to say, a differentiated corpuscle of denser protoplasm lying within the general protoplasm, and capable when the organism is killed by alcohol or weak acids of taking up the color of various dyes (such as carmine and hæmatoxylin) more readily and permanently than is the general protoplasm. In such cases the nucleus may be very small and exhibit none of the typical structure of larger nuclei. It is usually surrounded by a clear (*i.e.*, non-granular) halo of the general protoplasm which assists the observer in its detection. Nuclei have been discovered in many Reticularia (Foraminifera), a group in which they were supposed to be wanting, by Schultze (**11**) and the Hertwigs (**12**) and more recently in the Mycetozoa and in Vampyrella and Protomonas (Zopf, **13**), where so excellent an observer as Cienkowski had missed them.

It seems therefore not improbable that a nucleus is present though not observed in Protomyxa, Myxastrum, and other similar forms which have been by Haeckel and others classed as "Monera" or "Homogenea." The recently described (**14**) Archerina (Fig. II. 8, 11) certainly possesses no nucleus in the usual sense of that term, but it is possible that the chlorophyll-colored corpuscles of that organism should be considered as actually representing the nucleus. Whilst then refraining from asserting that there are no existing Protozoa devoid of nucleus corresponding in this character with non-nucleate Protophyta, such as the Bacteria, we shall not in our scheme of classification institute a group of Homogenea, but shall leave the taking of that step until it has been shown after critical examination that those forms now regarded by some observers as Homogenea are really so. In the meantime these forms will find their places alongside of the Nucleata most nearly allied to them in other characters.

The Protozoa with a definite permanent cortical substance of differentiated protoplasm are undoubtedly to be regarded as evolved from forms devoid of such differentiation of their substance, and we accordingly take this feature as the indication of a primary division of the Protozoa.[1] The lower grade, the Gymnomyxa, afford in other respects evidence of their being nearly related to the ancestral forms from which the Corticata (the higher grade) have developed. The Gymnomyxa all or nearly all, whilst exhibiting amœboid movement and the flowing of their protoplasm into "pseudopodia" of very varied shapes, produce spores which swim by means of one or two flagella of vibratile protoplasm (monadiform young or flagellulæ). These flagellate young forms are closely related to the Flagellata, a group of the Corticata from which it seems probable that the Dinoflagellata, the Ciliata, and the Acinetaria have been derived. The Gymnomyxa themselves cannot, on account of the small number of structural features which they offer as indications of affinity and divergence in genetic relationships *inter se*, be classified with anything like confidence in a genealogical system. We are obliged frankly to abandon the attempt to associate some of the simpler forms with their nearest genetic allies and to content ourselves with a more or less artificial system, which is not, however, artificial in so far as its main groups are concerned. Thus the genetic solidarity of each of the large classes Heliozoa, Reticularia, Mycetozoa, and Radiolaria is not open to question. The Lobosa on the other hand appear to be a more artificial assemblage, and it is difficult to say that genetically there is any wide separation between them and the Mycetozoa or between the Mycetozoa and some of the simpler forms which we bring together under the class Proteomyxa.

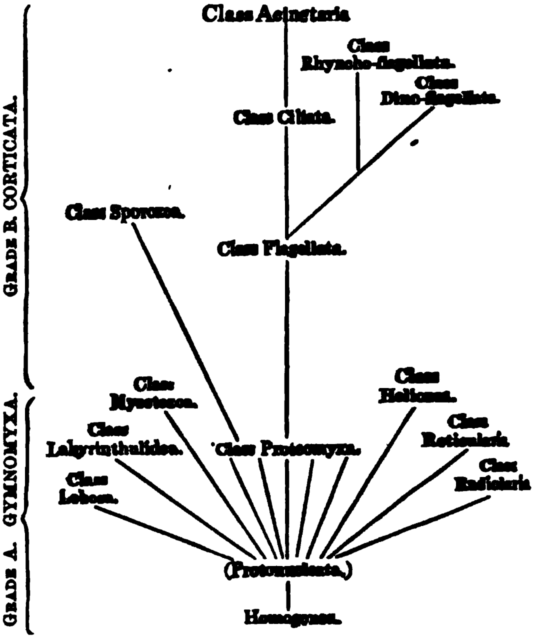
The scheme of classification which we adopt is the following:

PROTOZOA.

Sections.	GRADE A. *GYMNOMYXA.*
Proteana	Class I. PROTEOMYXA. Ex. *Vampyrella, Protomyxa, Archerina.*
Plasmodiata.	Class II. MYCETOZOA. Ex. The *Eu-mycetozoa* of Zopf.
Lobosa.	Class III. LOBOSA. Ex. *Amœba, Arcella, Pelomyxa.*
Filosa.	Class IV. LABYRINTHULIDEA. Ex. *Labyrinthula, Chlamydomyxa.* Class V. HELIOZOA. Ex. *Actinophrys, Raphidiophrys, Clathrulina.* Class VI. RETICULARIA. Ex. *Gromia, Lituola, Astrorhiza, Globigerina.* Class VII. RADIOLARIA. Ex. *Thalassicolla, Eucyrtidium, Acanthometra.*

	GRADE B. *CORTICATA.*
Lipostoma.	Class I. SPOROZOA. Ex. *Gregarina, Coccidium.*
Stomatophora.	Class II. FLAGELLATA. Ex. *Monas, Salpingœca, Euglena, Volvox.* Class III. DINOFLAGELLATA. Ex. *Prorocentrum, Ceratium.* Class IV. RHYNCHOFLAGELLATA. Ex. *Noctiluca.* Class V. CILIATA. Ex. *Vorticella, Paramœcium, Stentor.* Class VI. ACINETARIA. Ex. *Acineta, Dendrosoma.*

The genetic relationships which probably obtain among these groups may be indicated by the following diagram:



Literature.—Certain works of an older date dealing with microscopic organisms, and therefore including many Protozoa, have historical interest. Among these we may cite O. F. Müller, *Animalcula Infusoria*, 1786; Ehrenberg, *Infusionsthierchen*, 1838; Dujardin, *Histoire naturelle des Infusoires*, 1841; Pritchard, *Infusoria*, 1857.

The general questions relating to protoplasm and to the constitution of the Protozoon body as a single cell are dealt with in the following more recent treatises: **Max Schultze**, *Ueber den Organismus der Polythalamien*, 1854, and *Ueber das Protoplasma der Rhizopoden und Pflanzenzellen*, 1863; and Engelmann, article "Protoplasma" in Hermann's *Handwörterbuch der Physiologie*, 1880.

Special works of recent date in which the whole or large groups of Protozoa are dealt with in a systematic manner with illustrations of the chief known forms are the following: Bütschli, "Protozoa," in Bronn's *Classen und Ordnungen des Thierreichs*, a comprehensive and richly illustrated treatise now in course of publication, forming the most exhaustive account of the subject matter of the present article which has been attempted (the writer desires to express his obligation to this work, from the plates of which a large proportion of the woodcut figures here introduced have been selected); W. S. Kent, *Manual of the Infusoria*, 1882—an exhaustive treatise including figures and descriptions of all species of Flagellata, Dinoflagellata, Ciliata, and Acinetaria; Stein, *Der Organismus der Infusionsthiere*, 1867-1882; Haeckel, *Die Radiolarien*, 1862; Archer, "Résumé of recent contributions to our knowledge of freshwater Rhizopoda," *Quart. Jour. of Microscopical Science*, 1876-77; Zopf, "Pilzthiere" (Mycetozoa), in *Encyklopädie der Naturwissenschaften*, Breslau, 1884.

We shall now proceed to consider the classes and orders of Protozoa in detail.

PROTOZOA.

Characters.—Organisms consisting of a single cell or of a group of cells not differentiated into two or more tissues; incapable of assimilating nitrogen in its diffusible compounds (ammonia or nitrates) or carbon in the form of carbonates, except in special instances which there is reason to regard as directly derived from allied forms not possessing this capacity. The food of the Protozoa is in consequence as a rule taken in the form of particles into the protoplasm either by a specialized mouth or by any part of the naked cell-substance, there to be digested and rendered diffusible.

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[1] The "exoplasm" and "endoplasm" described in Amœbæ, etc., by some authors are not distinct layers but one and the same continuous substance—what was internal at one moment becoming external at another, no really structural difference existing between them.

GRADE A. *GYMNOMYXA*, Lankester, 1878 (64).

Characters.—Protozoa in which the cell-protoplasm is entirely or partially exposed to the surrounding medium, during the active vegetative phase of the life-history, as a naked undifferentiated slime or viscous fluid, which throws itself into processes or "pseudopodia" of various form either rapidly changing or relatively constant. Food can be taken into the protoplasm in the form of solid particles at any point of its surface or at any point of a large exposed area. The distinction into so-called "exoplasm" and "endoplasm" recognized by some authors, is *not* founded on a permanent differentiation of substance corresponding to the cortical and medullary substance of Corticata, but is merely due to the centripetal aggregation of granules lying in a uniform undifferentiated protoplasm. The cell-individual exhibits itself under four phases of growth and development—(1) as a swarm-spore (monadiform young or flagellula); (2) as an amœba form; (3) as constituent of a plasmodium or cell-fusion or conjugation; (4) as a cyst, which may be a flagellula (Schwärme)-producing cyst, an amœbula-producing cyst, a covered-spore(chlamydospore)-producing cyst (sporocyst *sens. stric.*, Zopf), or a simple resting cyst which does not exhibit any fission of its contents (hypnocyst). Any one of these phases may be greatly predominant and specialized whilst the others are relatively unimportant and rapidly passed through.

CLASS I. **PROTEOMYXA**, Lankester.

Characters—Gymnomyxa which exhibit in the amœba phase various forms of pseudopodia often changing in the same individual, and do not produce elaborate spore cysts; hence they are not referable to any one of the subsequent six classes. Mostly minute forms, with small inconspicuous nucleus (absent in some?).

A division into orders and families is not desirable, the group being confessedly an assemblage of negatively characterized or insufficiently known forms.

Genera.—*Vampyrella*, Cienkowski (15); *Vampyrellidium*, Zopf (13); *Spirophora*, Zopf (= *Amœba radiosa*, Perty); *Haplococcus*, Zopf; *Leptophrys*, Hertwig and Lesser (16); *Endyomena*, Zopf; *Bursulla*, Sorokin (17); *Myxastrum*, Haeckel (1); *Enteromyxa*, Cienkowski (18); *Colpodella*, Cienkowski (19); *Pseudospora*, Cienkowski (20); *Protomonas*, Cienkowski (15); *Diplophysalis*, Zopf (13); *Gymnococcus*, Zopf; *Aphelidium*, Zopf; *Pseudosporidium*, Zopf; *Protomyxa*, Haeckel (1); *Plasmodiophora*, Woronin (21); *Tetramyxa*, Göbel (22); *Gloidium*, Sorokin (23); *Gymnophrys*, Cienkowski (24); *Myxodictyum*, Haeckel (1); *Boderia*, Wright (25); *Biomyxa*, Leidy (32); *Protogenes*, Haeckel (1); *Protamœba*, Haeckel (1); *Nuclearia*, Cienkowski (26); *Monobia*, Aim. Schneider (27); *Archerina*, Lankester, (14).

The forms here brought together include several genera (the first nineteen) referred by Zopf to the Mycetozoa, some again (Vampyrella, Myxastrum, Nuclearia, Monobia) which are by Bütschli associated with the Heliozoa, others (Protamœba, Gloidium) referred by the same authority to the Lobosa (Amœbæa) and others (Colpodella, Protomonas) which might be grouped with the lower Flagellata. By grouping them in the manner here adopted we are enabled to characterize those higher groups more satisfactorily, and to give a just expression to our present want of that knowledge of the life history both of these forms and of the higher Gymnomyxa which when it is obtained may enable us to disperse this heterogeneous class of Proteomyxa. The group has the same function in relation to the other classes of Gymnomyxa which the group Vermes has been made to discharge in relation to the better defined phyla of the Metazoa; it is a lumber-room in which obscure, lowly-developed, and insufficiently known forms may be kept until they can be otherwise dealt with.

It is true that, thanks to the researches of Continental botanists (especially Cienkowski and Zopf), we know the life-history of several of these organisms; but we are none the less unable to connect them by tangible characteristics with other Gymnomyxa.

Nearly all of the above-named genera are parasitic rather than "voracious," that is to say, they feed on the organized products of larger organisms both plants and animals (Haplococcus is parasitic in the muscles of the pig), into whose tissues they penetrate, and do not, except in a few cases (Protomyxa, Vampyrella), engulph whole organisms, such as Diatoms, etc., in their protoplasm. Many live upon and among the putrefying debris of other organisms (*e.g.*, rotting vegetable stems and leaves, excrements of animals), and like the Mycetozoa exert a digestive action upon the substances with which they come in contact comparable to the putrefying and fermentative activity of the Schizomycetes (Bacteria).

Fig. II. illustrates four chief genera of Proteomyxa.

Protomyxa aurantiaca was described by Haeckel (1), who found it on shells of Spirula on the coast of the Canary Islands, in the form of orange yellow flakes consisting of branching and reticular protoplasm nourishing itself by the ingestion of Diatoms and Peridinia. This condition is not a simple amœba phase but a "plasmodium" formed by the union of several young amœbæ. The plasmodium under certain conditions draws itself together into a spherical form and secretes a clear membranous cyst around itself, and then breaks up into some hundreds of flagellulæ or swarm-spores (Fig. II. 2). The diameter of the cyst is .12 to .2 millimetre. The flagellulæ subsequently escape (Fig. II. 3) and swim by the vibratile movement of one end which is drawn out in the form of a coarse flagellum. The swarm-spore now passes into the amœba phase (Fig. II. 4). Several of the small amœbæ creeping on the surface of the spirula-shell then unite with one another and form a plasmodium which continues to nourish itself by "voracious" inception of Diatoms and other small organisms. The plasmodia may attain a diameter of one millimetre and be visible by the naked eye.

A nucleus was not observed by Haeckel in the spores nor in the amœba phase, nor scattered nuclei in the plasmodium, but it is not improbable that they exist and escaped detection in the living condition, in consequence of their not being searched for by methods of staining, etc., which have since come into use. A contractile vacuole does not exist.

Vampyrella spirogyræ, Cienkowski (Fig. II. 5, 6, 7), is one of several species assigned to the genus Vampyrella, all of which feed upon the living cells of plants. The nucleus previously stated to be absent has been detected by Zopf (13). There is no contractile vacuole. The amœba phase has an actinophryd character (*i.e.*, exhibits fine radiating pseudopodia resembling those of the sun-animalcule, Actinophrys, one of the Heliozoa). This species feeds exclusively upon the contents of the cells of Spirogyra, effecting an entrance through the cell-wall (Fig. II. 5), sucking out the contents, and then creeping on to the next cell. In some species of Vampyrella as many as four amœba-individuals have been observed to fuse to form a small plasmodium. Cysts are formed which enclose in this species a single amœba-individual. The cyst often acquires a second or third inner cyst membrane by the shrinking of the protoplasmic body after the first encystment and the subsequent formation of a new membrane. The encysted protoplasm sometimes merely divides into four parts each of which creeps out of the cyst as an Actinophrys-like amœba (Fig. II. 7); in other instances it forms a dense spore, the product of which is not known.

Protogenes primordialis is the name given by Haeckel to a very simple form with radiating filamentous pseudopodia which he observed in sea-water. It appears to be the same organism as that described and figured by Max Schultze as *Amœba porrecta*. Schultze's figure is copied in Fig. II. 12. No nucleus and no contractile vacuole is observed in this form. It feeds voraciously on smaller organisms. Its life-history has not been followed over even a few steps. Hence we must for the present doubt altogether as to its true affinities. Possibly it is only a detached portion of the protoplasm of a larger nucleate Gymnomyxon. The same kind of doubt is justified in regard to Haeckel's *Protamœba primitiva*, which was observed by him in pond water and differs from Protogenes in having lobose pseudopodia, whilst agreeing with it in absence of nuclei, contractile vacuoles, and other differentiation of structure.

The structureless protoplasmic network described by Haeckel from spirit-preserved specimens of Atlantic ooze and identified by him with Huxley's (28) Bathybius, as also the similar network described by Bessels (29) as Protobathybius, must be regarded for the present as insufficiently known.

It is possible that these appearances observed in the ooze dredged from great depths in the Atlantic are really due to simple Protozoa. On the other hand it has been asserted by Sir Wyville Thomson, who at one time believed in the independent organic nature of Bathybius, that the substance taken for protoplasm by both Huxley and Haeckel is in reality a gelatinous precipitate of calcium sulphate thrown down by the action of alcohol upon sea-water. Other naturalists have pointed to the possibility of the protoplasmic network which Bessels studied in the living condition on board ship being detached portions of the protoplasm of

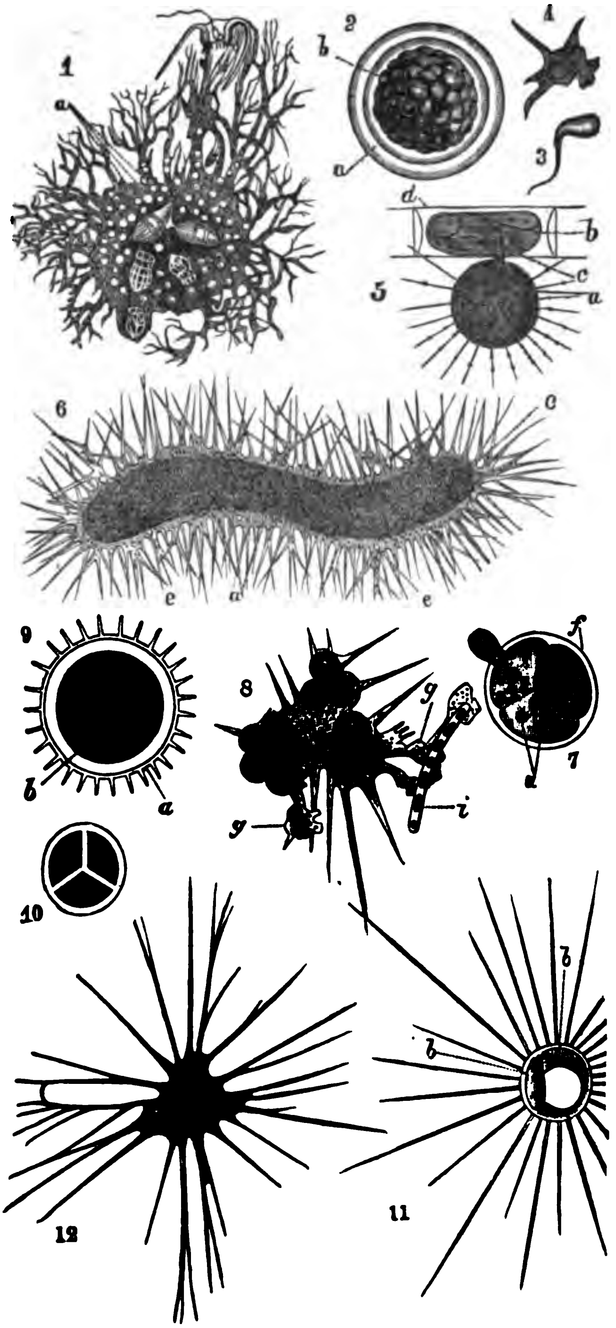


FIG. II.—Various **Proteomyxa.** 1. *Protomyxa aurantiaca*, Haeckel, plasmodium phase. The naked protoplasm shows branched reticulate processes (pseudopodia), and numerous non-contractile vacuoles. It is in the act of engulphing a Ceratium. Shells of engulphed Ciliata (Tintinnabula) are embedded deeply in the protoplasm *a*. 2. Cyst phase of Protomyxa. *a*, transparent cyst-wall; *b*, protoplasm broken up into spores. 3. Flagellula phase of Protomyxa, the form assumed by the spores on their escape from the cyst. 4. Amœbula phase of the same, the form assumed after a short period by the flagellulæ. 5. *Vampyrella spirogyræ*, Cienk., amœba phase penetrating a cell of Spirogyra *b*, by a process of its protoplasm *c*, and taking up the substance of the Spirogyra cell, some of which is seen within the Vampyrella *a*. 6. Large individual of Vampyrella, showing pseudopodia *e*, and food particles *a*. The nucleus (though present) is not shown in this drawing. 7. Cyst phase of Vampyrella. The contents of the cysts have divided into four equal parts, of which three are visible. One is commencing to break its way through the cyst-wall *f*; *a*, food particles. 8. *Archerina Boltoni*, Lankester, showing lobose and filamentous protoplasm, and three groups of chlorophyll corpuscles. The protoplasm *g* is engulphing a Bacterium *i*. 9. Cyst phase of Archerina. *a*, spinous cyst-wall; *b*, green-colored contents. 10. Chlorophyll corpuscle of Archerina showing tetraschistic division. 11. Actinophryd form of Archerina. *b*, chlorophyll corpuscles. 12. *Protogenes primordialis*, Haeckel (*Amœba porrecta*, M. Schultze), from Schultze's figure.

Reticularia and Radiolaria. The matter is one which requires further investigation.

Archerina Boltoni is the name given by Lankester (14) to a very simple Gymnomyxon inhabiting fresh-water ponds in company with Desmids and other simple green Algæ (Fig. II. 8 to 11). Archerina exhibits an amœba phase in which the protoplasm is thrown into long stiff filaments (Fig. II. 11), surrounding a spherical central mass about $\frac{1}{1000}$th inch in diameter (actinophryd form). A large vacuole (non-contractile) is present, or two or three small ones. No nucleus can be detected by careful use of reagents in this or other phases. The protoplasm has been seen to ingest solid food particles (Bacteria) and to assume a lobose form. The most striking characteristic of Archerina is the possession of chlorophyll corpuscles. In the actinophryd form two oval green-colored bodies (*b*, *b*) are seen. As the protoplasm increases by nutrition the chlorophyll corpuscles multiply by quaternary division (Fig. II. 10) and form groups of four or of four sets of four symmetrically arranged. The division of the chlorophyll corpuscles is not necessarily followed by that of the protoplasm, and accordingly specimens are found with many chlorophyll corpuscles embedded in a large growth of protoplasm (Fig. II. 8); the growth may increase to a considerable size, numbering some hundreds of chlorophyll corpuscles, and a proportionate development of protoplasm. Such a growth is not a plasmodium, that is to say, is not formed by fusion of independent amœba forms, but is due to continuous growth. When nutrition fails the individual chlorophyll corpuscles separate, each carrying with it an investment of protoplasm, and then each such amœba form forms a cyst around itself which is covered with short spines (Fig. II. 9). The cysts are not known to give rise to spores, but appear to be merely hypnocysts.

The domination of the protoplasm by the chlorophyll corpuscles is very remarkable and unlike anything known in any other organism. Possibly the chlorophyll corpuscles are to be regarded as nuclei, since it is known that there are distinct points of affinity between the dense protoplasm of ordinary nuclei and the similarly dense protoplasm of normal chlorophyll corpuscles.

CLASS II. **MYCETOZOA**, De Bary.

Characters.—Gymnomyxa which, as an exception to all other Protozoa, are not inhabitants of water but occur on damp surfaces exposed to the air. They are never parasitic, as are some of the Proteomyxa most nearly allied to them (Plasmodiophora, etc.), but feed on organic debris. They are structurally characterized by the fact that the amœba forms, which develop either directly or through flagellulæ from their spores, always form large, sometimes very large, *i.e.*, of several square inches area, fusion plasmodia (or rarely aggregation plasmodia), and that the spores are always chlamydospores (*i.e.*, provided with a coat) and are formed either in naked groups of definite shape (sori) or on the surface of peculiar columns (conidiophors) or in large fruit-like cysts which enclose the whole or a part of the plasmodium and develop besides the spores definite sustentacular structures (capillitium) holding the spores in a mesh-work.

Three orders of Mycetozoa are distinguishable according to the arrangement of the spores in more or less complex spore-fruits.

ORDER 1. SOROPHORA, Zopf.

Characters.—Mycetozoa which never exhibit a vibratile (monadiform) swarmspore or flagellula phase, but hatch from the spore as amœbæ. A true fusion plasmodium is not formed, but an aggregation plasmodium by the contact without fusion of numerous amœba forms. The spore fruit is a naked aggregation of definitely arranged encysted amœbæ called a sorus, not enclosed in a common capsule; each encysted amœba has the value of a single spore and sets free on germination a single amœbula. They inhabit the dung of various animals.

Genera.—*Copromyxa*, Zopf; *Cynthalina*, Cienk.; *Dictyostelium*, Brefeld; *Acrasis*, Van Tieghem; *Polysphondylium*, Brefeld.

ORDER 2. ENDOSPOREA, Zopf.

Characters.—Mycetozoa always passing through the flagellula phase and always forming true plasmodia by fusion of amœba forms. The spore-fruit is in the form of a large cyst which encloses a quantity of the plasmodium; the latter then breaks up into (*a*) spores (one corresponding to each nucleus of the enclosed plasmodium) each of which has a cellulose coat, and (*b*) a capillitium of threads which hold the spores together. Each spore (chlamydospore) liberates on germination a single nucleated flagellula, which develops into an amœbula, which in turn fuses with other amœbulæ to form the plasmodium. The Endosporea are essentially dwellers on rotten wood and such vegetable refuse.

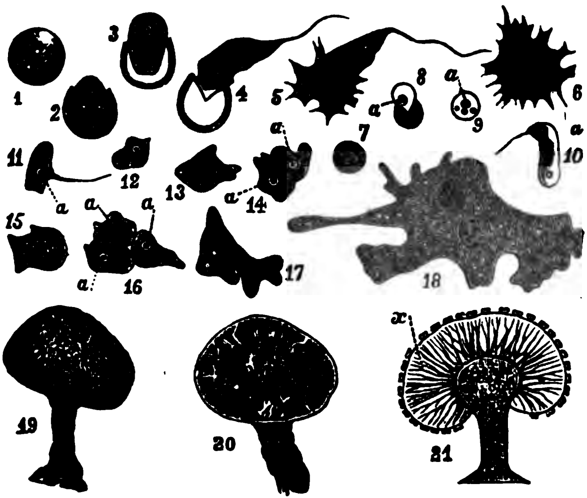


FIG. III.—**Mycetozoa** (after De Bary). 1–6, Germination of spore (1) of *Trichea varia*, showing the emerging "flagellula" (4, 5), and its conversion into an "amœbula" (6). 7–18. Series leading from spore to plasmodium phase of *Chondrioderma difforme*: 7, spore; 10, flagellula; 12, amœbula; 14, apposition of two amœbulæ; 15–17, fusions; 18, Plasmodium; 19, 20, Spore-fruit (cyst) of *Physarum leucophæum*, Fr. (× 25), the former from the surface, the latter in section with the spores removed to show the sustentacular network or capillitium. 21. Section of the spore-cyst of *Didymium squamulosum*, with the spores removed to show the radiating capillitium *x* and the stalk.

Sub-order 1. PERITRICHEA, Zopf.

Fam. 1. CLATHROPTYCHIACEÆ, Rostafinski.
Genera.—*Clathroptychium*, Rost.; *Enteridium*, Ehr.
Fam. 2. CRIBRARIACEÆ.
Genera.—*Dictydium*, Pers.; *Cribraria*, Pers.

Sub-order 2. ENDOTRICHEA, Zopf.

Fam. 1. PHYSAREA.
Genera.—*Physarum*, Pers.; *Craterium*, Trentepol; *Badhamia*, Berkeley; *Leocarpus*, Link.; *Tilmadoche*, Fr.; *Fuligo* (*Æthalium*), Hall; *Æthaliopsis*, Z.
Fam. 2. DIDYMIACEÆ.
Genera.—*Didymium*; *Lepidoderma*, De Bary.
Fam. 3. SPUMARIACEÆ.
Genera.—*Spumaria*, Pers.; *Diachea*, Fries.
Fam. 4. STEMONITEA.
Genera.—*Stemonitis*, Gleditsch; *Comatricha*, Preuss; *Lamproderma*, Rost.
Fam. 5. ENERTHENEMEA.
Genera.—*Enerthema*, Bowman.
Fam. 6. RETICULARIACEÆ, Zopf.
Genera.—*Amaurochæte*, Rost.; *Reticularia*, Bull.
Fam. 7. TRICHINACEÆ.
Genera.—*Hemiarcyria*, Rost.; *Trichia*, Hall.
Fam. 8. ARCYRIACEÆ.
Genera.—*Arcyria*, Hall; *Cornuvia*, Rost.; *Lycogala*, Ehr.
Fam. 9. PERICHÆNACEÆ.
Genera.—*Perichæna*, Fries.; *Lachnobolus*, Fries.
Fam. 10. LICEACEÆ.
Genera.—*Licea*, Schrader; *Tubulina*, Pers.; *Lindbladia*, Fries.; *Tubulifera*, Zopf.

ORDER 3. EXOSPOREA, Zopf.

Characters.—The chlamydospore liberates an amœbula in the first instance, which develops into a flagellula. This subsequently returns to the amœba form and by fusion with other amœbulæ it forms a true fusion plasmodium. The spores are not produced within a cyst but upon the surface of column-like up-growths of the plasmodium, each spore (conidium) forming as a little spherical outgrowth attached to the column (conidiophor) by a distinct pedicle.

Sole Genus.—*Ceratium*. [This name must be changed, since it was already applied to a genus of Dinoflagellata, when Famintzin and Woronin gave it to this Mycetozoon.]

Further Remarks on Mycetozoa.—About two hundred species of Mycetozoa have been described. Botanists, and especially those who occupy themselves with Fungi, have accumulated the very large mass of facts now known in reference to these organisms; nevertheless the most eminent botanist who has done more than any other to advance our knowledge of Mycetozoa, namely, De Bary, has expressed the view that they are to be regarded rather as animals than as plants. The fact is that, once the question is raised, it becomes as reasonable to relegate all the Gymnomyxa without exception to the vegetable kingdom as to do so with the Mycetozoa. Whatever course we take with the latter, we must take also with the Heliozoa, the Radiolaria, and the Reticularia.

The formation of plasmodia, for which the Mycetozoa are conspicuous, appears to be a particular instance of the general phenomenon of cell-conjugation. Small plasmodia are formed by some of the Proteomyxa; but among the other Gymnomyxa, excepting Mycetozoa, and among Corticate Protozoa, the fusion of two individuals (conjugation *sensu stricto*) is more usual than the fusion of several. Zopf (**18**) has attempted to distinguish arbitrarily between conjugation and plasmodium formation by asserting that in the former the nuclei of the cells which fuse are also fused, whereas in the latter process the nuclei retain their independence. Both statements are questionable. What happens to the nucleus in such conjugations as those of the Gregarinæ has not yet been made out, whilst it is only quite recently that Strasburger (**30**) has shown that the plasmodia of Mycetozoa contain numerous scattered nuclei, and it is not known that fusion does not occur between some of these. There is no doubt that the nuclei of plasmodia multiply by fission, though we have no detailed account of the process.

The Sorophora are exceptional in that the amœbæ which unite to form a cell-colony in their case do not actually fuse but only remain in close contact; with this goes the fact that there are no large spore-cysts, but an identification of spore and spore-cyst. The amœbæ arrange themselves in stalked clusters (sori), and each becomes encysted: one may, in this case, consider the cyst equally as a spore or as a spore-cyst which produces but a single spore. The amœbæ described by various writers as inhabiting the alimentary canal and the dung of higher animals (including man) belong to this group. The form described by Cunningham in the *Quart. Jour. Micr. Sci.*, 1881, as *Protomyxomyces coprinarius* is apparently related to the *Copromyxa* (*Guttulina*) *protea* of Fayod (**31**).

The spore-fruits of the Endosporeæ occur in various degrees of elaboration. Usually they are (1) spherical or pear-shaped cysts with or without an obvious stalk (Fig. III. 19, 20, 21), and often have a brilliant color and are of a size readily observed by the naked eye, the plasmodia which give rise to them being by no means microscopic. But they may present themselves (2) as irregular ridges growing up from the plasmodium, when they are termed serpula forms. Lastly, the cysts may be united side by side in larger or smaller groups instead of forming at various separate points of the plasmodium. These composite bodies are termed "fruit-cakes" or "æthalia," in view of the fact that the spore-cysts of Fuligo, also called Æthalium—the well-known "flowers of tan"—form a cake of this description.

The capillitium or network of threads which lies between the spores in the spore-cysts of Endosporeæ is a remarkable structure which exhibits special elaborations in detail in different genera, here not to be noticed for want of space. Although definite in form and structure, these threads are not built up by cells but are formed by a residual protoplasm (*cf.* Sporozoa) which is left in the cyst after the spores have been segregated and enclosed each in its special coat. They are often impregnated by calcium carbonate and exhibit crystalline masses of it, as does also the cyst-wall.

The spores of the Mycetozoa are as a rule about the $\frac{1}{1500}$th inch in diameter. They are produced by millions in the large fruit-cakes of such forms as Fuligo. Often the spore-coat is colored; it always consists of a substance which gives the cellulose reaction with iodine and sulphuric acid. This has been sometimes considered an indication of the vegetable nature of the Mycetozoa, but cannot be so regarded since many animals (especially the Tunicata and various Protozoa) produce substances giving this same reaction.

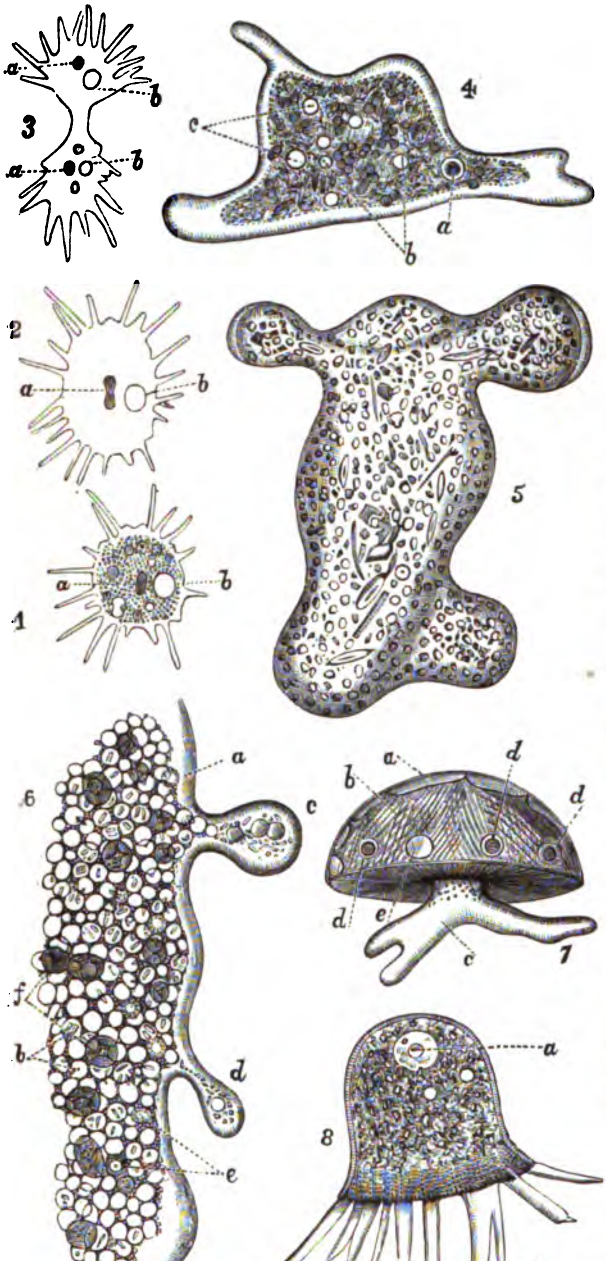


FIG. IV.—Various **Lobosa**. 1,2,3, *Dactylosphæra* (*Amœba*) *polypodia*, M. Schultze, in three successive stages of division: the changes indicated occupied fifteen minutes. *a*, nucleus; *b*, contractile vacuole (copied from F. E. Shultze, in *Archiv. f. Mikrosk. Anat.*). 4. *Amœba princeps*, Ehr. (after Auerbach). *a*, nucleus; *b*, *c*, vacuoles (one or more contractile; the shaded granules are food-particles). 5. *Pelomyxa palustris*, Greeff (after Greeff), an example with comparatively few food-particles (natural size $\frac{1}{10}$th inch in length). 6. Portion of a Pelomyxa more highly magnified. *a*, clear superficial zone of protoplasm (so-called "exoplasm"); *b*, vacuoles, extremely numerous; *c*, lobose pseudopodium; *d*, a similar pseudopodium; *e*, nuclei; *f*, "refractive bodies" (reproductive?); scattered about in the protoplasm are seen numerous cylindrical crystals. 7. *Arcella vulgaris*, Ehr. *a*, shell; *b*, protoplasm within the shell; *c*, extended protoplasm in the form of lobose pseudopodia; *d*, nuclei; *e*, contractile vacuole; the dark bodies unlettered are gas vacuoles. 8. *Cochliopodium pellucidum*, Hert. and Less. *a*, nucleus surrounded by a hyaline halo sometimes mistaken for the nucleus, whilst the latter is termed nucleolus.

Dryness, low temperature, and want of nutriment lead to a dormant condition of the protoplasm of the plasmodium of many Mycetozoa and to its enclosure in cyst-like growths known as "sclerotia" which, do not give rise to spores, but from which the protoplasm creeps forth unaltered when temperature, nutrition and moisture are again favorable. The sclerotia are similar in nature to the hypnocysts of other Protozoa.

The physiological properties—chemical composition, digestive action, reaction to moisture, heat, light and other physical influences—of the plasmodia of Mycetozoa have been made the subject of important investigations; they furnish the largest masses of undifferentiated protoplasm available for such study. The reader is referred to Zopf's admirable treatise (12) as to these matters and also for a detailed account of the genera and species.

CLASS III. LOBOSA, Carpenter.

Characters.—Gymnomyxa in which (as in the succeeding four classes) the amœba-phase predominates over the others in permanence, size attained, and, physiological importance. The pseudopodia are lobose, ranging in form from mere wave-like bulgings of the surface to blunt finger-like processes, but never having the character of filaments either simple, arborescent, or reticulate. Fusions of two individuals (conjugation) have been observed in a few cases, but not fusions of many individuals so as to form plasmodia; nevertheless the size attained by the naked protoplasm by pure growth is in some cases considerable, forming masses readily visible by the naked eye (Pelomyxa). The presence of more than one nucleus is a frequent character. A contractile vacuole may or may not be present. The formation of sporocysts and of chlamydospores (coated spores) has not been observed in any species, but naked spores (flagellulæ or amœbulæ) have been with more or less certainty observed as the product of the breaking up of some species (Amœba? Pelomyxa). The cyst phase is not unusual, but the cryst appears usually to be a hypnocyst and not a sporocyst. In the best observed case of spore-production (Pelomyxa) the spores were apparently produced without the formation of a cyst. Reproduction is undoubtedly most freely effected by simple fission (Amœba) and by a modified kind of bud-fission (Arcella). Fresh-water and marine. Two orders of the Lobosa are distinguished in accordance with the presence or absence of a shell.

ORDER 1. NUDA.

Characters.—Lobosa devoid of a shell.

Genera.—*Amœba*, Auct. (Fig. IV. 4); *Ouramœba*, Leidy (with a villous tuft at one end, Wallich's *A. villosa*); *Corycia*, Duj. (low, ridge-like pseudopodia); *Lithamœba*, Lankester (Fig. V.); *Dinamœba*, Leidy (23) (covered with short stiff processes); *Hyalodiscus*, H. and L.; *Plakopus*, F. E. Schultze; *Dactylosphæra*, H. and L. (Fig. IV. 1, 2, 3); *Pelomyxa*, Greeff (Fig. IV. 5, 6); *Amphizonella*, Greeff (forms a gelatinous case which is broken through by the pseudopodia).

ORDER 2. TESTACEA.

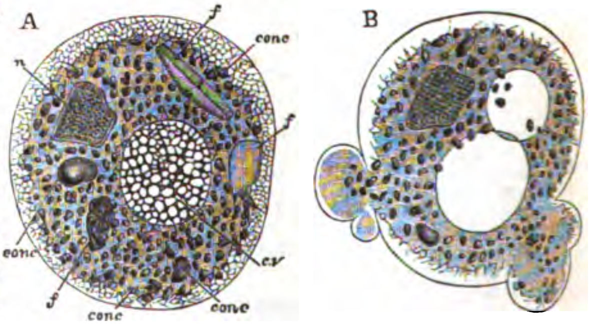


FIG. V.—*Lithamœba discus*, Lank. (after Lankester, 34). A, quiescent; B, throwing out pseudopodia. *c. v.*, contractile vacuole, overlying which the vacuolated protoplasm is seen; *conc*, concretions insoluble in dilute HCl and dilute KHO, but soluble in strong HCl; *n*, nucleus.

Characters.—Lobosa which secrete a shell provided with an aperture from which the naked protoplasm can be protruded. The shell is either soft and membranous, or strengthened by the inclusion of sand particles, or is hard and firm.

Genera.—*Cochliopodium* (Fig. IV. 8), H. and L. *Pyxidicula*,

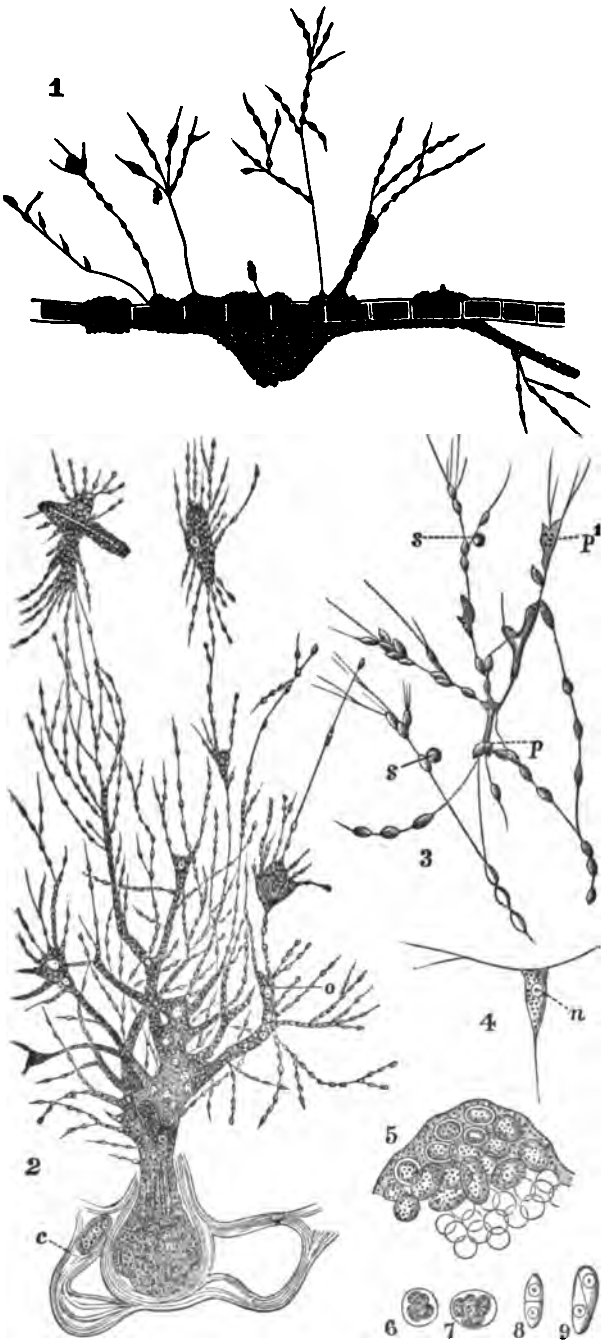


Fig. VI.—Labyrinthulidea. 1. A colony or "cell heap" of *Labyrinthula vitellina*, Cienk., crawling upon an Alga. 2. A colony or "cell-heap" of *Chlamydomyxa labyrinthuloides*, Archer, with fully expanded network of threads on which the oat-shaped corpuscles (cells) are moving. *o* is an ingested food particle; at *c* a portion of the general protoplasm has detached itself and become encysted. 3. A portion of the network of *Labyrinthula vitellina*, Cienk., more highly magnified. *p*, protoplasmic mass apparently produced by fusion of several filaments; *p′*, fusion of several cells which have lost their definite spindle-shaped contour; *s*, corpuscles which have become spherical and are no longer moving (perhaps about to be encysted). 4. A single spindle cell and threads of *Labyrinthula macrocystis*, Cienk. *n*, nucleus. 5. A group of encysted cells of *L. macrocystis*, embedded in a tough secretion. 6, 7. Encysted cells of *L. macrocystis*, with enclosed protoplasm divided into four spores. 8, 9. Transverse division of a non-encysted spindle-cell of *L. macrocystis*.

Ehr.; *Arcella*, Ehr. (Fig. IV. 7); *Hyalosphenia*, Stein; *Quadrula*, F. E. Schultze (shell membraneous, areolated); *Difflugia*, Leclerc (shell with adventitious particles).

Further remarks on the Lobosa.—The Lobosa do not form a very numerous nor a very natural assemblage. Undoubtedly some of the forms which have been described as species of Amœba are amœba forms of Mycetozoa; this appears to be most probably the case in parasitic and stercoricolous forms. But when these are removed, as also those Proteomyxa which have pseudopodia of varying character, at one time lobose and at another filamentous, we have left a certain small number of independent lobose Gymnomyxa which it is most convenient to associate in a separate group. We know very little of the production of spores (whether it actually obtains or not) or of developmental phases among these Lobosa. The common Amœbæ are referable to the species *A. princeps*, *A. lobosa*, *Dactylosphæra polypodia Ouramœba villosa*. Of none of these do we know certainly any reproductive phenomena excepting that of fission (see Fig. IV. 1, 2, 3). Various statements have been made pointing to a peculiar change in the nucleus and a production of spores having the form of minute Amœbæ, arising from that body; but they cannot be considered as established. Whilst the observed cases of supposed reproductive phenomena are very few, it must be remembered that we have always to guard (as the history of the Ciliata has shown, see below) against the liability to mistake parasitic amœbulæ and flagellulæ for the young forms of organisms in which they are merely parasitic. The remarkable *Pelomyxa palustres* of Greeff (**32**) was seen by him to set free (without forming a cyst) a number of amœbulæ which he considers as probably its young. Mr. Weldon of St. John's College, Cambridge, has observed the same phenomenon in specimens of Pelomyxa which made their appearance in abundance in an aquarium in the Morphological Laboratory, Cambridge. It seems probable that the amœbulæ in this case are not parasites but spore-like young, and this is the best observed case of such reproduction as yet recorded in the group.

Arcella is remarkable for the production of bud-spores which may be considered as a process intermediate between simple fission and the complete breaking up of the parent body into spores. As many as nine globular processes are simultaneously pinched off from the protoplasm extruded from the shell of the Arcella; the nuclei (present in the parent Arcella to the number of two or three) have not been traced in connection with this process. The buds then become nipped off, and acquire a shell and a contractile vacuole (**33**).

The presence of more than one nucleus is not unusual in Lobosa, and is not due to a fusion of two or more uninuclear individuals, but to a multiplication of the original nucleus. This has been observed in some Amœbæ (*A. princeps?*) as well as Arcella. Pelomyxa (Fig. IV. 6) has a great number of nuclei like the Heliozoon, Actinosphærium (Fig. VIII.).

Pelomyxa is the most highly differentiated of the Lobosa. The highly vacuolated character of its protoplasm is exhibited in a less degree by Lithamœba and resembles that of Heliozoa and Radiolaria. Besides the numerous nuclei there are scattered in the protoplasm strongly refringent bodies (Fig. IV. 6, *f*), the significance of which has not been ascertained. The superficial protoplasm is free from vacuoles, hyaline, and extremely mobile. Occasionally it is drawn out into very short fine filaments. Scattered in the protoplasm are a number of minute cylindrical crystals, of unascertained composition. Pelomyxa is of very large size for Protozoon, attaining a diameter of $\frac{1}{16}$th of an inch. It takes into its substance a quantity of foreign particles, both nutrient organic matter such as Rotifera and Diatoms and sand particles. It occurs not uncommonly in old muddy ponds, (such as duck-ponds), creeping upon the bottom, and has a white appearance to the naked eye. Lithamœba (Fig. V.), is distinguished by its large size, disk-like form the disk-like shape of its pseudopodia, the presence of specific concretions, the vacuolation of its protoplasm, and the block-like form and peculiar tessellated appearance of its large nucleus, which has a very definite capsule. In Lithamœba it is easy to recognize a distinct pellicle or temporary cuticle which is formed upon the surface of the protoplasm, and bursts when a pseudopodium is formed. In fact it is the rupture of this pellicle which appears to be the proximate cause of the outflow of protoplasm as a pseudopodium. Probably a still more delicate pellicle always forms on the surface of naked protoplasm, and in the way just indicated determines by its rupture the form and the direction of the "flow" of protoplasm which is described as the "protrusion" of a pseudopodium.

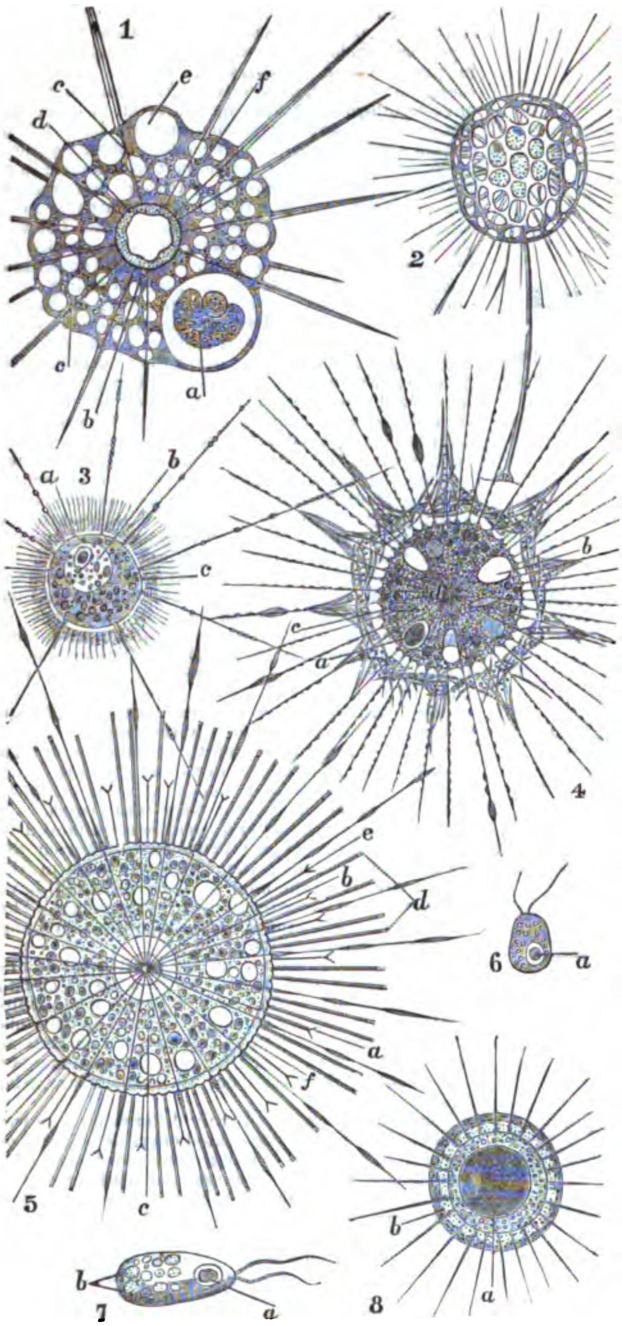


Fig. VII.—Heliozoa. 1. *Actinophrys sol*, Ehrb.; × 800. *a*. food-particle lying in a large food-vacuole; *b*, deep-lying finely granular protoplasm; *c*, axial filament of a pseudopodium extended inwards to the nucleus; *d*, the central nucleus; *e*, contractile vacuole; *f*, superficial much-vacuolated protoplasm. 2. *Clathrulina elegans*, Cienk.; × 200. 3. *Heterophrys marina*, H. and L. × 660. *a*, nucleus; *b*, clearer protoplasm surrounding the nucleus; *c*, the peculiar felted envelope. 4. *Raphidiophrys pallida*, F. E. Schultze; × 430. *a*, food-particle; *b*, the nucleus; *c*, contractile vacuole; *d*, central granule in which all the axis-filaments of the pseudopodia meet. The tangentially disposed spicules are seen arranged in masses on the surface. 5. *Acanthocystis turfacea*, Carter; × 240. *a*, probably the central nucleus; *b*, clear protoplasm around the nucleus; *c*, more superficial protoplasm with vacuoles and chlorophyll corpuscles; *d*, coarser silicious spicules; *e* finer forked silicious spicules; *f*, finely granular layer of protoplasm. The long pseudopodia reaching beyond the spicules are not lettered. 6. Bi-flagellate "flagellula" of *Acanthocystis aculeata*. *a*, nucleus. 7. Ditto of *Clathrulina elegans*. *a*, nucleus. 8. *Astrodisculus ruber*, Greeff; × 320. *a*, red-colored central sphere (? nucleus); *b*, peripheral homogeneous envelope.

The shells of Lobosa Testacea are not very complex. That of Arcella is remarkable for its hexagonal areolation, dark color, and firm consistence; it consists of a substance resembling chitin. That of Difflugia has a delicate membranous basis, but includes foreign particles, so as to resemble the built-up case of a Caddis worm.

Arcella is remarkable among all Protozoa for its power of secreting gas-vacuoles (observed also in an Amœba by Bütschli), which serve a hydrostatic function, causing the Arcella to float. The gas can be rapidly absorbed by the protoplasm, when the vacuole necessarily disappears and the Arcella sinks.

CLASS IV. LABYRINTHULIDEA.

Characters.—Gymnomyxa forming irregular heaps of ovoid nucleated cells, the protoplasm of which extends itself as a branching network or labyrinth of fine threads. The oval (spindle-shaped) corpuscles, consisting of dense protoplasm, and possessing each a well-marked nucleus (not observed in Chlamydomyxa), travel regularly and continuously along the network of filaments. The oval corpuscles multiply by fission; they also occasionally become encysted and divide into four spherical spores. The young forms developed from these spores presumably develop into colonies, but have not been observed.

Genera.—Two genera only of Labyrinthulidea are known: *Labyrinthula*, Cienkowski; *Chlamydomyxa*, Archer.

Cienkowski (35) discovered Labyrinthula on green Algæ growing on wooden piles in the harbor of Odessa (marine). It has an orange color and forms patches visible to the naked eye. Chlamydomyxa was discovered by Archer of Dublin (36) in the cells of Sphagnum and crawling on its surface; hence it is a fresh-water form. Unlike Labyrinthula, the latter forms a laminated shell of cellulose (Fig. VI. 2, *c*), in which it is frequently completely enclosed, and indeed has rarely been seen in the expanded labyrinthine condition. The laminated cellulose shells are very freely secreted, the organism frequently deserting one and forming another within or adherent to that previously occupied. The network of Chlamydomyxa appears to consist of hyaline threads of streaming protoplasm, whilst that of Labyrinthula has a more horny consistence, and is not regarded by Cienkowski as protoplasm.

The spindle-shaped cells are much alike in form and size in the two genera; but no nucleus was detected by Archer in those of Chlamydomyxa. The encysting of the spindle-cells and their fission into spores has been seen only in Labyrinthula. Chlamydomyxa is often of a brilliant green color owing to the presence of chlorophyll corpuscles, and may exhibit a red or mottled red and green appearance owing to the chemical change of the chlorophyll. It has been observed to take in solid nourishment, though Labyrinthula has not.

The Labyrinthulidea present strong resemblances to the Mycetozoa. The genus Dactylostelium (Sorophora) would come very close to Labyrinthula were the amœbæ of its aggregation plasmodium set upon a network of threads. Such a net-work, whether in the condition of soft protoplasm or hardened and horny, is represented in the higher Mycetozoa by the capillitium of the sporocysts.

The most important difference between Archer's Chlamydomyxa and Cienkowski's Labyrinthula is that in the former the threads of the network appear to consist of contractile protoplasm, whilst in the latter they are described as firm horny threads exuded by the spindle-cells. Neither form has been re-examined since its discovery; and it is possible that this apparent difference will be removed by further study.

CLASS V. HELIOZOA, Haeckel, 1866.

Characters.—Gymnomyxa in which the dominating amœba phase has the form of a spherical body from the surface of which radiate numerous isolated filamentous pseudopodia which exhibit very little movement or change of form except when engaged in the inception of food-particles. The protoplasm of the spherical body is richly vacuolated; it may exhibit one or more contractile vacuoles and either a single central nucleus or many nuclei (Nuclearia, Actinosphærium). Skeletal products may or may not be present.

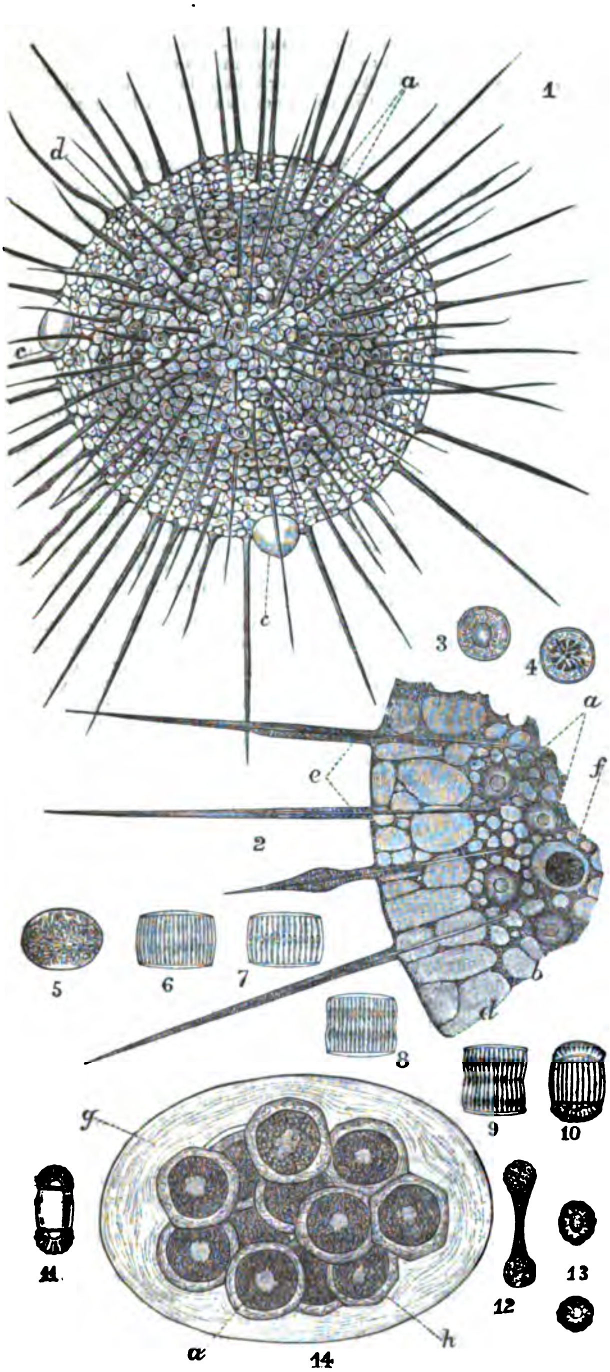


FIG. VIII.—**Heliozoa.** 1. *Actinosphærium Eichhornii*, Ehr.; × 200. *a*, nuclei; *b*, deeper protoplasm with smaller vacuoles and numerous nuclei; *c*, contractile vacuoles; *d*, peripheral protoplasm with larger vacuoles. 2. A portion of the same specimen more highly magnified and seen in optical section. *a*, nuclei; *b*, deeper protoplasm (so-called endosarc); *d*, peripheral protoplasm (so-called ectosarc); *e*, pseudopodia showing the granular protoplasm streaming over the stiff axial filament; *f*, food-particle in a food-vacuole. 3, 4. Nuclei of Actinosphærium in the resting condition. 5–13. Successive stages in the division of a nucleus of Actinosphærium, showing fibrillation and in 7 and 8 formation of an equatorial plate of chromatin substance (after Hertwig). 14. Cyst-phase of *Actinosphærium Eichhornii*, showing the protoplasm divided into twelve chlamydospores, each of which has a silicious coat; *a*, nucleus of the spore; *g*, gelatinous wall of the cyst; *h*, silicious coat of the spore.

Flagellulæ have been observed as the young forms of some species (Acanthocystis, Clathrulina), but very little has been as yet ascertained as to spore-formation or conjugation in this group, though isolated facts of importance have been observed. Mostly fresh-water forms.

ORDER 1.—APHROTHORACA, Hertwig (56).

Characters.—Heliozoa devoid of a spicular or gelatinous envelope, excepting in some a temporary membranous cyst.

Genera.—*Nuclearia*, Cienk. (37) (many nuclei; many contractile vacuoles; body not permanently spherical, but amœboid); *Actinophrys*, Ehr. (Fig. VII. 1; body spherical; pseudopodia with an axial skeletal filament; central nucleus; one large contractile vacuole; often forming colonies; *A. sol*, the Sun-animalcule); *Actinosphærium*, Stein (Fig. VIII.; spherical body; pseudopodia with axial filament; nuclei very numerous; contractile vacuoles 2 to 14); *Actinolophus*, F. E. Schulze (stalked).

ORDER 2. CHLAMYDOPHORA, Archer (57).

Characters.—Heliozoa with a soft jelly-like or felted fibrous envelope.

Genera.—*Heterophrys*, Archer (Fig. VII. 3); *Sphærastrum*, Greeff; *Astrodisculus*, Greeff (Fig. VII. 8).

ORDER 3. CHALAROTHORACA, Hertw. and Lesser (58).

Characters.—Heliozoa with a loose envelope consisting of isolated silicious spicules.

Genera.—*Raphidiophrys*, Archer (Fig. VII. 4; skeleton in the form of numerous slightly curved spicules placed tangentially in the superficial protoplasm); *Pompholyxophrys*, Archer; *Pinacocystis* H. and L.; *Pinaciophora*, Greeff; *Acanthocystis*, Carter (skeleton in the form of radially disposed silicious needles; encysted condition observed, and flagellula young, Fig. VII. 6); *Wagnerella*, Meresch.

ORDER 4. DESMOTHORACA, Hertw. and Less.

Characters.—Heliozoa with a skeletal envelope in the form of a spherical or nearly spherical shell of silica preforated by numerous large holes.

Genera.—*Orbulinella*, Entz (without a stalk); *Clathrulina*, Cienk (with a stalk, Fig. VII. 2).

Further remarks on the Heliozoa.—The Sun-animalcules, Actinophrys and Actinosphærium, were the only known members of this group when Carter discovered, in 1863, Acanthocystis. Our further knowledge of them is chiefly due to Archer of Dublin, who discovered the most important forms, and figured them in the *Quart. Jour. Micr. Sci.* in 1867.

Some of the Proteomyxa (*e.g.*, Vampyrella) exhibit "heliozoon-like" or "actinophryd" forms, but are separated from the true Heliozoa by the fact that their radiant pseudopodia are not maintained for long in the stiff isolated condition characteristic of this group. It is questionable whether Nuclearia should not be relegated to the Proteomyxa on account of the mobility of its body, which in all other Heliozoa has a constant spherical form.

Actinophrys sol is often seen to form groups or colonies (by fission), and so also is Raphidiophrys. It is probable from the little that is known that reproduction takes place not only by simple fission but by multiple fission, producing flagellate spores which may or may not be preceded by encystment. Only Clathrulina, Acanthocystis, Actinosphærium, and Actinophrys have been observed in the encysted state, and only the first two have been credited with the production of flagellated young. The two latter genera form covered spores within their cysts, those of Actinosphærium being remarkable for their silicious coats (Fig. VIII. 14), but their further development has not been seen.

CLASS VI. **RETICULARIA**, Carpenter, 1862.

Foraminifera, Auct., *Thalamophora*, Hertwig).

Characters.—Gymnomyxa in which the dominating amœbaphase, often of great size (an inch in diameter), has an irregular form, and a tendency to throw out great trunks of branching and often anastomosing filamentous pseudopodia, and an equally strong tendency to form a shell of secreted membrane or secreted lime or of agglutinated sand particles (only in one genus of secreted silex) into which the Protoplasm (not in all?) can be drawn and out of and over which it usually streams in widely spreading lobes and branches. One nucleus is present, or there are many. A contractile vacuole is sometimes, but not as a rule, present (or at any rate not described). Reproduction is by fission and (as in some other Protozoa) by the forma-

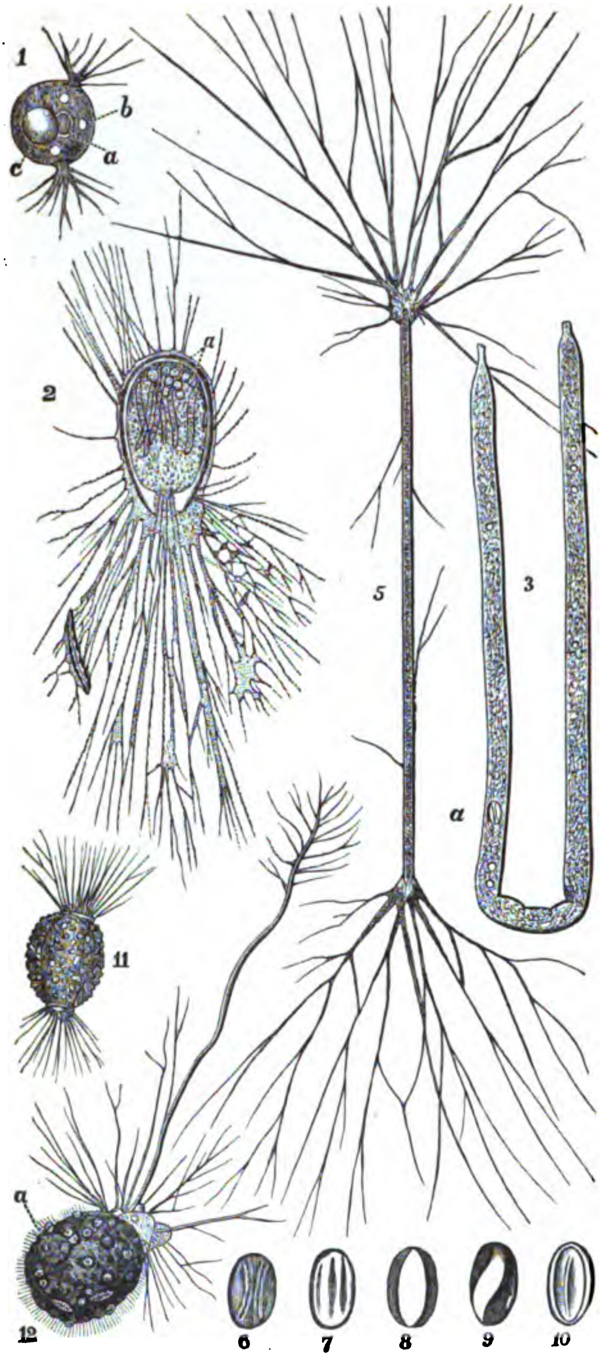


FIG. IX.—**Gromiidea (Reticularia membranosa).** 1. *Diplophrys Archeri*, Barker. *a*, nucleus; *b*, contractile vacuoles; *c*, the yellow oil-like body. Moor pools, Ireland. 2. *Gromia oviformis*, Duj. *a*, the numerous nuclei; near these the elongated bodies represent ingested Diatoms. Fresh-water. 3. *Shepheardella tæniiformis*, Siddall (*Quart. Jour. Micr. Sci.*, 1880); × 30 diameters. Marine. The protoplasm is retracted at both ends into the tubular case. *a*, nucleus. 5. *Shepheardella tæniiformis;* × 15; with pseudopodia fully expanded 6–10 Varying appearance of the nucleus as it is carried along in the streaming protoplasm within the tube. 11. *Amphitrema Wrightianum*, Archer, showing membranous shell encrusted with foreign particles. Moor pools, Ireland. 12. *Diaphorophodon mobile*, Archer. *a*, nucleus. Moor pools, Ireland.

tion of peculiar bud-spores which remain for a time after their formation embedded in the parental protoplasm. No multiple breaking up into spores after or independent of the formation of a cyst is known. Marine and fresh-water.

The Reticularia are divisible into several orders. The marked peculiarity of the shell structure in certain of these orders is only fitly emphasized by grouping them together as a sub-class Perforata, in contrast to which the remaining orders stand as a sub-class Imperforata. The distinction, however, is not an absolute one, for a few of the Lituolidea are perforate, that is, are sandy isomorphs of perforate genera such as Globigerina and Rotalia.

SUB-CLASS A. Imperforata.

Characters.—Shell-substance not perforated by numerous apertures through which the protoplasm can issue, but provided with only one or two large apertures, or in branched forms with a few such apertures.

ORDER 1. GROMIIDEA, Brady.

Characters.—Shell or test membranous, in the form of a simple sac with a pseudopodial aperture either at one extremity or at both. Pseudopodia thread-like, long, branching, reticulated. Marine and fresh water.

Fam. 1. MONOSTOMINA, with a single aperture to the shell.

Genera.—*Lieberkuhnia*, Clap. and Lach.; *Gromia*, Duj. (Fig. IX. 2); *Mikrogromia*, Hertw.; *Euglypha*, Duj. (shell built up of hexagonal silicious plates); *Diaphorophodon*, Archer (**38**) (many foreign particles cemented to form shell; small pseudopodia issue between these, hence resembling Perforata, and large long ones from the proper mouth of the shell, Fig. IX. 12).

Fam. 2. AMPHISTOMINA, with an aperture at each end of the shell.

Genera.—*Diplophrys*, Barker (Fig. IX. 1); *Ditrema*, Archer; *Amphitrema*, Archer (Fig. IX. 11); *Shepheardella*, Siddall (**39**) (membranous shell very long and cylindrical so as to be actually tubular, narrowed to a spout at each end, Fig. IX. 3; protoplasm extended from either aperture, Fig. IX. 5, and rapidly circulating within the tubular test during life, carrying with it the nucleus which itself exhibits peculiar movements of rotation, Fig. IX. 6, 7, 8, 9, 10).

ORDER 2. ASTRORHIZIDEA, Brady.

Characters.—Test invariably consisting of foreign particles: it is usually of large size and single-chambered, often branched or radiate with a pseudopodial aperture to each branch, the test often continued on to the finer branches of the pseudopodia (Fig. X. 12); never symmetrical. All marine.

Fam. 1. ASTRORHIZINA, Brady. Walls thick, composed of loose sand or mud very slightly cemented.

Genera.—*Astrorhiza*, Sandahl (Fig. X. 12, very little enlarged); *Pelosina*, Brady; *Storthosphæra*, Brady; *Dendrophrya*, St. Wright; *Syringammina*, Brady.

Fam. 2. PILULININA. Test single-chambered; walls thick, composed chiefly of felted sponge-spicules and fine sand, without calcareous or other cement.

Genera.—*Pilulina*, Carpenter; *Technitella*, Norman; *Bathysiphon*, Sars.

Fam. 3. SACCAMMININA. Chambers nearly spherical; walls thin, composed of firmly cemented sand grains.

Genera.—*Psammosphæra*, Schultze; *Sorosphæra*, Brady; *Saccammina*, M. Sars.

Fam. 4. RHABDAMMININA. Test composed of firmly cemented sand-grains, often with sponge-spicules intermixed; tubular; straight, radiate, branched or irregular; free or adherent: with one, two, or more apertures; rarely segmented.

Genera.—*Jaculella*, Brady; *Marsipella*, Norman (Fig. X. 13): *Rhabdammina*, M. Sars; *Aschemonella*, Brady; *Rhizammina*, Brady; *Sagenella*, Brady; *Botellina*, Carp.; *Haliphysema* Bowerbank (test wine-glass-shaped, rarely branched, attached by a disk-like base; generally beset with sponge-spicules, Fig. X. 11; pseudopodial aperture at the free extremity). This and Astrorhiza are the only members of this order in which the living protoplasm has been observed; in the latter it has the appearance of a yellowish cream, and its microscopic structure is imperfectly known (**61**). In Haliphysema the network of expanded pseudopodia has been observed by Saville Kent as drawn in Fig. X. 11. Lankester (**59**) discovered numerous vesicular nuclei scattered in the protoplasm (Fig. X. 10, *n*), and also near the mouth of the shell reproductive bodies (probably bud-spores) embedded in the protoplasm (Fig. X. 8). Haliphysema was described by Bowerbank as a Sponge, and mistaken by Haeckel (**60**) for a very simple two-cell-layered animal (Enterozoon), to which he assigned the class name of Physemaria.

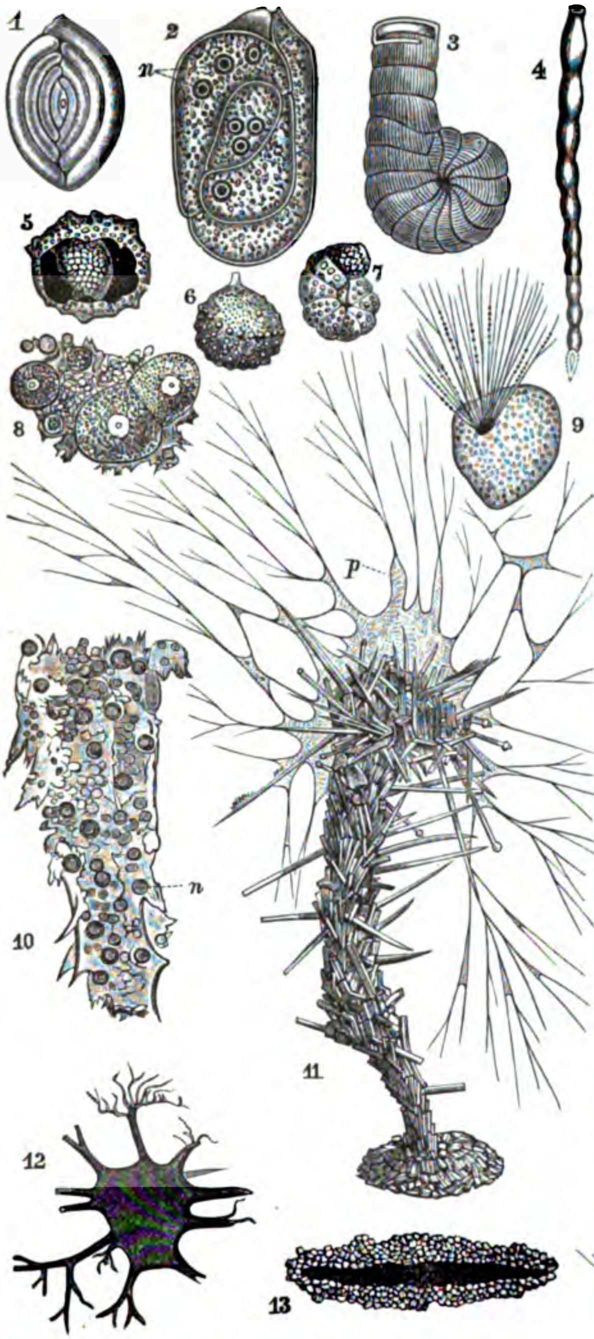


FIG. X.—**Imperforata.** 1. *Spiroloculina planulata*, Lamarck, showing five "coils"; porcellanous. 2. Young ditto, with shell dissolved and protoplasm stained so as to show the seven nuclei *n*. 3. Spirolina (Peneroplis); a sculptured imperfectly coiled shell; porcellanous. 4. Vertebralina, a simple shell consisting of chambers succeeding one another in a straight line; porcellanous. 5, 6. *Thurammina papillata*, Brady, a sandy form. 5 is broken open so as to show an inner chamber; recent. × 25. 7. *Lituola* (*Haplophragmium*) *canariensis*, a sandy form; recent. 8. Nucleated reproductive bodies (bud-spores) of Haliphysema. 9. *Squammulina lævis*, M. Schultze; × 40; a simple porcellanous Miliolide. 10. Protoplasmic core removed after treatment with weak chromic acid from the shell of *Haliphysema Tumanovitzii*, Bow. *n*, vesicular nuclei, stained with hæmætoxylin (after Lankester). 11. *Haliphysema Tumanovitzii*; × 25 diam.; living specimen, showing the wine-glass-shaped shell built of sand-grains and sponge-spicules, and the abundant protoplasm *p*, issuing from the mouth of the shell and spreading partly over its projecting constituents. 12. Shell of *Astrorhiza limicola*, Sand.; × [illegible]; showing the branches of the test on some of the rays usually broken away in preserved specimens (original). 13. Section of the shell of Marsipella, showing thick walls built of sand-grains.

ORDER 3. MILIOLIDEA, Brady.

Characters.—Test imperforate; normally calcareous and porcellanous, sometimes encrusted with sand; under starved conditions (*e.g.*, in brackish water) becoming chitinous or chitino-arenaceous; at abyssal depths occasionally consisting of a thin homogeneous imperforate, silicious film. The test has usually a chambered structure, being divided by septa (each with a hole in it) into a series of loculi which may follow one another in a straight line (Fig. X. 4) or the series may be variously coiled (Fig. X. 1 and 3). The chambering of the test does not express a corresponding cell-segmentation of the protoplasm; the latter, although growing in volume as the new shell-chambers are formed, remains one continuous cell-unit with many irregularly scattered nuclei (Fig. X. 2). The chambered and septate structure results in this group and in the other orders from the fact that the protoplasm, expanded beyond the last-formed chamber, forms a new test upon itself whilst it lies and rests upon the surface of the old test. The variations in such a formation are shown in Fig. XII. 1, 2, 3, 4.

Fam. 1. NUBECULARINA. Test free or adherent, taking various irregular asymmetrical forms, with variable aperture or apertures.

Genera.—*Squammulina*, Schultze (Fig. X. 9, showing the expanded pseudopodia); *Nubecularia*, Defrance.

Fam. 2. MILIOLINA. Shell coiled on an elongated axis, either symmetrically or in a single plane or inequilaterally; two chambers in each convolution. Shell aperture alternately during growth (addition of new chambers) at either end of the shell.

Genera.—*Biloculina*, D'Orb.; *Fabularia*, Defrance; *Spiroloculina*, D'Orb. (Fig. X. 1, 2); *Miliolina*, Williamson (Fig. XI.).

Fam. 3. HAUERININA. Shell dimorphous; chambers partly milioline, partly spiral or rectilinear.

Genera.—*Articulina*, D'Orb.; *Vertebralina*, D'Orb. (Fig. X. 4); *Ophthalmidium*, Kubler; *Hauerina*, D'Orb.; *Planispirina*, Seguenza.

Fam. 4. PENEROPLIDINA. Shell planospiral or cyclical, sometimes crosier-shaped, bilaterally symmetrical.

Genera.—*Cornuspira*, Schultze; *Peneroplis*, Montfort (Fig. X. 3); *Orbiculina*, Lamarck; *Orbitolites*, Lamarck (by a division of the chambers regularly into chamberlets, and a cyclical mode of growth which results in shells of the size of a shilling, a very elaborate-looking structure is produced which has been admirably analyzed by Carpenter (**40**), to whose memoir the reader is specially referred.

Fam. 5. ALVEOLININA. Shell spiral, elongated in the line of the axis of the convolution; chambers divided into chamberlets.

Genus.—*Alveolina*, D'Orb.

Fam. 6. KERAMOSPHÆRINA. Shell spherical; chambers in concentric layers.

Genus.—*Keramosphæra*, Brady.

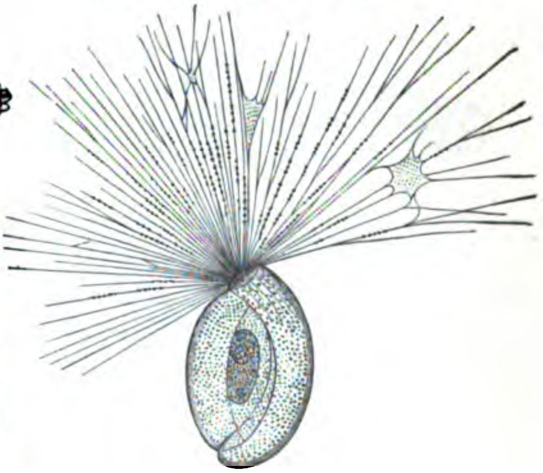


FIG. XI.—*Miliolina* (*Triloculina*) *tenera*. Young living animal with expanded pseudopodia (after Max Schultze). A single nucleus is seen in the innermost chamber.

ORDER 4. LITUOLIDEA, Brady.

Characters.—Test arenaceous, usually regular in contour;

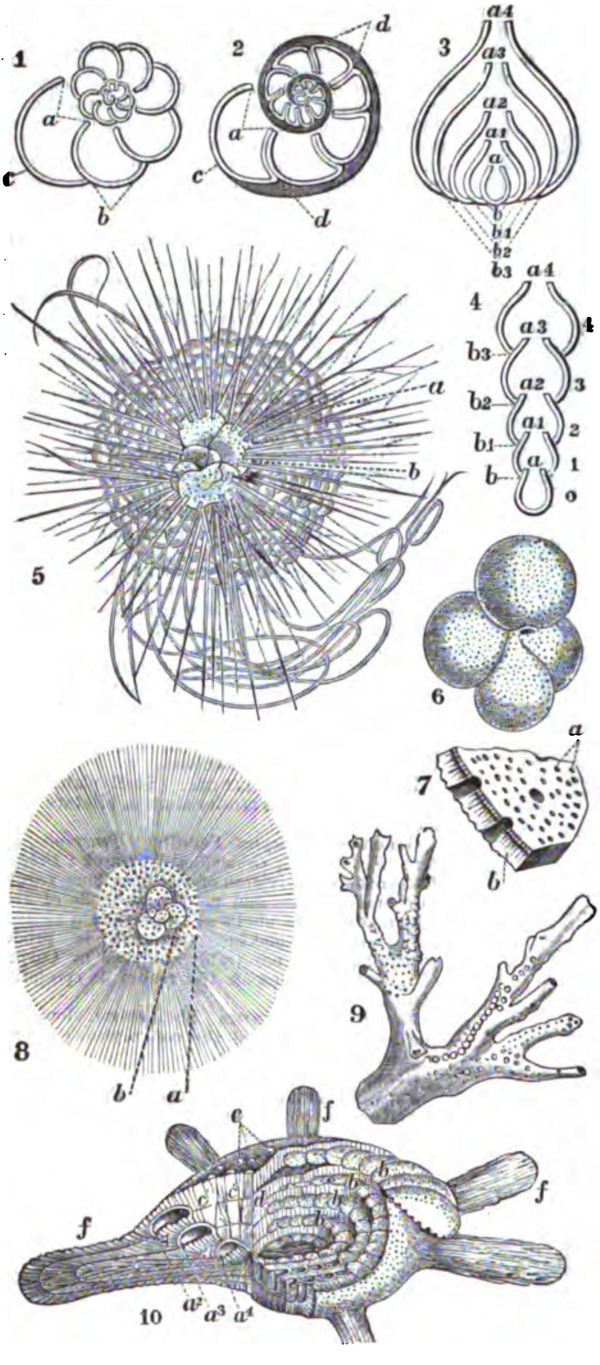


Fig. XII.—**Perforata.** 1. Spiral arrangement of simple chambers of a Reticularian shell. 2. Ditto, with double septal walls, and supplemental shell-substance (shaded). 3. Diagram to show the mode in which successively-formed chambers may completely embrace their predecessors. 4. Diagram of a simple straight series of non-embracing chambers. 5. *Hastigerina* (*Globigerina*) *Murrayi*, Wyv. Thompson. *a*, bubbly (vacuolated) protoplasm, enclosing *b*, the perforated Globigerina-like shell (conf. central capsule of Radiolaria). From the peripheral protoplasm project, not only fine pseudopodia, but hollow spines of calcareous matter, which are set on the shell, and have an axis of active protoplasm. Pelagic; drawn in the living state. 6. *Globigerina bulloides*, D'Orb., showing the punctiform perforations of the shell and the main aperture. 7. Fragment of the shell of Globigerina, seen from within, and highly magnified. *a*, fine perforations in the inner shell substances; *b*, outer (secondary) shell substance. Two coarser perforations are seen in section, and one lying among the smaller. 8. *Orbulina universa*, D'Orb. Pelagic example, with adherent radiating calcareous spines (hollow), and internally a small Globigerina shell. It is uncertain whether Orbulina is merely a developmental phase of Globigerina. *a*, Orbulina shell; *b*, Globigerina shell. 9. *Polytrema miniaceum*, Lin.; × 12. Mediterranean. Example of a branched adherent, calcareous perforate Reticularian. 10. *Calcarina Spengleri*, Gmel.; × 10. Tertiary, Sicily. Shell dissected so as to show the spiral arrangement of the chambers, and the copious secondary shell substance. a^2, a^3, a^4, chambers of three successive coils in section, showing the thin primary wall (finely tubulate) of each; *b*, *b*, *b*, *b*, perforate surfaces of the primary wall of four tiers of chambers, from which the secondary shell substance has been cleared away; c', c', secondary or intermediate shell substance in section, showing coarse canals; *d*, section of secondary shell substance at right angles to c'; *e*, tubercles of secondary shell substance on the surface; *f*, *f*, club-like processes of secondary shell substance.

septation of the many-chambered forms often imperfect, the cavity being labyrinthic. This order consists of sandy isomorphs of the simpler Miliolidea, and also of the simpler Perforata (Lagena, Nodosaria, Cristellaria, Globigerina, Rotalia, Nonionina, etc.); it also contains some peculiar adherent species.

Fam. 1. Lituolina. Test composed of coarse sand-grains, rough externally; often labyrinthic.

Genera.—*Reophax*, Montfort; *Haplophragmium*, Reuss (Fig. X. 7); *Coskinolina*, Stache; *Placopsilina*, D'Orb.; *Haplostiche*, Reuss; *Lituola*, Lamarck; *Bdelloidina*, Carter.

Fam. 2. Trochamminina. Test thin, composed of minute sand-grains incorporated with calcareous and other organic cement, or embedded in a chitinous membrane; exterior smooth, often polished; interior smooth or rarely reticulated; never labyrinthic.

Genera.—*Thurammina*, Brady (test consisting typically of a single spherical chamber with several mammillate apertures, Fig. X. 5, 6); *Hippocrepina*, Parker; *Hormosina*, Brady; *Ammodiscus*, Reuss; *Trochammina*, Parker and Jones; *Carterina*, Brady; *Webbina*, D'Orb.

Fam. 3. Endothyrina. Test more calcareous and less sandy than in the other groups of Lituolidea; sometimes perforate; septation distinct.

Genera.—*Nodosinella*, Brady; *Polyphragma*, Reuss; *Involutina*, Terq.; *Endothyra*, Phillips; *Bradyina*, Möll.; *Stacheia*, Brady.

Fam. 4. Loftusina. Test of relatively large size; lenticular, spherical, or fusiform; constructed either on a spiral plan or in concentric layers, the chamber cavities occupied to a large extent by the excessive development of the finely arenaceous cancellated walls.

Genera.—*Cyclammina*, Brady; *Loftusia*, Brady; *Parkeria*, Carpenter.

Sub-class B. **Perforata.**

Characters.—Shell substance perforated by numerous minute apertures, through which as well as from the main aperture the protoplasm can issue.

Order 5. TEXTULARIDEA, Brady.

Characters.—Tests of the larger species arenaceous, either with or without a perforate calcareous basis; smaller forms hyaline and conspicuously perforated. Chambers arranged in two or more alternating series, or spiral or confused: often dimorphous.

Fam. 1. Textularina. Typically bi- or triserial; often bi- rarely tri-morphous.

Genera.—*Textularia*, Defrance; *Cuneolina*, D'Orb.; *Verneiulina*, D'Orb.; *Tritaxia*, Reuss; *Chrysalidina*, D'Orb.; *Bigenerina*, D'Orb.; *Pavonina*, D'Orb.; *Spiroplecta*, Ehr.; *Gaudryina*, D'Orb.; *Valvulina*, D'Orb.; *Calvulina*, D'Orb.

Fam. 2. Buliminina. Typically spiral; weaker forms more or less regularly biserial; aperture oblique, comma-shaped or some modification of that form.

Genera.—*Bulimina*, D'Orb.; *Virgulina*, D'Orb.; *Bifarina*, Parker and Jones; *Bolivina*, D'Orb.; *Pleurostomella*, Reuss.

Fam. 3. Cassidulina. Test consisting of a Textularia-like series of alternating segments more or less coiled upon itself.

Genera.—*Cassidulina*, D Orb.; *Ehrenbergina*, Reuss.

Order 6. CHILOSTOMELLIDEA, Brady.

Characters.—Test calcareous, finely perforate, many-chambered. Segments following each other from the same end of the long axis, or alternately at the two ends, or in cycles of three, more or less embracing. Aperture a curved slit at the end or margin of the final segment.

Genera.—*Ellipsoidina*, Seguenza; *Chilostomella*, Reuss; *Allomorphina*, Reuss.

ORDER 7. LAGENIDEA, Brady.

Characters.—Test calcareous, very finely perforated; either single-chambered, or consisting of a number of chambers joined in a straight, curved, spiral, alternating, or (rarely) branching series. Aperture simple or radiate, terminal. No interseptal skeleton nor canal system.

Fam. 1. LAGENINA. Shell single-chambered.

Genera.—*Lagena*, Walker and Boys; *Nodosaria*, Lamk.; *Lingulina*, D'Orb.; *Frondicularia*, Defrance; *Rhabdogonium*, Reuss; *Marginulina*, D'Orb.; *Vaginulina*, D'Orb.; *Rimulina*, D'Orb.; *Cristellaria*, Lamk.; *Amphicoryne*, Schlumb.; *Lingulinopsis*, Reuss; *Flabellina*, D'Orb.; *Amphimorphina*, Neugeb.; *Dentalinopsis*, Reuss.

Fam. 2. POLYMORPHININA. Segments arranged spirally or irregularly around the long axis; rarely biserial and alternate.

Genera.—*Polymorphina*, D'Orb.; *Dimorphina*, D'Orb.; *Uvigerina*, D'Orb.; *Sagrina*, P. and J.

Fam. 3. RAMULININA. Shell branching, composed of spherical or pyriform chambers connected by long stoloniferous tubes.

Genus.—*Ramulina*, Rupert Jones.

ORDER 8. GLOBIGERINIDEA, Brady.

Characters.—Test free, calcareous, perforate; chambers few, inflated, arranged spirally; aperture single or multiple, conspicuous. No supplementary skeleton nor canal system. All the larger species pelagic in habit.

Genera.—*Globigerina*, D'Orb. (Fig. XII. 6); *Orbulina*, D'Orb (Fig. XII. 8); *Hastigerina*, Wy. Thompson (Fig. XII. 5); *Pullenia*, P. and J.; *Sphæroidina*, D'Orb.; *Candeina*, D'Orb.

ORDER 9. ROTALIDEA, Brady.

Character.—Test calcareous, perforate; free or adherent. Typically spiral and "rotaliform" (Fig. XII. 2), that is to say, coiled in such a manner that the whole of the segments are visible on the superior surface, those of the last convolution only on the inferior or apertural side, sometimes one face being more convex sometimes the other. Aberrant forms evolute, outspread, acervuline, or irregular. Some of the higher modifications with double chamber-walls, supplemental skeleton, and a system of canals. The nature of this supplemental skeleton is shown in Fig. XII. 2 and 10.

Fam. 1. SPIRILLININA. Test a complanate, planospiral, non-septate tube; free or attached.

Genus.—*Spirillina*, Ehr.

Fam. 2. ROTALINA. Test spiral, rotaliform, rarely evolute, very rarely irregular or acervuline.

Genera.—*Patellina*, Williamson; *Cymbalopora*, Hay; *Discorbina*, P. and J.; *Planorbulina*, D'Orb.; *Truncatulina*, D'Orb.; *Anomalina*, P. and J.; *Carpenteria*, Gray (adherent); *Rupertia*, Wallick; *Pulvinulina*, P. and J.; *Rotalia*, Lamk.; *Calcarina*, D'Orb. [Shell rotaliform; periphery furnished with radiating spines; supplemental skeleton and canal system largely developed. This form is shown in a dissected condition in Fig. XII. 10. Outside and between the successive chambers with finely perforated walls a^2, a^3, a^4, a secondary shell-substance is deposited by the protoplasm which has a different structure. Whilst the successive chambers with their finely perforate walls (resembling dentine in structure) are formed by the mass of protoplasm issuing from the mouth of the last-formed chamber, the secondary or supplemental-shell substance is formed by the protoplasm which issues through the fine perforations of the primary shell substance; it is not finely canaliculated, but is of denser substance than the primary shell and traversed by coarse canals (occupied by the protoplasm) which make their way to the surface of the test (c', c'). In Calcarina a large bulk of this secondary shell-substance is deposited around each chamber and also forms the heavy club-like spines.]

Fam. 3. TINOPORINA. Test consisting of irregularly heaped chambers with (or sometimes without) a more or less distinctly spiral primordial portion; for the most part without any general pseudopodial aperture.

Genera.—*Tinoporus*, Carpenter; *Gypsina*, Carter; *Aphrosina*, Carter; *Thalamopora*, Roemer; *Polytrema*, Risso. [Shell parasitic, encrusting or arborescent; surface areolated, colored pink or white, Fig. XII. 9. Interior partly occupied by small chambers, arranged in more or less regular layers, and partly by non-segmented canal-like spaces, often crowded with sponge-spicules. No true canal system. This is one of the most important types as exhibiting the arborescent and encrusting form of growth. It is fairly abundant.]

ORDER 10. NUMMULINIDEA, Brady.

Characters.—Test calcareous and finely tubulated; typically free, many chambered, and symmetrically spiral. The higher modifications all possess a supplemental skeleton, and canal system of greater or less complexity.

Fam. 1. FUSILININA. Shell bilaterally symmetrical; chambers extending from pole to pole; each convolution completely enclosing the previous whorls. Shell-wall finely tubulated. Septa single or rarely double; no true interseptal canals. Aperture a single elongated slit, or a row of small rounded pores, at the inner edge of the final segment.

Genera.—*Fusulina*, Fischer; *Schwagerina*, Möller.

Fam. 2. POLYSTOMELLINA. Shell bilaterally symmetrical, nautiloid. Lower forms without supplemental skeleton or interseptal canals; higher types with canals opening at regular intervals along the external septal depressions.

Genera.—*Nonionina*, D'Orb.; *Polystomella*, Lamarck.

Fam. 3. NUMMULITINA. Shell lenticular or complanate; lower forms with thickened and finely tubulated shell-wall, but no intermediate skeleton; higher forms with interseptal skeleton and complex canal system.

Genera.—*Archæodiscus*, Brady; *Amphystegina*, D'Orb.; *Operculina*, D'Orb.; *Heterostegina*, D'Orb.; *Nummulites*, Lamarck; *Assilina*, D'Orb.

Fam. 4. CYCLOCLYPEINA. Shell complanate, with thickened centre or lenticular; consisting of a disk of chambers arranged in concentric annuli, with more or less lateral thickening of laminated shell substance, or acervuline layers of chamberlets. Septa double and furnished with a system of interseptal canals.

Genera.—*Cycloclypeus*, Carpenter; *Orbitoides*, D'Orb.

Fam. 5. EOZOONINA. Test forming irregular, adherent, acervuline masses.

Genus.—*Eozoon*, Dawson.

Further Remarks on the Reticularia.—The name Thalamophora pointing to the peculiar tendency which the larger members of the group have to form chamber after chamber and so to build up a complex shell, has been proposed by Hertwig (56) and adopted by many writers. The old name Foraminifera (which did not refer to the fine perforations of the Perforata but to the large pseudopodial aperture leading from chamber to chamber) has also been extended by some so as to include the simpler Gromia-like forms. On the whole Carpenter's term Reticularia (62) seems most suitable for the group, since they all present the character indicated. It has been objected that the Radiolaria are also reticular in their pseudopodia, but if we except the pelagic forms of Reticularia (Globigerina, Orbulina, etc.), we find that the Radiolaria are really distinguishable by their stiffer, straighter, radiating pseudopodia. No doubt the Labyrinthulid Chlamydomyxa and the plasmodia of some Mycetozoa are as reticular in their pseudopodia as the Reticularia, but they possess other distinctive features which serve, at any rate in an artificial system, to separate them.

The protoplasm of the majority of the Reticularia is unknown, or only very superficially observed; hence we have made a point of introducing among our figures as many as possible, which show this essential part of the organism. It is only recently (1876) that nuclei have been detected in the calcareous-shelled members of the group, and they have only been seen in a few cases.

The protoplasm of the larger shell-making forms is known to be often strongly colored, opaque, and creamy, but its minute structure remains for future investigation. Referring the reader to the figures and their explanation, we would draw especial attention to the structure of the protoplasmic body of Hastigerina (one of the Globigerinidea) as detected by the "Challenger" naturalists. It will be seen from Fig. XII. 5 that the protoplasm extends as a relatively enormous "bubbly" mass around the shell which is sunk within it; from the surface of this "bubbly" (vacuolated or alveolated) mass the pseudopodia radiate.

The reader is requested to compare this with Fig. XIII., representing the "bubbly" protoplasmic body of Thalassicolla. It then becomes obvious that the perforated central capsule CK of the latter holds the same relation to the mass of the protoplasm as does the central perforated shell of Globigerina (Hastigerina). The extreme vacuolation of the protoplasm in both cases (the vacuoles being filled with sea-water accumulated by endosmosis) and the stiff radiating pseudopodia are directly correlated with the floating pelagic life of the two organisms. All the Radiolaria are pelagic, and many exhibit this vacuolation; only a few of the Reticularia are so, and their structural correlation to that habit has only lately been ascertained.

The Reticularia are almost exclusively known by their shells, which offer a most interesting field for study on account of the very great complexity of form attained by some of them, notwithstanding the fact that the animal which produces them is a simple uni-cellular Protozoon. Space does not permit the exposition here of the results obtained by Carpenter in the study of the complex shells of Orbitolites, Operculina, Nummulites, etc.; it is essential that his work *Introduction to the Study of the Foraminifera* (Ray Society, 1862) should be consulted, and in reference to the sandy-shelled forms the monograph by Brady, in the *Challenger Reports*, vol. ix., 1883; and it must be sufficient here to point out the general principles of the shell-architecture of the Reticularia. Let us suppose that we have an ever-growing protoplasmic body which tends to produce a calcareous shell on its surface, leaving an aperture for the exit of its pseudopodia. It will grow too large for its shell and accumulate outside the shell. The accumulated external mass may then secrete a second chamber, resting on the first as chamber 1 rests on chamber 0 in Fig. XII. 4. By further growth a new chamber is necessitated, and so is produced a series following one another in a straight line, each chamber communicating with the newer one in front of it by the narrow pseudopodial aperture (a, a^1, a^2, a^3,). Now it is possible for these chambers to be very variously arranged instead of simply as in Fig. XII. 4. For instance, each new chamber may completely enclose the last, as in Fig. XII. 3, supposing the protoplasm to spread all over the outside of the old chamber before making a new deposit. Again the chambers need not succeed one another in a straight line, but may be disposed in a spiral (Fig. XII. 1). And this spiral may be a flat coil, or it may be a helicine spiral with a rising axis; further it may be close or open. All these forms in various degrees of elaboration are exhibited by Miliolidea and various Perforata.

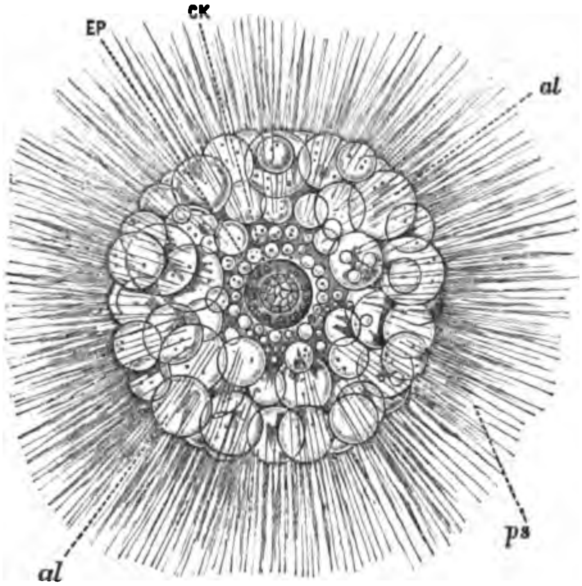


FIG. XIII.—*Thalassicolla pelagica*, Haeckel; × 25. CK, central capsule; EP, extracapsular protoplasm; *al*, alveoli, liquid-holding vacuoles in the protoplasm similar to those of Heliozoa, Pelomyxa, Hastigerina, etc.; *ps*, pseudopodia. The minute unlettered dots are the "yellow cells."

But the Perforata in virtue of their perforate shell-walls introduce a new complication. The protoplasm issues not only from the mouth of the last-formed chamber, but from the numerous pores in the wall itself. This latter protoplasm exerts its lime-secreting functions; it gathers itself into coarse branching threads which remain uncalcified, whilst all around a dense deposit of secondary or supplemental shell-substance is thrown down, thus producing a coarsely canalicular structure. The thickness and amount of this secondary shell and the position it may occupy between and around the chambers of primitive shell-substance vary necessarily in different genera according to the mode in which the primitive chambers are arranged and connected with one another. Calcarina is a fairly typical instance of an abundant secondary shell-deposit (Fig. XII. 10), and it is the existence of structure resembling the chambers of Calcarina with their surrounding primary and secondary shell-substances which has rendered it necessary to regard Eozoon (**41**) as the metamorphosed encrusting shell of a pre-Cambrian Reticularian.

The division of the Reticularia into Imperforata and Perforata which is here maintained has no longer the significance which was once attributed to it. It appears, according to the researches of Brady, that it is not possible to draw a sharp line between these sub-classes, since there are sandy forms which it is difficult to separate from imperforate Lituolidea and are nevertheless perforate, in fact are "sandy isomorphs of Lagena, Nodosaria, Globigerina, and Rotalia." It does not appear to the present writer that there can be any insurmountable difficulty in separating the Lituolidea into two groups—those which are sandy isomorphs of the porcellanous Miliolidea, and those which are sandy isomorphs of the hyaline Perforata. The two groups of Lituolidea thus formed might be placed in their natural association respectively with the Imperforata and the Perforata.

The attempt to do this has not been made here, but the classification of Brady has been adopted. In Bütschli's large work on the Protozoa (**9**) the breaking up of the Lituolidea is carried out to a logical conclusion, and its members dispersed among the Miliolidea on the one hand and the various orders of Perforata on the other hand.

The calcareous shell-substance of the Miliolidea being opaque and white has led to their being called "Porcellana," whilst the transparent calcareous shells of the smaller Perforata has gained for that group the synonym of "Hyalina."

The shells of the calcareous Reticularia and of some of the larger arenaceous forms are found in stratified rocks, from the Palæozoic strata onwards. The chalk is in places largely composed of their shells, and the Eocene Nummulitic limestone is mainly a cemented mass of the shells of Nummulites often as large each as a shilling. The Atlantic ooze is a chalky deposit consisting largely of the shells of Globigerina, etc.

CLASS VII. RADIOLARIA, Haeckel, 1862 (63) (*Polycystina*, Ehr.).

Characters.—Gymnomyxa in which the protoplasmic body of the dominant amœba phase has the form of a sphere or cone from the surface of which radiate filamentous pseudopodia, occasionally anastomosing, and encloses a spherical (homaxonic) or cone-shaped (monaxonic) perforated shell of membranous consistence known as the central capsule, and probably homologous with the perforated shell of a Globigerina. The protoplasm within the capsule (intracapsular protoplasm) is continuous through the pores or apertures of the capsules with the outer protoplasm. Embedded in the former lies the large and specialized nucleus (one or more). Gelatinous substance is frequently formed peripherally by the extracapsular protoplasm, constituting a kind of soft mantle which is penetrated by the pseudopodia. A contractile vacuole is never present.

Usually an abundant skeleton, consisting of spicules of silica or of a peculiar substance called acanthin arranged radially or tangentially, loose or united into a basket work, is present. Oil globules, pigment, and crystals are found in greater or less abundance in the protoplasm.

In most but not all Radiolaria peculiar nucleated yellow corpuscles are abundantly present, usually regarded as parasitic Algæ. Reproduction by fission has been observed, and also in some few species a peculiar formation of swarm spores (flagellulæ) within the central capsule, in which the nucleus takes an important part. All the Radiolaria are marine. The Radiolaria are divided into two sub-classes according to the chemical nature of their spicular skeleton, and into orders according to the nature and the disposition of the apertures in the wall of the central capsule.

SUB-CLASS I. **Silica-Skeleta**, Lankester.

Characters.—A more or less elaborate basket-work of tangential and radial elements consisting of secreted silica is present; in rare exceptions no skeleton is developed.

ORDER 1. PERIPYLÆA, Hertwig.

Characters.—Silico-skeletal Radiolaria in which the central capsule is uniformly perforated all over by fine pore-canals; its form is that of a sphere (homaxonic), and to this form the silicious skeleton primarily conforms, though it may become discoid, rhabdoid, or irregular. The nucleus is usually single, but numerous nuclei are present in each central capsule of the Polycyttaria.

Fam. 1. SPHÆRIDA, Haeck. Spherical Peripylæa with a

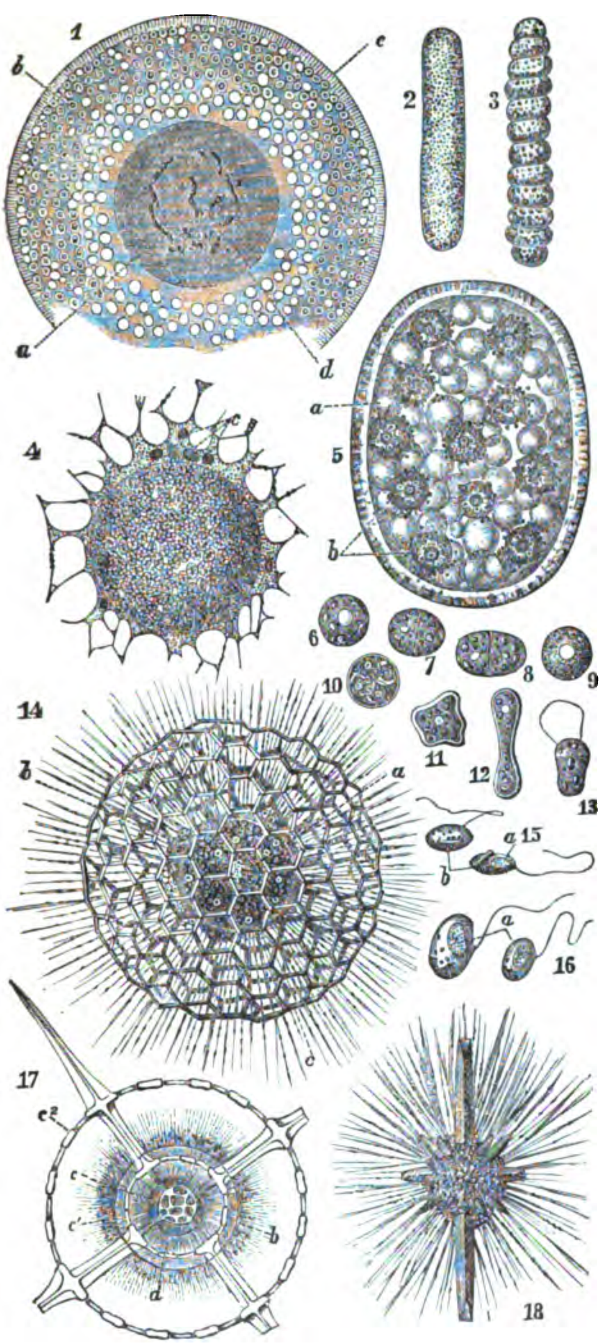


Fig. XIV.—Radiolaria. 1. Central capsule of *Thalassicolla nucleata*, Huxley, in radial section. *a*, the large nucleus (Binnenbläschen); *b*, corpuscular structures of the intracapsular protoplasm, containing concretions; *c*, wall of the capsule, (membranous shell), showing the fine radial pore-canals; *d*, nucleolar fibres (chromatin substance) of the nucleus. 2. 3. *Collozoum inerme*, J. Müller, two different forms of colonies, of the natural size. 4. Central capsule from a colony of *Collozoum inerme*, showing the intracapsular protoplasm and nucleus, broken up into a number of spores, the germs of swarm-spores or flagellulæ; each encloses a crystalline rod. *c*, yellow cells lying in the extracapsular protoplasm. 5. A small colony of *Collozoum inerme*, magnified 25 diameters. *a*, alveoli (vacuoles) of the extracapsular protoplasm; *b*, central capsules, each containing besides protoplasm a large oil-globule. 6-13. Yellow cells of various Radiolaria: 6, normal yellow cell; 7, 8, division with formation of transverse septum; 9, a modified condition according to Brandt; 10, division of a yellow cell into four; 11, amœboid condition of a yellow cell from the body of a dead Sphærozoon; 12, a similar cell in process of division; 13, a yellow cell the protoplasm of which is creeping out of its cellulose envelope. 14. *Heliosphæra inermis*, Haeck., living example; × 400. *a*, nucleus; *b*, central capsule: *c*, silicious basket-work skeleton. 15. Two swarm-spores (flagellulæ) of *Collozoum inerme*, set free from such a central capsule as that drawn in 4; each contains a crystal *b* and a nucleus *a*. 16. Two swarm-spores of *Collozoum inerme*, of the second kind, viz., devoid of crystals, and of two sizes, a macrospore and a microspore. They have been set free from central capsules with contents of a different appearance from that drawn in 4. *a*, nucleus. 17. *Actinomma asteracanthion*, Haeck.; × 260; one of the Peripylæa. Entire animal in optical section. *a*, nucleus; *b*, wall of the central capsule; *c*, innermost silicious shell enclosed in the nucleus; *c*¹, middle shell lying within the central capsule; *c*², outer shell lying in the extracapsular protoplasm. Four radial silicious spines, holding the three spherical shells together are seen. The radial fibrillation of the protoplasm and the fine extracapsular pseudopodia are to be noted. 18. *Amphilonche messanensis*, Haeck.; × 200: one of the Acanthometridea. Entire animal as seen living.

spherical basket-work skeleton, sometimes surrounded by a spongy outer skeleton, sometimes simple, sometimes composed of many concentric spheres (never discoid, flattened, or irregular). The central capsule sometimes encloses a part of the spherical skeleton, and often is penetrated by radiating elements.

Genera (selected). — *Ethmosphæra*, Haeck.; *Xiphosphæra*, Haeck.; *Staurosphæra*, Haeck.; *Heliosphæra*, Haeck. (Fig. XIV. 14); *Astromma*, Haeck.; *Haliomma*, Haeck.; *Actinomma*, Haeck. (Fig. XIV. 17; note the sphere within sphere, the smallest lying in the nucleus, and the whole series of spherical shells connected by radial spines); *Arachnosphæra*, Haeck.; *Plegmosphæra*, Haeck.; *Spongosphæra*, Haeck. (Fig. XVI. 8).

Fam. 2. Discida, Haeck. Discoid Peripylæa; both skeleton and central capsule flattened.

Genera (selected).—*Phæodiscus*, Haeck.; *Heliodiscus*, Haeck.; *Spongodiscus*, Haeck.; *Spongurus*, Haeck.

Fam. 3. Thalassicollida. Peripylæa devoid of a skeleton, or with a skeleton composed of loose silicious spicules only. Nucleus single; central capsule and general protoplasm spherical.

Genera (selected).—*Thalassicolla*, Huxley (Fig. XIII., Fig. XIV. 1); *Thalassosphæra*, Haeck.; *Physematium*, Haeck.

Fam. 4. Polycyttaria. Peripylæa consisting of colonies of many central capsules united by their extracapsular protoplasm. Central capsules multiplying by fission. Nuclei in each central capsule numerous. Silicious skeleton either absent, or of loose spicules, or having the form of a spherical fenestrated shell surrounding each central capsule.

Genera (selected). — *Collosphæra*, Müller (with fenestrated globular skeleton); *Sphærozoum*, Haeck., (skeleton of numerous loose spicules which are branched); *Raphidozoum*, Haeck., (spicules simple); *Collozoum*, Müller (devoid of skeleton, Fig. XIV. 2, 3, 4, 5).

Order 2. MONOPYLÆA, Hertwig.

Characters.—Silico-skeletal Radiolaria in which the central capsule is not spherical but monaxonic (cone-shaped), with a single perforate area (pore-plate) placed on the basal face of the cone; the membrane of the capsule is simple, the nucleus single; the skeleton is extracapsular, and forms a scaffold-like or bee-hive-like structure of monaxonic form.

Fam. 1. Plectida, Haeck. Skeleton formed of silicious spines loosely conjoined.

Genera (selected).—*Plagiacantha*, Haeck.; *Plegmatium*, Haeck.

Fam. 2. Cyrtida, Haeck. Skeleton a monaxonic or triradiate shell, or continuous piece (bee-hive-shaped).

Genera (selected).—*Halicalyptra*, Haeck.; *Eucyrtidium*, Haeck. (Fig. XV.); *Carpocanium*, Haeck. (Fig. XVI. 3),

Fam. 3. Botrida, Haeck. Irregular forms; the shell composed of several chambers agglomerated without definite order; a single central capsule.

Genera.—*Botryocyrtis*, Haeck; *Lithobotrys*, Haeck.

Fam. 4. Spyrida, Haeck. Gemminate forms, with shell consisting of two conjoined chambers; a single central capsule.

Fam. 5. Stephida, Haeck. Skeleton cricoid, forming a single silicious ring or several conjoined rings.

Genera (selected).—*Acanthodesmia*, Haeck.; *Zygostephanus*, Haeck.; *Lithocircus*, Haeck. (Fig. XVI. 1).

Order 3. PHÆODARIA, Haeck. (*Tripylæa*, Hertwig).

Characters.—Silico-skeletal Radiolaria in which the central capsule has a double membrane and more than one perforate area, viz., one chief "polar aperture," and one, two, or more accessory apertures (Fig. XVI. 5). The nucleus is single. Around the central capsule is an abundant dark brown pigment (phæodium of Haeckel). The silicious skeleton exhibits various shapes regular and irregular, but is often remarkable for the fact that it is built up of hollow tubes.

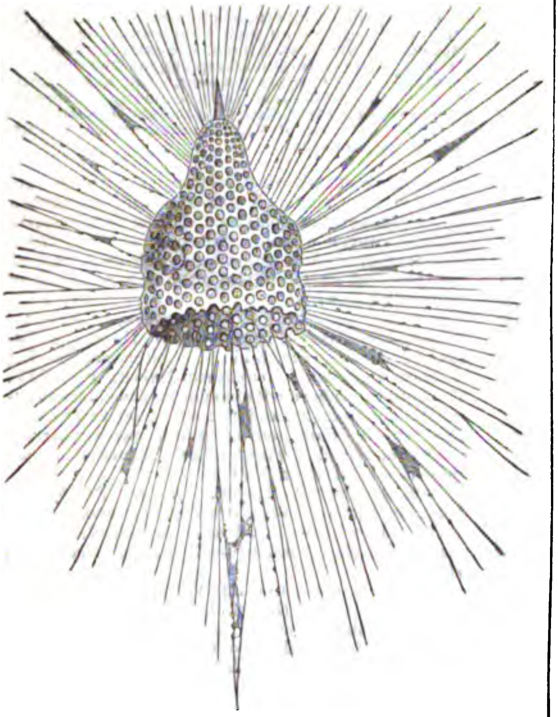


FIG. XV.—*Eucyrtidium cranioides*, Haeck.; × 150; one of the Monopylæa. Entire animal as seen in the living condition. The central capsule is hidden by the bee-hive-shaped silicious shell within which it is lodged.

Fam. 1. PHÆOCYSTIDA, Haeck. The silicious skeleton is either entirely absent or consists of hollow needles which are disposed outside the central capsule, regularly or irregularly.

Genera (selected).—*Aulacantha*, Haeck.; *Thalassoplancta*, Haeck.

Fam. 2. PHÆOGROMIDA, Haeck. The silicious skeleton consists of a single fenestrated shell, which may be spherical, ovoid, or often dipleuric, but always has one or more large openings.

Genera (selected).—*Challengeria*, Wy. Thomson; *Lithogromia*, Haeck.

Fam. 3. PHÆOSPHÆRIDA. The silicious skeleton consists of numerous hollow tubes which are united in a peculiar way to form a large spherical or polyhedral basket-work.

Genera (selected).—*Aulosphæra*, Haeck. (Fig. XVI. 9); *Auloplegma*, Haeck.; *Cannacantha*, Haeck.

Fam. 4. PHÆOCONCHIDA. The siliceous skeleton consists of two separate fenestrated valves, similar to a mussel's shells; often there are attached to the valves simple or branched hollow tubes of silex.

Genera (selected).—*Conchidium*, Haeck.; *Cœlodendrum*, Haeck. (Fig. XVI. 4).

SUB-CLASS II. **Acanthometridea**, Lankester (= *Acanthino skeleta*).

Characters.—Radiolaria in which the skeleton is composed of a peculiar horny substance known as acanthin (rarely of silica). The central capsule is uniformly perforate (Peripylæa type). A divided or multiple nucleus is present in the capsule; the capsule-wall is single. The skeleton always has the form of spines which radiate from a central point within the capsule where they are all fitted to one another. Rarely a fenestrated tangential skeleton is also formed.

Fam. 1. ACANTHONIDA, Haeck. Skeleton consisting of twenty spines of acanthin disposed in five parallel zones of four spines each, meeting one another at the central point of the organism; never forming a fenestrated shell.

Genera (selected).—*Acanthometra*, J. Müller (Fig. XVI. 6, 7); *Astrolonche*, Haeck.; *Amphilonche*, Haeck. (Fig. XIV 18).

Fam. 2. DIPLOCONIDA, Haeck. Skeleton a double cone.

Genus unicum.—*Diploconus*, Haeck.

Fam. 3. DORATASPIDA, Haeck. The twenty acanthin spines of the skeleton form by transverse outgrowths a spherical fenestrated shell.

Genera (selected).—*Stauraspis*, Haeck.; *Dorataspis*, Haeck.

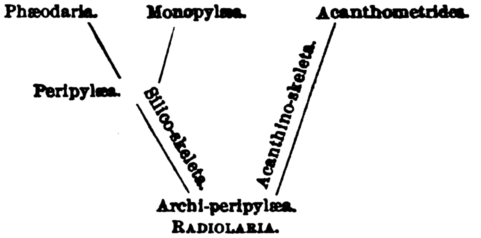
Fam. 4. SPHÆROCAPSIDA, Haeck. The twenty acanthin spines are joined together at their free apices by a simple perforate shell of acanthin.

Genus unicum.—*Sphærocapsa*.

Fam. 5. LITHOLOPHIDA. Skeleton of many needles of acanthin radiating from a single point without definite number or order.

Genera.—*Litholophus*, Haeck.; *Astrolophus*, Haeck.

Further remarks on the Radiolaria.—It has not been possible in the systematic summary above given to enumerate the immense number of genera which have been distinguished by Haeckel (42) as the result of the study of the skeletons of this group. The important differences in the structure of the central capsule of different Radiolaria were first shown by Hertwig, who also discovered that the spines of the Acanthometridea consist not of silica but of an organic compound. In view of this latter fact and of the peculiar numerical and architectural features of the Acanthometrid skeleton, it seems proper to separate them altogether from the other Radiolaria. The Peripylæa may be regarded as a starting point of the Radiolarian pedigree, and have given rise on the one hand to the Acanthometridea, which retain the archaic structure of the central capsule whilst developing a peculiar skeleton, and on the other hand to the Monopylæa and Phæodaria which have modified the capsule but retained the silicious skeleton.



The occasional total absence of any silicious or acanthinous skeleton does not appear to be a matter of classificatory importance, since skeletal elements occur in close allies of those very few forms which are totally devoid of skeleton. Similarly it does not appear to be a matter of great significance that some forms (Polycyttaria) form colonies, instead of the central capsules separating from one another after fission has occurred.

It is important to note that the skeleton of silex or acanthin does not correspond to the shell of other Gymnomyxa, which appears rather to be represented by the membranous central capsule. The skeleton does, however, appear to correspond to the spicules of Heliozoa, and there is an undeniable affinity between such a form as Clathrulina (Fig. VII. 2.) and the Sphærid Peripylæa (such as Heliosphæra, Fig. XIV. 14). The Radiolaria, are, however, a very strongly marked group, definitely separated from all other Gymnomyxa by the membranous central capsule sunk in their protoplasm. Their differences *inter se* do not affect their essential structure. The variations in the chemical composition of the skeleton and in the perforation of the capsule do not appear superficially. The most obvious features in which they differ from one another relate to the form and complexity of the skeleton, a part of the organism so little characteristic of the group that it may be wanting altogether. It is not known how far the form-species and form-genera which have been distinguished in such profusion by Haeckel as the result of a study of the skeletons are permanent (*i.e.*, relatively permanent) physiological species. There is no doubt that very many are local and conditional varieties of a single Protean species. The same remark applies to the species discriminated among the shell-bearing Reticularia. It must not be supposed, however, that less importance is to be attached to the distinguishing and recording of such forms because we are not able to assert that they are permanent species.

The *yellow cells* (of spherical form, .005 to 0.15 of a millimetre in diameter) which occur very generally scattered in

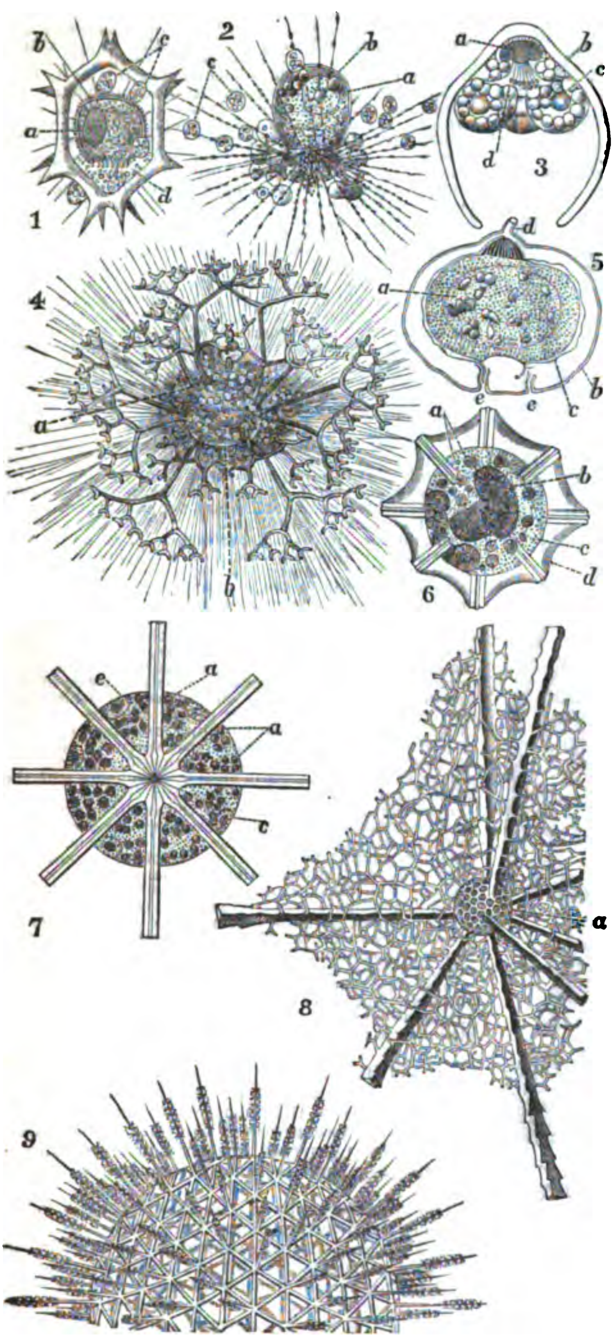


Fig. XVI.—Radiolaria. 1. *Lithocircus annularis*, Hertwig; one of the Monopylæa. Whole animal in the living state (optical section). *a*, nucleus; *b*, wall of the central capsule; *c*, yellow cells; *d*, perforated area of the central capsule (Monopylæa). 2. *Cystidium inerme*, Hertwig; one of the Monopylæa. Living animal. An example of a Monopylæon destitute of skeleton. *a*, nucleus; *b*, capsule-wall; *c*, yellow cells in the extracapsular protoplasm. 3. *Carpocanium diadema*, Haeck.; optical section of the bee-hive-shaped shell to show the form and position of the protoplasmic body. *a*, the tri-lobed nucleus; *b*, the silicious shell; *c*, oil-globules; *d*, the perforate area (pore-plate) of the central capsule. 4. *Cœlodendrum gracillimum*, Haeck.; living animal, complete; one of the Tripylæa. *a*, the characteristic dark pigment (phæodium) surrounding the central capsule *b*. The peculiar branched silicious skeleton, consisting of hollow fibres, and the expanded pseudopodia are seen. 5. Central capsule of one of the Trypylæa, isolated, showing *a*, the nuclens; *b.c*, the inner and the outer laminæ of the capsule-wall; *d*, the chiefor polar aperture; *e,e*, the two secondary apertures. 6, 7, *Acanthometra Claparedei*, Haeck. 7 shows the animal in optical section, so as to exhibit the characteristic meeting of the spines at the central point as in all Acanthometridea; 6 shows the transition from the uninuclear to the multinuclear condition by the breaking up of the large nucleus. *a*, small nuclei; *b*, large fragments of the single nucleus; *c*, wall of the central capsule; *d*, extracapsular jelly (not protoplasm); *e*, peculiar intracapsular yellow cells. 8. *Spongosphæra streptacantha*, Haeck.; one of the Peripylæa. Silicious skeleton not quite completely drawn on the right side. *a*, the spherical extracapsular shell (compare Fig. XIV. 17), supporting very large radial spines which are connected by a spongy network of silicious fibres. 9. *Aulosphæra elegantissima*, Haeck.; one of the Phæodaria. Half of the spherical silicious skeleton.

the extracapsular protoplasm of Radiolaria were at one time regarded as essential components of the Radiolarian body. Their parasitic nature is now rendered probable by the observations of Cienkowski (**43**), Brandt (**44**), and Geddes (**45**), who have established that each cell has a cellulose wall and a nucleus (Fig. XIV. 6 to 13), that the protoplasm is impregnated by chlorophyll which, as in Diatoms, is obscured by the yellow pigment, and that a starch-like substance is present (giving the violet reaction with iodine). Further Cienkowski showed, not only that the yellow cells multiply by fission during the life of the Radiolarian, but that when isolated they continue to live; the cellulose envelope becomes softened; the protoplasm exhibits amœboid movements and escapes from the envelope altogether (Fig. XIV. 13) and multiplies by fission. Brandt has given the name *Zooxanthella nutricola* to the parasitic unicellular Alga thus indicated. He and Geddes have shown that a similar organism infests the endoderm cells of Anthozoa aud of some Siphonophora in enormous quantities, and the former has been led, it seems erroneously, to regard the choloropyll corpuscles of *Hydra viridis*, Spongilla, and Ciliata as also parasitic Algæ, for which he has coined the name Zoochlorella. The same arguments which Brandt has used to justify this view as to animal chlorophyll would warrant the creation of a genus "Phytochlorella" for the hypothetical Alga which has hitherto been described as the "chlorophyll corpuscles" of the cells of ordinary green plants.

Zooxanthella nutricola does not, for some unknown reason, infest the Acanthometridea, and it is by no means so universally present in the bodies of the Silico-skeleta as was supposed before its parastic nature was recognized.

The *streaming of the granules of the protoplasm* has been observed in the pseudopodia of Radiolaria as in those of Heliozoa and Reticularia: it has also been seen in the deeper protoplasm; and granules have been definitely seen to pass through the pores of the central capsule from the intracapsular to the extracapsular protoplasm. A feeble vibrating movement of the pseudopodia has been occasionally noticed.

The *production of swarm-spores* has been observed only in Acanthometra and in the Polycyttaria and Thalassicolidæ, and only in the two latter groups have any detailed observations been made. Two distinct processes of swarm-spore production have been observed by Cienkowski (**43**), confirmed by Hertwig (**46**)—distinguished by the character of the resulting spores which are called "crystalligerous" (Fig. XIV. 15) in the one case, and "dimorphous" in the other (Fig. XIV. 16). In both processes the nucleated protoplasm within the central capsule breaks up by a more or less regular cell-division into small pieces, the details of the process differing a little in the two cases. In those individuals which produce crystalligerous swarm-spores, each spore encloses a small crystal (Fig. XIV. 15). On the other hand, in those individuals which produce dimorphous swarm-spores, the contents of the capsule (which in both instances are set free by its natural rupture) are seen to consist of individuals of two sizes "macrospores" and "microspores," neither of which contain crystals (Fig. XIV. 16). The further development of the spores has not been observed in either case. Both processes have been observed in the same species, and it is suggested that there is an alternation of sexual and asexual generations, the crystalligerous spores developing directly into adults, which in their turn produce in their central capsules dimorphous swarm-spores (macrospores and microspores), which in a manner analogous to that observed in the Volvocinean Flagellata copulate (permanently fuse) with one another (the larger with the smaller) before proceeding to develop. The adults resulting from this process would, it is suggested, produce in their turn crystalligerous swarm-spores. Unfortunately we have no observations to support this hypothetical scheme of a life history.

Fusion or *conjugation* of adult Radiolaria, whether preliminary to swarm-spore-production or independently of it, has not been observed—this affording a distinction between

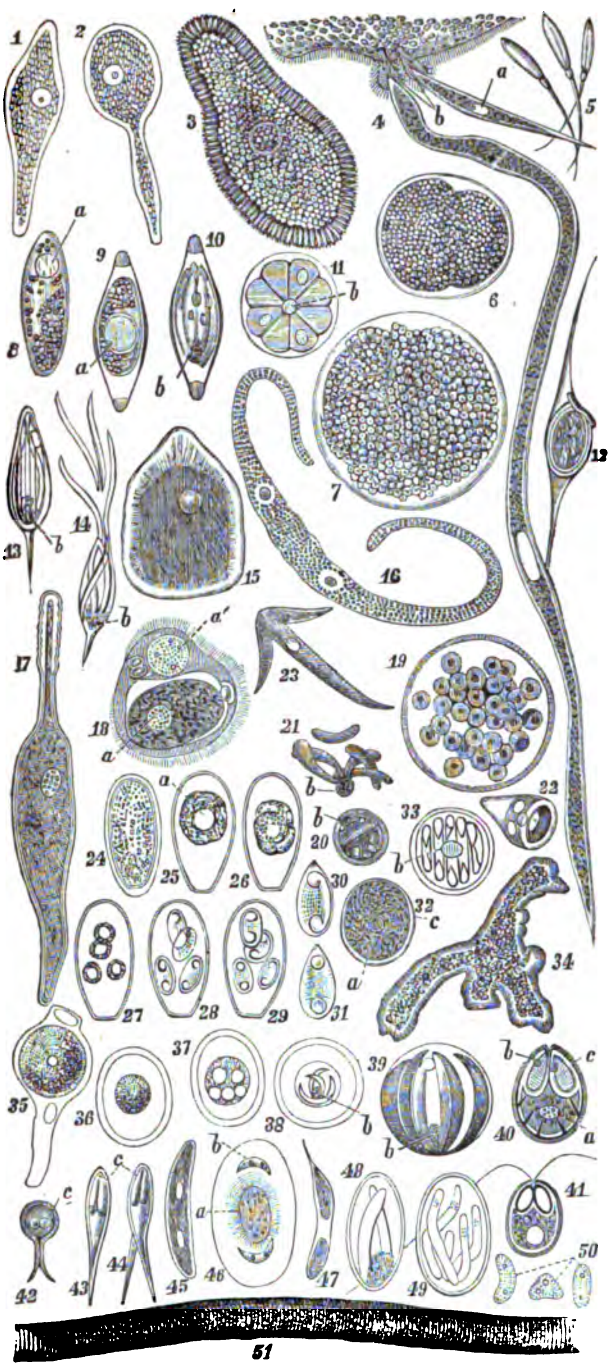


Fig. XVII.—Sporozoa. 1, 2. *Monocystis agilis*, Stein; × 250; from the testis of the Earthworm. Two phases of movement—a ring-like contraction passing along the body from one end to the other. 3. Individual of the same species which has penetrated in the young stage a sperm-cell of the Earthworm, and is now clothed as it were with spermatoblasts. 4. *Monocystis magna*, A. Schmidt, from the testis of the Earthworm (*L. terrestris*, L.). Two individuals, which are implanted by one extremity at *b* in two epithelial cells of the rosette of the spermatic duct. *a*, nucleus of the Monocystis. 5. Tailed chlamydospores of *Monocystis sænuridis*, Köll. 6. Two *M. agilis* encysted, spores forming on the surface of the protoplasm. 7. A similar cyst further advanced in spore-formation (see Fig. XVIII.). 8. Spore of *M. agilis*, now elongated but still naked. *a*, nucleus. × 1400. 9. The spore has now encased itself in a navicula-shaped coat. *a*, nucleus. 10. The spore protoplasm has now divided into several falciform swarm-spores, leaving a portion of the protoplasm unused. *b*. Schneider's residual core. 11. Optical transverse section of a completed spore. *b*, Schneider's residual core. 12. Chlamydospore of *Klossia chitonis*, nov. sp. from the liver of Chiton (original). 13, 14. Chlamydospore of *Monocystis nemertis*, Köll., liberating falciform young. *b*. Schneider's residue. 15. *Monocystis pellucida*, Köll. (from Nereis); × 150; to show the very thick cortical substance and its fibrillation (after Lankester, **54**). 16. *Monocystis sænuridis*, Kölle, two individuals adhering to one another (a syzygium). For spores see 5. 17. *Monocystis aphroditæ*, Lankester (**55**); × 60; remarkable among Monocystids for its long proboscis resembling the epimerite of some Septata. 18. *Klossia helicina*, Aim. Schn., from the kidney of *Helix hortensis*. A single cell of the renal epithelium in which a full-grown Klossia is embedded. *a*, nucleus of the Klossia; *a'*, nucleus of the renal cell. 19. Cyst of *Klossia helicina*, the contents broken up into spherical chlamydospores. 20. Single spore from the last, showing falciform young and a Schneider's residue *b*. 21. The contents of the same spore. 22. A small renal cell of Helix containing two of the youngest stage of Klossia. 23. *Monocystis sagittata*, Leuck., from the intestine of *Capitella capitata*; × 100. 24 to 31. *Coccidium oviforme*, Leuck., from the liver of the Rabbit: 24, adult individual encysted; 25, the protoplasm contracted—*a*, nucleus; 26, 27, division into four spores, as yet naked; 28, 29, the spores having acquired a covering, *i.e.*, are chlamydospores, and each contains a single falciform young; 30, 31, two views of a chlamydospore more highly magnified so as to show the single falciform young (from Leuckart). 32. *Klossia octopiana*, Aim. Schn., from Cephalopoda. *a*, nucleus; *c*, cyst-membrane. × 200 diam. 33. Single spherical spore of the same; × 1400 diam; showing numerous falciform young, and *b*, Schneider's residue. 34. *Myxidium Lieberkühnii*, Bütschli, one of the Myxosporidia, from the bladder of the Pike (Esox); creeping euglena phase, showing strongly lobed amœboid character (pseudopodia and undifferentiated (?) cortex); × 60 diam. 35-39. *Eimeria falciformis*, Eimer, sp., from the Mouse: 35, an adult non-encysted individual inhabiting an epithelial cell of the intestine of the mouse; 36, encysted phase; 37, clear corpuscles appear in the encysted protoplasm; 38, the protoplasm now forms a single spore containing several falciform young; *b*, Schneider's residue; 39, isolated spore showing falciform young, and *b*, Schneider's residue. 40. Chlamydospore of *Myxobolus Mülleri*; Bütschli; one of the Myxosporidia from the gills of Cyprinoid Fishes. *a*, nucleus; *b*, refringent corpuscle; *c*, polar body or thread capsule. 41. A similar chlamydospore which has ejected the filaments from its thread capsules. 42. Chlamydospore of a Myxosporidium infesting the kidney of *Lota vulgaris*. *c*, polar body (psorosperm of authors). 43, 44. Chlamydospores of a Myxosporidium from the gills of Perca (psorosperm of authors). Compare with the tailed chlamydopores of *Monocystis sænuridis*, 5. 45-47. *Drepanidium ranarum*, Lankester, the falciform young of an unascertained Coccidiide infesting the Frog (supposed by Gaule to be produced by the blood corpuscles): 45, specimen stained by iodine; 46, red-blood corpuscle of Frog, showing *b*, two contained Drepanidia, and *a*, the nucleus of the blood corpuscle; 47, living Drepanidium. 48. Chlamydospore of Lieberkühn's Coccidium of the Frog's kidney, perhaps belonging to the life-cycle of *Drepanidium ranarum*. The spore contains two falciform young (Drepanidia ?) and a Schneider's residue. 49. Chlamydospore of *Monocystis thalassemæ*, Lankester, containing numerous falciform young. 50, 51. *Sarcocystis Miescheri*, Lankester: —50, falciform young escaped from chlamydospores; 51, adult euglena phase inhabiting a striated muscle fibre of the Pig.

them and Heliozoa, and an agreement, though of a negative character, with the Reticularia.

Simple fission of the central capsule of adult individuals and subsequently of the whole protoplasmic mass has been observed in several instances, and is probably a general method of reproduction in the group.

The silicious shells of the Radiolaria are found abundantly in certain rocks. They furnish, together with Diatoms and Sponge-spicules, the silica which has been segregated as flint in the chalk formation. They are present in quantity (as much as 10 per cent.) in the Atlantic ooze, and in the celebrated "Barbados earth" (a Tertiary deposit) are the chief components.

GRADE B. *CORTICATA*, Lankester, 1878 (**64**).

Characters.—Protozoa in which the protoplasm of the cell-body, in its adult condition, is permanently differentiated into two layers, an outer denser cortical substance and an inner more fluid medullary substance (not to be confused with the merely temporary distinction of exoplasm and endoplasm sometimes noted in Gymnomyxa, which is not structural but due to the gravitation and self-attraction of the coarser granules often embedded in the uniformly fluid protoplasm).

Since the Corticata have developed from simple Gymnomyxa exhibiting both amœboid and flagellate phases of form and activity, it results (1) that the forms of the body of many Corticata are traceable to modifications of these primitive forms; (2) that the young stages of the Corticata are in the lower classes of that group typical flagellulæ or amœbulæ; and (3) that there are certain archaic forms included in those lower classes whose position there is doubtful, and which might be with almost equal propriety assigned to the Gymnomyxa, since they are transitional from that lower grade to the higher grade of Corticata.

CLASS I. SPOROZOA, Leuckart (47); Syn. *Gregrainida*, Auct.

Characters.—Corticata parasitic in almost all classes and orders of animals, imbibing nutriment from the diffusible albuminoids of their hosts and therefore mouthless. In typical cases there is hatched from a chlamydospore one or more modified nucleate or non-nucleate flagellulæ (falciform young, drepanidium phase). The flagellula increases in size and differentiates cortical and medullary substance. Fission is common in the younger stages of growth. The movements now become neither vibratile nor amœboid but definitely restrained, and are best described as "euglenoid" (*cf.* Flagellata, Fig. XX. 27, 28). The nucleus is single, large, and spherical. No contractile vacuole and rarely any vacuole is present. A size of $\frac{1}{10}$th inch may be attained in this phase, which may be definitely spoken of as the euglena phase corresponding to the amœba phase of Gymnomyxa. It is usually of oblong form, with sac-like contractile wall of cortical substance, but may be spherical (Coccidiidea) or even amœboid (Myxosporidia).

Conjugation, followed directly or after an interval by sporulation, may now ensue. The conjugated individuals (two) or sometimes a single individual, become encysted. The contents of the cysts now rapidly divide (by a process the details of which are unknown) into minute ovoid nucleated (?) bodies; sometimes a portion of the protoplasm is not converted into spores but may form sporoducts (*cf.* capillitium of Mycetozoa). Each piece acquires a special chitin-like colorless coat, and is then a chlamydospore. Rarely one spore only is formed from the whole contents of a cyst. The spore-coat is usually thick, and remarkable for processes and other accessory developments. The included protoplasm of the chlamydospore frequently divides into several pieces before hatching. These usually, when set free from the spore-coat, have the form of modified nucleated flagellulæ, *i.e.*, flagellulæ in which the protoplasm is not drawn out into a thread-like flagellum but exhibits an elongate form, uniformly endowed with vibratile activity. With few (if any) exceptions, the falciform young thus characterized penetrates a cell of some tissue of its host and there undergoes the first stages of its growth (hence called Cytozoa). In some forms the pre-cystic phase never escapes from its cell host. In other cases it remains connected with the hospitable cell long after it has by growth exceeded by many hundred times the bulk of its quondam entertainer: often it loses all connection with its cell host and is carried away to some other part of the infested animal before completing its growth and encysting

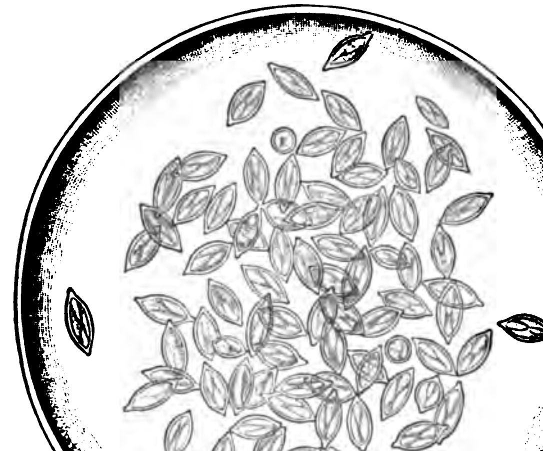


FIG. XVIII.—Cyst of *Monocystis agilis*, the common Gregarinide of the Earthworm; × 750 diam.; showing ripe chlamydospores and complete absence of any residual protoplasm or other material in the cyst (original).

The Sporozoa are divided into four sub-classes, differing from one another according to the form and development attained by the euglena phase. We shall place the most highly developed first, not only because our knowledge about it is most complete, but because it is possible that one at least of the other sub-classes is derived by degeneration from it.

SUB-CLASS I. Gregarinidea, Bütschli (9).

Characters.—Sporozoa in which the euglena phase is dominant, being relatively of large size, elongate in form, definitely shaped, having contractile but not viscid cortex, and exhibiting often active nutritional and locomotor phenomena. Though usually if not invariably cell-parasites in early youth, they become free before attaining adult growth, and inhabit either the body-cavity or the intestine of their hosts. Many spores are produced in the encysted phase. The spores have an oblong, sometimes caudate coat, and produce each one or several falciform young. At present only known as parasites of Invertebrata.

ORDER 1. HAPLOCYTA, Lankester.

Characters.—Gregarinidea in which there is never at any time a partition of the medullary substance into two or more chambers. The euglenoid is always a single contractile sac with one mass of medullary substance in which floats the large vesicular transparent nucleus. Spores larger than in the next group, each producing several falciform young.

Genus unicum.—*Monocystis*, Stein, 1848. The various generic subdivisions proposed by Aim. Schneider (48), and accepted by Bütschli, appear to the present writer to have insufficient characters, and serve to complicate rather than to organize our knowledge of the subject. We do not yet know enough of the sporulation and subsequent development of the various monocystic Gregarinides to justify the erection of distinct genera.

Monocystis agilis, Stein, Fig. XVII. 1, 2, 3, 6, 7, 8, 9, 10, 11, and Fig. XVIII. is the type. The other species of Monocystis occur chiefly (and very commonly) in marine Annelids, Platyhelminthes, Gephyræa, and Tunicata; not in Arthropoda, Mollusca, nor Vertebrata. The only definite differences which they present of possibly more than specific worth, as compared with *M. agilis*, are in the form of the chlamydospores, which are sometimes tailed, as in *M. sænuridis* (Fig. XVII. 5), and in *M. nemertis* (Fig. XVII. 13) and *sipunculi*, and further also certain differences in the general form, as for instance the anchor-like *M. sagittata* (Fig. XVII. 23), and the proboscidiferous *M. aphroditæ* (Fig. XVII. 17). The fine parallel striation of the cuticule in some species (*M. serpulæ*, etc.) might also be made the basis of a generic or sub-generic group.

On the whole it seems best to leave all the species for the present in the one genus Monocystis, pending further knowledge. It seems probable that more than one species (at least two, *M. agilis* and *M. magna*) infest the common Earthworm.

ORDER 2. SEPTATA, Lankester.

Characters.—Gregarinidea in which the adult in the medullary substance is separated into two chambers—a smaller anterior (the protomerite) and a larger posterior (the deutomerite), in which lies the nucleus. There is frequently if not always present, either in early growth or more persistently, an anterior proboscis-like appendage (the epimerite) growing from the protomerite. The epimerite serves to attach the parasite to its host, and may for that purpose carry hooklets. It is always shed sooner or later. The phase in which it is present is called a "cephalont," the phase after it has broken off a "sporont" (see Fig. XIX. 22, 23). The spores are smaller than in the preceding group, often very minute, and sometimes the cyst is complicated by the formation of sporoducts, and by a kind of "capillitium" of residual protoplasm (Fig. XIX. 2). Spores producing each only a single (?) falciform young.

Genera.—*Gregarina*, Dufour; *Hoplorhynchus*, Von Carus.

[The numerous genera which have been proposed at different times by Hammerschmidt and others, and more recently by Aimé Schneider, appear to the present writer to be unserviceable, owing to the fact that our knowledge is as yet very incomplete. A good basis for generic or family distinctions might probably be found in the greater or less elaboration of the cyst and the formation or not of sporoducts. But of the majority of Septata we do not know the cysts or the history of sporulation; we merely know that some have simple cysts with complete sporulation leaving

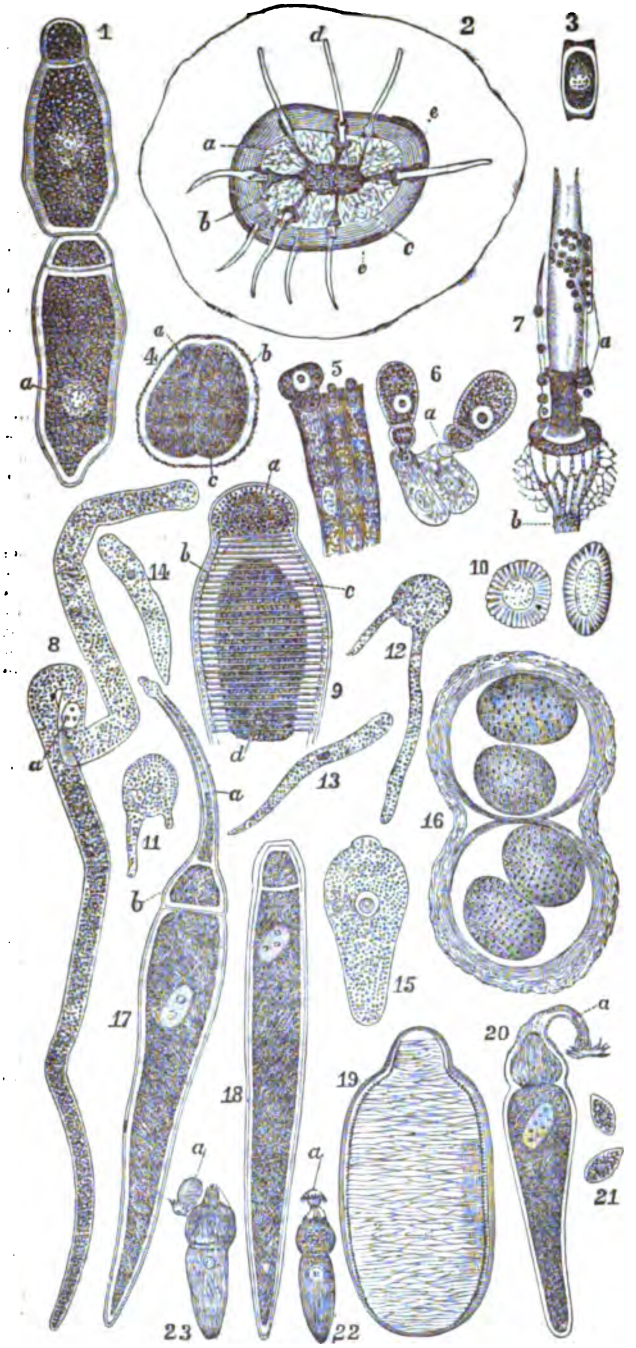


FIG. XIX.—**Sporozoa** (Septata). 1. *Gregarina blattarum*, Siebold, from the intestine of *Blatta orientalis*; × 80. A syzygium of two individuals. Each animal consists of a small anterior chamber, the protomerite, and a large posterior chamber, the deutomerite, in which is the nucleus *a*. 2. Over-ripe cyst of *Gregarina blattarum*, with thick gelatinous envelope, *e*, and projecting sporoducts *d*. The spores have been nearly all discharged, but a mass of them still lies in the centre of the cyst *b*. The specimen has been treated with dilute KHO, and the granular contents of the cyst dissolved. Around the central mass of spores is rendered visible the network of protoplasmic origin in which the ejected spores were embedded. This distinctly resembles in origin and function the capillitium of Mycetozoa (Fig. III). *a*, the plasmatic channels leading to the everted sporoducts; *b*, the still remaining spores; *c*, the proper cyst-wall; *d*, the everted sporoducts; *e*. the gelatinous envelope. 3. A ripe spore (chlamydospore) of *Gregarina blattarum*, a long time after its escape from the cyst, × 1600 diam. 4. Commencing encystment of a syzygium *G. blattarum*. *a*, protomerite of one individual; *b*, gelatinous envelope; *c*, protomerite of the second individual. 5. Three epithelial cells of the mid-gut of *Blatta orientalis*, into the end of each of which an extremely young *Gregarina blattarum* has made its way. 6. Further development of the young Gregarina; only the epimerite *a* is now buried in the substance of the epithelial cell, and this will soon break off and set the Gregarina free. It is now a "cephalont" it will then become a "sporont." 7. Basal part of an everted sporoduct of *Gregarina blattarum*. *a*, granular-fibrous mass investing the base of the duct; *b*, commencement of the plasmatic channel in the interior of which the sporoduct was produced as an invaginated cuticular formation before its eversion. 8. *Gregarina gigantea*, E. Van Ben., from the intestine of the Lobster; × 150. *a*, nucleus. 9, Anterior end of the same more highly magnified. *a*, protomerite; *b*. layer of circular fibrillæ lying below the cuticle; *c*, cortical substance of the deutomerite; *d*, medullary substance of the deutomerite. 10. Two spores of *Gregarina gigantea* (after Bütschli) showing the very thick coat of the spore. 11–15. Stages in the development of *Gregarina gigantea*: 11, recently escaped from the spore-coat, no nucleus; 12, still no nucleus, one vibratile and one motionless process; 13, the two processes have divided; one here drawn has developed a nucleus; 14, further growth; 15, the deutomerite commences to develop. 16. Cysts of *Gregarina gigantea*, from the rectum of the Lobster. The double contents are believed by Ed. Van Beneden to be due not to conjugation previous to encystment but to subsequent fission. 17, 18. *Gregarina longicollis*, Stein, from the intestine of *Blaps mortisaga*: 17, cephalont phase, with a long proboscis-like epimerite *a*, attached to the protomerite *b*; 18, sporont phase, the epimerite having been cast preliminary to syzygy and encystment. 19. *Gregarina Manieri*, Aim. Schneider, from the intestine of *Timarcha tenebricosa*, to show the network of anastomosing fibres beneath the cuticle, similar to the annular fibrillæ of *G. gigantea* shown in 9. 20. *Gregarina* (*Hoplorhynchus*) *obligacanthus*, Stein, from the intestine of the larva of Agrion. Cephalont with spine-crowned epimerite *a*. 21. Spores of *Gregarina obligacanthus*. 22, 23, *Gregarina* (*Hoplorhynchus*) *Dujardini*, Aim. Schneider, from the intestine of *Lithobius forficatus*: 22, specimen with epimerite *a*, therefore a "cephalont"; 23, specimen losing its epimerite by rupture and becoming a "sporont."

no residue protoplasm, and that others form cysts with double walls and elaborate tubular ducts, whilst a part of the protoplasm is not sporulated but forms a capillitium (Fig. XIX. 2.)

Another possible basis for generic division of the Septata may be found in the characters of the epimerite. This may be present or absent altogether. It may exist only in the young condition or persist until growth is completed. It may be simple, short, elongate, or provided with hooklets. The presence of hooklets on the epimerite is the only character which at present seems to serve conveniently for generic distinction. With regard to the other points mentioned we are not sufficiently informed, since we know the complete history of development from the young form set free from the spore in only one or two cases.]

The Septata are found exclusively in the alimentary canals of Arthropoda (Insects, Myriapoda, Crustacea, not Arachnida). See Fig. XIX for various examples of the group.

SUB-CLASS II. **Coccidiidea**, Bütschli (9).

Sporozoa in which the euglena phase remains of relatively minute size, of spherical shape and simple egg-cell-like structure. It is not locomotive, but continues, until the cyst is formed, to inhabit a single cell of the host. Many, few, or one single chlamydospore are formed in the cyst. One or more falciform young escape from each spore, and exhibit active movements (flagellula-like) leading to a penetration of a tissue-cell by the young form as in Gregarinidea. Many are parasites of Vertebrata.

ORDER 1. MONOSPOREA, Aim. Schn.

Characters.—The whole content of the cyst forms but a single spore,

Genus unicum.—*Eimerii* (in the intestinal epithelium of Triton, Frog, Sparrow, Mouse, and the Myriapods, Lithobius and Glomeris, Fig. XVII. 35 to 39).

ORDER 2. OLIGOSPOREA, Aim. Schn.

Characters.—The cyst-content develops itself into a definite and constant but small number of spores.

Genus unicum.—*Coccidium*, Leuck. (in intestinal epithelium and liver of Mammals, and some Invertebrates, Figs. XVII. 24 to 31).

ORDER 3. POLYSPOREA.

Characters.—The cyst-content develops itself into a great number of spores (sixty or more).

Genus unicum.—*Klossia*, Aim. Schn. Three species of Klossia are found in Mollusca—viz., in Helix, in Cephalopods, and in Chiton. Schneider's genus, Adelea, from Lithobius, appears to belong here. Kloss (49) discovered the parasite of the renal cells of *Helix hortensis* represented in Fig. XVII. 18, 19, 20, 21, and 22; Schneider that of Cephalopods, Fig. XVII. 32, 33. In Chiton Dr. Tovey has discovered a third species with very remarkable spores, which are here figured for the first time (Fig. XVII. 12).

The *Drepanidium Ranarum* (Fig. XVII, 45, 46, 47), discovered by Lankester (50) in the Frog's blood, is probably the falciform young of a Coccidium parasitic in the Frog's kidney, and discovered there by Lieberkühn (51). A spore of this Coccidium is shown in Fig. XVII. 48; whilst in 46 two Drepanidia which have penetrated a red-blood corpuscle of the Frog are represented.

The Polysporous Coccidiidea come very close to the Gregarinide genus Monocystis, from which they may be considered as being derived by an arrest of development. The spores and falciform young of the Coccidiidea are closely similar to those Monocystis, and the young in both cases penetrate the tissue-cells of their host; but in Monocystis this is only a temporary condition, and growth leads to the cessation of such "cell-parasitism." On the other hand, growth is arrested in the Coccidiidea, and the organism is permanently a cell-parasite.

Since the parasitism is more developed in the case of a cell-parasite than in the case of a parasite which wanders in the body cavity, it seems probable that the Coccidiidea have been derived from the Gregarinidea rather than that the reverse process has taken place.

SUB-CLASS III. **Myxosporidia**, Bütschli.

Characters.—Sporozoa in which the euglena-phase is a large multinucleate amœba-like organism (Fig. XVII. 34). The cysts are imperfectly known, but appear to be simple; some attain a diameter of two lines. The spores are highly characteristic, having each a thick coat which is usually provided with a bifurcate process or may have thread capsules (like nematocysts) in its substance (Fig. XVII. 40, 41, 42, 43, 44).

The spores contain a single nucleus, and are not known to produce falciform young, but in one case have been seen to liberate an amœbula. The further development is unknown. The Myxosporidia are parasitic beneath the epidermis of the gills and fins, and in the gall-bladder and urinary bladder of Fishes, both fresh-water and marine.

Genera.—*Myxidium*, Bütschli (Pike, Fig. XVII. 34); *Myxobolus*, Bütschli (Cyprinoids); *Lithocystis*, Giard (the Lamellibranch Echinocardium).

The Myxosporidia are very imperfectly known. They present very close affinities to the Mycetozoa, and are to be regarded as a connecting link between the lower Gymnomyxa and the typical Sporozoa. Possibly their large multinucleate amœba phase is a plasmodium formed by fusion of amœbulæ set free from spores, though it is possible that the many nuclei are the result of a division of an original single nucleus, preparatory to sporulation.

Their spores are more elaborate in structure than those of any other Protozoa, and are more nearly paralleled by those of some species of Monocystis than by those of Mycetozoa. The thread capsules of the spores are identical in structure with those of Hydrozoa, and probably serve as organs of attachment, as do the furcate processes of the spore-case. It is not certain that a definite cyst is always or ever formed, but as occurs rarely in some Gregarinidea, the spores may be formed in a non-encysted amœba form.

Although pseudopodia, sometimes short and thread-like, have been observed in the amœba phase, yet it is also stated that a distinction of cortical and medullary substance obtains.

The "psorosperms" of J. Müller are the spores of Myxosporidia.

SUB-CLASS IV. **Sarcocystidia**, Bütschli.

(This division is formed by Bütschli for the reception of Sarcocystis, parasitic in the muscular fibres of Mammals, and of Amœbidium, parasitic in Crustacea. Both are very insufficiently known, but have the form of tubular protoplasmic bodies in which numerous ovoid spores are formed from which falciform young escape.)

Genera.—*Sarcocystis*, Lankester; *Amœbidium*, Cienkowski (52). Sarcocystis (Fig. XVII. 50, 51, *S. Miescheri*, Lank.), was first observed by Miescher in the striated muscle-fibres of the Mouse; then by Rainey in a similar position in the Pig, and taken by him for the youngest stage in the development of the cysts of *Tænia solium;* subsequently studied by Beale and others in connection with the cattle-plague epidemic, and erroneously supposed to have a causal connection with that disease. It is common in healthy butcher's meat. See Leuckart. (47).

Further remarks on the Sporozoa.—The Sporozoa contrast strongly with the large classes of Gymnomyxa, the Heliozoa, Reticularia, and Radiolaria, as also with the Ciliate and Tentaculiferous, Corticata, by their abundant and rapidly recurrent formation of spores, and agree in this respect with some Proteomyxa with Mycetozoa, and some Flagellata. Their spores are remarkable for the firm, chitin-like spore-coat and its varied shapes, contrasting with the cellulose spherical spore-coat of Mycetozoa and with the naked spores of Radiolaria and Flagellata.

The protoplasm of the more highly developed forms (Gregarinidea) in the euglenoid phase exhibits considerable differentiation. Externally a distinct cuticle may be present, marked by parallel rugæ (*Monocystis serpulæ*) or by fine tubercles (*Monocystis sipunculi*). A circlet of hooks may be formed by the cuticle at one end of the body. Below the cuticle is sometimes developed a layer of fibrils running transversely to the long axis of the body (Fig. XIX. 9 and 19), which have been regarded as contractile, but are probably cuticular. The cortical layer of protoplasm below these cuticular structures is dense and refringent and sometimes fibrillated (*Monocystis pellucida*, Fig. XVII. 15). It is the contractile substance of the organism, and encloses the finely granular more liquid medullary substance. The granules of the latter have been shown by Bütschli (9) to give a starch-like reaction with iodide, etc. Probably the protoplasm in which they lie is finely reticulate or vacuolar, and when the granules are few it is actually seen to be so. No contractile vacuole is ever present. In Myxosporidia the medullary protoplasm is colored yellow by hæmatoidin derived from the blood of its host or by absorbed bile-pigment, and also contains small crystals.

The nucleus of the gregarinidea is a large clear capsule, with a few or no nucleolar granules. It has never been seen in a state of division, and it is not known what becomes of it during sporulation, though sporulating Gregarinidea have been observed with many minute nuclei scattered in their protoplasm, presumably formed by a breaking up of the single nucleus.

The habit of attaching themselves in pairs which is common in Gregarinidea is perhaps a reminiscence of a more extensive formation of aggregation plasmodia (compare Mycetozoa). The term "syzygium" is applied to such a conjunction of two Gregarinidea; it is not accompanied by fusion of substance. The formation of cysts is not connected with this pairing, since the latter occurs in young individuals long before encystment. Also cysts are formed by single Gregarinidea, as is always the case in the non-motile Coccidiidea.

The encystment always leads to the formation of spores, but in rare cases sporulation has been observed in unencysted Gregarinidea, and it occurs perhaps normally without true cyst-formation in the Myxosporidia.

The cell-parasitism of the young Sporozoa, and their flagellula-like (falciform) young and active vibratile movement, are points indicating affinity with the lower Gymnomyxa, and especially with those Proteomyxa, such as Vampyrella and Plasmodiophora, which are cell-parasites. Indeed it is probable that we have in this fact of cell-parasitism, and especially of parasitism in animal cells, a basis for the theoretical association of several unicellular organisms. The Haplococcus of Zopf (regarded by him as a Mycetozoon) is parasitic in the muscular cells of the Pig, and is probably related to Sarcocystis. Recently Von Lendenfeld (53) has described in Australia an amœba-like organism as parasitic in the skin of Sheep, which will probably be found to be either a Sporozoon or referable to those parasitic spore-producing Proteomyxa which are separated from Sporozoa only by their negative characters (see previous remarks on the negative characters of Proteomyxa).

The application of the name "Gregarines" has sometimes been made erroneously to external parasitic organisms, which have nothing in common with the Sporozoa. This was the case in regard to a fungoid growth in human hair—the so-called "chignon Gregarine." The Silk-worm disease known as "pebrine" has also been attributed to a Gregarine. It seems probable that the parasitic organism which causes that disease is (as is also the distinct parasite causing the disease known as "flaccidezza" in the same animals) one of the Schizomycetes (Bacteria). No disease is known at present as due to Sporozoa, although (*e. g.* the *Klossiachitonis*) they may lead to atrophy of the organs of the animals which they infest, in consequence of their enormous numbers. Coccidia and Sarcocystis are stated to occur in Man.

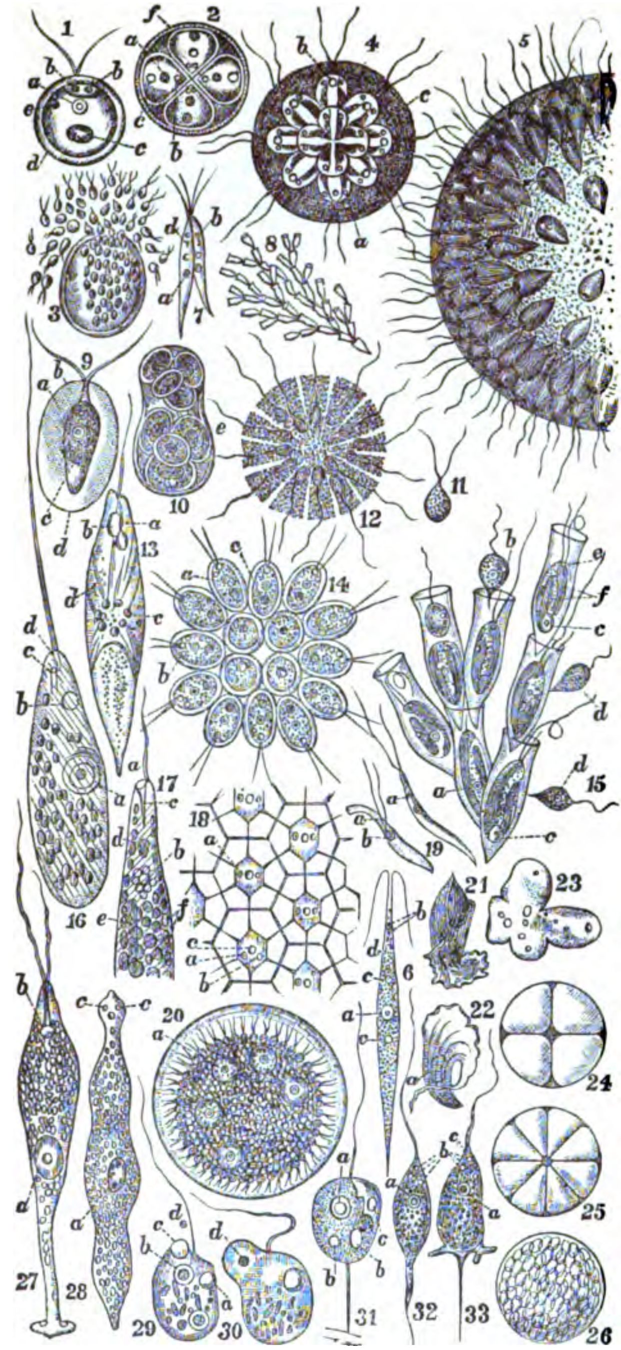


FIG. XX.—**Flagellata.** 1. *Chlamydomonas pulvisculus*, Ehr. (= *Zigoselmis*, From.); one of the Phytomastigoda; free-swimming individual. *a*, nucleus; *b*, contractile vacuole; *c*, starch corpuscle; *d*, cellulose investment; *e*, stigma (eye-spot). 2. Resting stage of the same, with fourfold division of the cell-contents. Letters as before. 3. Breaking up of the cell-contents into minute biflagellate swarm-spores, which escape, and whose history is not further known. 4. *Syncrypta volvox*, Ehr.; one of the Phytomastigoda. A colony enclosed by a common gelatinous test *c*. *a*, stigma; *b*, vacuole (non-contractile). 5. *Uroglena volvox*, Ehr.; one of the Monadidea. Half of large colony, the flagellates embedded in a common jelly. 6. *Chlorogonium euchlorum*, Ehr.; one of the Phytomastigoda. *a*, nucleus; *b*, contractile vacuole; *c*, starch grain; *d*, eye-spot. 7. *Chlorogonium euchlorum*, Ehr., one of the Phytomastigoda. Copulation of two liberated microgonidia. *a*, nucleus; *b*, contractile vacuole; *d*, eye-spot (so-called). 8. Colony of *Dinobryon sertularia*, Ehr.; × 200; one of the Monadidea. 9. *Hæmatococcus palustris*, Girod (= *Chlamydococcus*, Braun, *Protococcus*, Cohn), one of the Phytomastigoda; ordinary individual with widely separated test. *a*, nucleus; *b*, contractile vacuole; *c*, amylon nucleus (pyrenoid). 10. Dividing resting stage of the same, with eight fission products in the common test *e*. 11. A microgonidium of the same. 12. *Phalansterium consociatum*, Cienk., one of the Choanoflagellata; × 325. Disk-like colony. 13. *Euglena viridis*, Ehr.; × 300; one of the Euglenoidea. *a*, pigment spot (stigma); *b*, clear space; *c*, paramylum granules; *d*, chromatophor (endochrome plate). 14. *Gonium pectorale*, O. F. Müller; one of the Phytomastigoda. Colony seen from the flat side. × 300. *a*. nucleus; *b*, contractile vacuole; *c*, amylon nucleus. 15. *Dinobryon sertularia*, Ehr.; one of the Monadidea. *a*, nucleus; *b*, contractile vacuole; *c*, amylon nucleus; *d*, free colorless flagellates, probably not belonging to Dinabryon; *e*, stigma (eye-spot); *f*, chromatophors. 16. *Peranema trichophorum*, Ehr. (one of the Euglenoidea), creeping individual seen from the back; × 140. *a*, nucleus; *b*, contractile vacuoles; *c*, pharynx; *d*, mouth. 17. Anterior end of *Euglena acus*, Ehr., in profile. *a*, mouth; *b*, contractile vacuoles; *c*, pharynx; *d*, stigma (eye-spot); *e*, paramylum-body; *f*, chlorophyll corpuscles. 18. Part of the surface of a colony of *Volvox globator*, L. (Phytomastigoda), showing the intercellular connective fibrils. *a*, nucleus; *b*, contractile vacuole; *c*, amylum granule. 19. Two microgonidia of *Volvox globator*, L. *a*, nucleus; *b*, contractile vacuole. 20. Ripe asexually produced daughter-individual *Volvox minor*, Stein, still enclosed in the cyst of the parthenogonidium. *a*, young parthenogonidia. 21, 22. *Trypanosoma sanguinis*, Gruby; one of the Rhizomastigina, from the blood of *Rana esculenta*. *a*, nucleus. × 500. 23–26. Reproduction of *Bodo caudatus*, Duj. (one of the Heteromastigoda), after Dallinger and Drysdale: 23, fusion of several individuals (plasmodium); 24, encysted fusion-product dividing into four; 25, later into eight; 26, cyst filled with swarm-spores. 27. *Astasia tenax*, O. F. Müll. (Proteus); one of the Euglenoidea; × 440. Individual with the two flagella, and strongly contracting hinder region of the body. *a*, nucleus; *b*, contractile vacuole, close to the pharynx. 28. The same devoid of flagella. *a*, nucleus; *c*, *c*, the two dark pigment spots (so-called eyes) near the mouth. 29. *Oikomonas termo* (*Monas termo*, Ehr.; one of the Monadidea. *a*, nucleus; *b*, contractile vacuole; *c*, food-ingesting vacuole; *d*, food-particle. × 440. 30. The food particle *d* has now been ingested by the vacuole. 31. *Oikomonas mutabilis* Kent (Monadidea) with adherent stalk. *a*, nucleus; *b*, contractile vacuole; *c*, food-particle in food vacuole. 32, 33. *Cercomonas crassicauda*, Duj. (Monadidea), showing two conditions of the pseudopodium-protruding tail. *a*, nucleus; *b*, contractile vacuoles; *c*, mouth.

CLASS II. **FLAGELLATA,**[1] Ehrenberg.

Characters.—Corticata in which the dominant phase in the life-history is a corticate flagellula, that is, a nucleated cell-body provided with one or a few large processes of vibratile protoplasm. Very commonly solid food particles are ingested through a distinct cell-mouth or aperture in the cortical protoplasm, though in some an imbibition of nutritive matter by the whole surface and a nutritional process chemically resembling that of plants (holophytic), chlorophyll being present, seems to occur.

Conjugation followed by a breaking up into very numerous minute naked spores is frequent in some; as also a division into small individuals (microgonidia), which is followed by their conjugation with one another or with big individuals (macrogonidia) and subsequent normal growth and binary fission.

Many have a well-developed cuticle, which may form collar-like outgrowths or stalk-like processes. Many produce either gelatinous or chitin-like shells (cups or cœnœcia), which are connected so as to form spherical or arborescent colonies; in these colonies the protoplasmic organisms themselves produce new individuals by fission, which separate entirely from one another but are held together by the continuity, with those already existing, of the new shells or jelly-houses or stalk-like supports produced by the new individuals. A single well-marked spherical nucleus, and one or more contractile vacuoles, are always present in the full-grown form.

Often, besides ingested food-particles, the protoplasm contains starch granules (amylon nuclei), paramylum corpuscles, chromatophors and chlorophyl corpuscles, some of which may be so abundant as to obscure the nucleus. One or two pigment spots (stigmata or so-called eye-spots) are often present at the anterior end of the body.

SUB-CLASS I. **Lissoflagellata,** Lankester.

Never provided with a collar-like outgrowth around the oral pole.

ORDER 1. MONADIDEA, Bütschli.

Characters.—Lissoflagellata of small or very small size and simple structure; often naked and more or less amœboid, sometimes forming tests. Usually colorless, seldom with chromatophors. With a single anterior large flagellum or sometimes with two additional paraflagella. A special mouth-area is often wanting, sometimes is present, but is never produced into a well-developed pharynx.

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[1] Bütschli's work (9) has been pretty closely followed in the diagnosis of the groups of flagellata and the enumeration of genera here given.

Fam. 1. RHIZOMASTIGINA, Bütschli. Simple mouthless forms with 1 to 2 flagella; either permanently exhibiting a Gymnomyxa-like development of pseudopodia or capable of passing suddenly from a firm-walled into a Gymnomyxa-like condition, when the flagella may remain or be drawn in. Ingestion of food by aid of the pseudopodia.

Genera.—*Mastigamœba*, F. E. Schultze; *Ciliophrys*, Cienkowski (65); *Dimorpha*, Gruber; *Actinomonas*, Kent; *Trypanosoma*, Gruby (parasitic in the blood of Frogs and other Amphibia and Reptiles, Fig. XX. 21, 22). The Rhizomastigina might all be assigned to the Proteomyxa, with which they closely connect the group of Flagellata. The choice of the position to be assigned to such a form as Ciliophrys must be arbitrary.

Fam. 2. CERCOMONADINA, Kent. Minute oblong cell-body which posteriorly may exhibit amœboid changes. One large anterior flagellum. Mouth at the base of this organ. Reproduction by longitudinal fission and by multiple fission producing spores in the encysted resting state.

Genera.—*Cercomonas*, Duj. (Fig. XX. 32, 33); *Herpetomonas*, S. Kent; *Oikomonas*, Kent (= *Monas*, James Clark; *Pseudospora*, Cienkowski, Fig. XX. 29, 30, 31); *Ancyromonas*, S. K.

Fam. 3. CODONŒCINA, Kent. Small colorless monads similar to Oikomonas in structure, which secrete a fixed gelatinous or membranous envelope or cup.

Genera.—*Codonœca*, James Clark; *Platythœca*, Stein.

Fam. 4. BIKŒCINA, Stein. Distinguished from the last family by the fact that the monad is fixed in its cup by a contractile thread-like stalk; cup usually raised on a delicate stalk.

Genera.—*Bicosœca*, J. Cl.; *Poteriodendron*, Stein.

Fam. 5. HETEROMONADINA, Bütschli. Small colorless or green monads which possess, besides one chief flagellum, one or two smaller paraflagella attached near it, often forming colonies secreting a common stalk.

Genera.—*Monas* (Ehr.), Stein; *Dendromonas*, Stein; *Cephalothamnium*, Stein; *Anthrophysa*, Bory d. Vinc. (Fig. XXI. 12, 13); *Dinobryon*, Ehr. Fig. XX. 8 and 15); *Epipyxis*, Ehr.; *Uroglena*, Ehr. (Fig. XX. 5.).

ORDER 2. EUGLENOIDEA, Bütschli.

Characters.—Generally somewhat large and highly developed monoflagellate forms, of monaxonic or slightly asymmetrical build. Cuticle present; cortical substance firm, contractile, and elastic; some forms quite stiff, others capable of definite annular contraction and worm-like elongation. At the base of the flagellum a small or large mouth leading into a more or less distinct pharyngeal tube. Near this is always the contractile vacuole. Rarely a pair of flagella instead of one.

Fam. 1. CŒLOMONADINA. Colored Euglenoidea, with numerous small chlorophyll corpuscles or one to two large plate-like green or brown chromatophors. Mouth and pharynx inconspicuous; nutrition probably largely vegetable (holophytic).

Genera.—*Cœlomonas*, Stein; *Gonyostomum*, Dies.; *Vacuolaria*, Cienk., *Microglena*, Ehr.; *Chromulina*, Cienk.; *Cryptoglena*, Ehr.

Fam. 2. EUGLENINA, Stein. Body monaxonic, elongated, hinder end pointed. Spirally striated cuticle. A fine mouth-aperture leads into the well-developed tubular pharynx. Flagellum usually single, sometimes paired, often cast off. Near the pharynx is the "reservoir" of the contractile vacuoles and several of the latter. A single (sometimes two) stigma or color-speck near the same spot. Cromatophors nearly always present, generally bright green. A large nucleus in the middle of the body. Multiplication by longitudinal fission. Encysted condition and attendant fission imperfectly studied. Copulation doubtful.

Genera.—(*a*) With flexible cuticle: *Euglena*, Ehr. (Fig. XX. 13, 17; this is probably Priestley's "green matter," from which he obtained oxygen gas; though one of the very commonest of all Protozoa, its life-history has yet to be worked out); *Colacium*, Ehr.; *Eutreptia*, Perty.

(*b*) With stiff, shell-like cuticle: *Ascoglena*, Stein; *Trachelomonas*, Ehr.; *Lepocinclis*, Perty; *Phacus*, Nitzsch.

Fam. 3. MENOIDINA, Bütschli. Similar to the Euglenina, but devoid of chlorophyll, a deficiency connected with the saprophytic mode of life. Stigma always absent.

Genera.—(*a*) With flexible cuticle: *Astasiopsis*, Bütschli; *Astasiodes*, Bütschli.

(*b*) With stiff cuticle and non-contractile body: *Monoidium*, Perty; *Atractonema*, Stein; *Rhabdomonas*, Fresenius.

Fam. 4. PERANEMINA. Very contractile (metabolic) colorless Euglenoids. Mouth and pharynx large; inception of solid nutriment certainly observed.

Genera.—*Peranema*, Duj. (Fig. XX. 16); *Urceolus*, Meresch.

Fam. 5. PETALOMONADINA. Colorless, non-metabolic forms. Mouth opening at the base of the single large flagellum.

Genera.—*Petalomonas*, Stein.

Fam. 6. ASTASINA. Colorless, metabolic, or stiff Euglenoids, differing from the rest in having a small or large paraflagellum in addition to the chief one. Nutrition partly saprophytic partly animal.

Genera.—*Astasia*, Ehr. emend. Stein (Fig. XX. 27, 28); *Heteronema*, Duj.; *Zygoselmis*, Duj.; *Sphenomonas*, Stein; *Tropidoscyphus*, Stein.

ORDER 3. HETEROMASTIGODA, Bütschli.

Characters.—Small and large monads. Naked and even amœboid or with stiff cuticle. Two flagella at the anterior end differing in size: the smaller directed forwards subserves the usual locomotor function; the larger is directed backwards and trailed, without movement. Sometimes two backwardly directed flagella are present. Always a mouth and animal nutrition. Always colorless.

Fam. 1. BODONINA, Bütschli. Size of the two flagella not very different.

Genera.—*Bodo*, Ehb. emend. Stein (Fig. XX. 23 to 26, and Fig. XXI. 10; the hooked monad and the springing monad of Dallinger and Drysdale (66); *Heteromita* of Dujardin and Kent); *Phyllomitus*, Stein; *Colponema*, Stein; *Dallingeria*, Kent; *Trimastix*, Kent.

Fam. 2. ANISONEMINA, Kent. Large forms with cuticle; difference of the two flagella considerable. Mouth, pharynx, and animal nutrition.

Genera.—*Anisonema*, Duj.; *Entosiphon*, Stein.

ORDER 4. ISOMASTIGODA, Bütschli.

Characters.—Small and middle-sized forms of monaxonic rarely bilateral shape. Fore-end with 2, 4, or seldom 5 equal-sized and similar flagella. Some are colored, some colorless; naked or with strong cuticle or secreting an envelope. Mouth and pharynx seldom observed; nutrition generally holophytic (*i.e.*, like a green plant), but in some cases, nevertheless, holozoic (*i.e.*, like a typical animal).

Fam. 1. AMPHIMONADINA. Small, colorless, biflagellate Isomastigoda.

Genera.—*Amphimonas*, Duj. (? *Pseudospora*, Cienk.).

Fam. 2. SPONGOMONADINA, Stein. Small colorless oval forms with two closely contiguous flagella. Chief character in the union of numerous individuals in a common jelly or in branched gelatinous tubes, the end of each of which is inhabited by a single and distinct individual.

Genera.—*Spongomonas*, Stein; *Cladomonas*, Stein; *Rhipidomonas*, Stein.

[Group **Phytomastigoda**, Bütschli. The following three families, viz., Chrysomonadina, Chlamydomonadina, and Volvocina, are so closely related to one another as to warrant their union as a sub-order. They are typical Isomastigoda, but have chlorophyll corpuscles and holophytic nutrition, with correlated deficient mouth and pharynx. They are usually regarded by botanists as belonging to the unicellular Algæ.]

Fam. 3. CHRYSOMONADINA, Bütschli. Single or colony forming; seldom an envelope. Spherical free-swimming colonies may be formed by grouping of numerous individuals around a centre. With two or rarely one brown or greenish brown chromatophor; a stigma (eye-speck) at the base of the flagella.

Genera.—*Stylochrysalis*, Stein; *Chrysopyxis*, Stein; *Nephroselmis*, Stein; *Synura*, Ehr.; *Syncrypta*, Ehr. (Fig. XX. 4).

Fam. 4. CHLAMYDOMONADINA. Fore-end of the body with two or four (seldom five) flagella. Almost always green in consequence of the presence of a very large single chromatophor. Generally a delicate shell-like envelope of membranous consistence. 1 to 2 contractile vacuoles at the base of the flagella. Usually one eye-speck. Division of the protoplasm within the envelope may produce four, eight, or more new individuals. This may occur in the swimming or in a resting stage. Also by more continuous fission microgonidia of various sizes are formed. Copulation is frequent.

Genera.—*Hymenomonas*, Stein; *Chlorangium*, Stein; *Chlorogonium*, Ehr. (Fig. XX. 6, 7); *Polytoma*, Ehr.; *Chlamydomonas*, Ehr. (Fig. XX. 1, 2, 3); *Hæmatococcus*, Agardh (= *Chlamydococcus*, A. Braun, Stein; *Protococcus*, Cohn, Huxley, and Martin; *Chlamydomonas*, Cienkowski); *Carteria*, Diesing; *Spondylomorum*, Ehr.; *Coccomonas*, Stein; *Phacotus*, Perty.

Fam. 5. VOLVOCINA. Colony-building Phytomastigoda, the cell-individuals standing in structure between Chlamydomonas and Hæmatococcus, and always biflagellate. The number of individuals united to form a colony varies very much, as does the shape of the colony. Reproduction by the continuous division of all or of only certain individuals of the colony, resulting in the production of a daughter colony

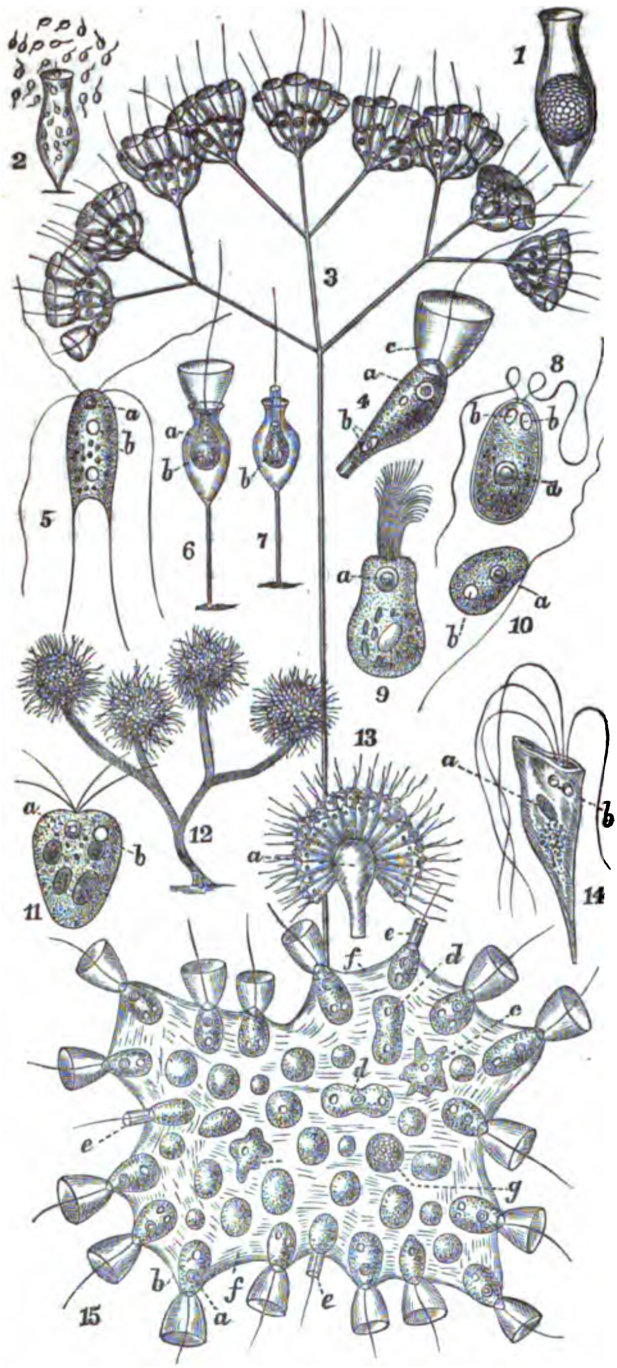

FIG. XXI.—**Flagellata.** 1. *Salpingœca fusiformis*, S. Kent; one of the Choanoflagellata. The protoplasmic body is drawn together within the goblet-shaped shell, and divided into numerous spores. × 1500. 2. Escape of the spores of the same as monoflagellata and swarm-spores. 3. *Codosiga umbellata*, Tatem; one of the Choanoflagellata; adult colony formed by dichotomous growth; × 625. 4. A single zooid of the same; × 1250. *a*, nucleus; *b*, contractile vacuole; *c*, the characteristic "collar" formed by cuticle on the inner face of which is a most delicate network of naked streaming protoplasm. 5. *Hexamita inflata*, Duj.; one of the Isomastigoda; × 650; normal adult, showing *a*, nucleus, and *b*, contractile vacuole. 6, 7. *Salpingœca urceolata*, S. Kent; one of the Choanoflagellata; –6, with collar extended; 7, with collar retracted within the stalked cup. *a*, nucleus; *b*, contractile vacuole. 8. *Polytoma uvella*. Müll. sp.; one of the Phytomastigoda. *a*, nucleus; *b*, contractile vacuole. × 800. 9. *Lophomonas blattarum*, Stein; one of the Isomastigoda, from the intestine of *Blatta orientalis*. *a*, nucleus. 10. *Bodo lens*, Mull.; one of the Heteromastigoda; × 800. *a*, nucleus; *b*, contractile vacuole; the wavy filament is a flagellum, the straight one is an immobile trailing thread. 11. *Tetramitus sulcatus*, Stein; one of the Isomastigoda; × 430. *a*, nucleus; *b*, contractile vacuole. 12. *Anthophysa vegetans*, O. F. Müller; one of the Monadidea; × 300. A typical, erect, shortly-branching colony stock with four terminal monad-clusters. 13. Monad cluster of the same in optical section (× 800), showing the relation of the individual monads or flagellate zooids to the stem *a*. 14. *Tetramitus rostratus*, Perty; one of the Isomastigoda; × 1060. *a*, nucleus; *b*, contractile vacuole. 15. *Proterospongia Haeckeli*, Saville Kent; one of the Choanoflagellata; × 800. A social colony of about forty flagellate zooids. *a*, nucleus; *b*, contractile vacuole; *c*, amœbiform zooid sunk within the common jelly or test (compared by S. Kent to the mesoderm-cells of a sponge colony); *d*, similar zooid multiplying by transverse fission; *e*, normal zooids with their collars contracted; *f*, hyaline mucilaginous common test or zoothecium; *g*, individual contracted and dividing into minute flagellate spores (microgonidia) comparable to the spermatozoa of a Sponge.

(from each such individual). In some, probably in all, at certain times copulation of the individuals of distinct sexual colonies takes place, without or with a differentiation of the colonies and of the copulating cells as male and female. The result of the copulation is a resting zygospore (also called zygote or oo-spermospore or fertilized egg-cell), which after a time develops itself into one or more new colonies.

Genera.—*Gonium*, O. F. Müller (Fig. XX. 14); *Stephanosphæra*, Cohn; *Pandorina*, Bory de Vinc.; *Eudorina*, Ehr.; *Volvox*, Ehr. (Fig. XX. 18, 20).

[The sexual reproduction of the colonies of the Volvocina is one of the most important phenomena presented by the Protozoa. In some families of Flagellata full-grown individuals become amœboid, fuse, encyst, and then break up into flagellate spores which develop simply to the parental form (Fig. XX. 23 to 26). In the Chlamydomonadina a single adult individual by division produces small individuals, so-called "microgonidia." These copulate with one another or with similar microgonidia formed by other adults (as in Chlorogonium, Fig. XX. 7); or more rarely in certain genera a microgonidium copulates with an ordinary individual (macrogonidium). The result in either case is a "zygote," a cell formed by fusion of two which divides in the usual way to produce new individuals. The microgonidium in this case is the male element and equivalent to a spermatozoon; the macrogonidium is the female and equivalent to an egg-cell. The zygote is a fertilized egg-cell, or oo-spermospore. In the colony-building forms we find that only certain cells produce by division microgonidia; and, regarding the colony as a multicellular individual, we may consider these cells as testis-cells and their microgonidia as spermatozoa. In some colony-building forms the microgonidia copulate with ordinary cells of the colony which, when thus fertilized, become encysted as zygotes, and subsequently separate and develop by division into new colonies. In Volvox the macrogonidia are also specially-formed cells (not merely any of the ordinary vegetative cells), so that in a sexually ripe colony we can distinguish egg-cells as well as sperm mother-cells. Not only so, but in some instances (Eudorina and some species of Volvox) the colonies which produce sexual cells can not merely be distinguished from the asexual colonies (which reproduce parthenogenetically), but can be distinguished also *inter se* into male colonies, which produce from certain of their constituent cell-units spermatozoa or microgonidia only, and female colonies which produce no male cells, but only macrogonidia or egg-cells which are destined to be fertilized by the microgonidia or spermatozoa of the male colonies.

The differentiation of the cell-units of the colony into neutral or merely carrying cells of the general body on the one hand and special sexual cells on the other is extremely important. It places these cell-colonies on a level with the Enterozoa (Metazoa) in regard to reproduction, and it cannot be doubted that the same process of specialization of the reproductive function, at first common to all the cells of the cell-complex, has gone on in both cases. The perishable body which carries the reproductive cells is nevertheless essentially different in the two cases, in the Volvocina being composed of equipollent units, in the Enterozoa being composed of units distributed in two physiologically and morphologically distinct layers or tissues, the ectoderm and the endoderm.

The sexual reproduction of the Vorticellidæ may be instructively compared with that of the Phytomastigoda; see below.]

Fam. 6. TETRAMITINA. Symmetrical, naked, colorless, somewhat amœboid forms, with four flagella or three and an undulating membrane. Nutrition animal, but mouth rarely seen.

Genera.—*Collodictyon*, Carter; *Tetramitus*., Perty (Fig. XXI.

II, 14; calycine monad of Dallinger and Drysdale (66); *Monocercomonas*, Grassi; *Trichomonas*, Donné; *Trichomastix*, Blochmann.

Fam. 7. Polymastigina. Small, colorless, symmetrical forms. Two flagella at the hinder end of the body and two or three on each side in front. Nutrition animal or saprophytic.

Genera.—*Hexamitus*, Duj. (Fig. XXI. 5); *Megastoma*, Grassi; *Polymastix*, Bütschli.

Fam. 8. Trepomonadina, Kent. As Polymastigina, but the lateral anterior flagella are placed far back on the sides.

Genera.—*Trepomonas*, Duj., described recently without name by Dallinger (67).

Fam. 9. Cryptomonadina. Colored or colorless, laterally compressed, asymmetrical forms; with two very long anterior flagella, placed a little on one side springing from a deep atrium-like groove or furrow (*cf.* Dinoflagellata and Noctiluca, to which these forms lead).

Genera.—*Cyathomonas*, From.; *Chilomonas*, Ehr.; *Cryptomonas*, Ehr.; *Oxyrrhis*, Duj.

Fam. 10. Lophomonadina. A tuft of numerous flagella anteriorly.

Genus.—*Lophomonas*, Stein (Fig. XXI. 9, connects the Flagellata with the Peritrichous Ciliata).

Sub-Class II. **Choanoflagellata**, Saville Kent.

Flagellata provided with an upstanding collar surrounding the anterior pole of the cell from which the single flagellum springs, identical in essential structure with the "collared cells" of Sponges. Single or colony-building. Individuals naked (*Codosiga*), or inhabiting each a cup (*Salpingœca*), or embedded in a gelatinous common investment (*Proterospongia*).

Order 1. NUDA, Lankester.

Characters.—Individuals naked, secreting neither a lorica (cup) nor a gelatinous envelope.

Genera.—*Monosiga*, S. Kent (solitary stalked or sessile); *Codosiga*, James Clark (united socially on a common stalk or pedicle, Fig. XXI. 3, 4); *Astrosiga*, S. Kent; *Desmarella*, S. Kent.

Order 2. LORICATA, Lankester.

Characters.—Each individual collared-cell unit secretes a horny cup or shell.

Genera.—*Salpingœca*, James Clark (sedentary, Fig. XXI. 6, 7); *Lagenœca*, S. Kent (free swimming); *Polyœca*, S. Kent (cups united socially to form a branching zoœcium as in Dinobryon).

Order 3. GELATINIGERA, Lankester.

The cell-units secrete a copious gelatinous investment and form large colonies.

Genera.—*Phalansterium*, Cienk. (Fig. XX. 12); *Proterospongia*, Saville Kent (Fig. XXI. 15).

[The Choanoflagellata were practically discovered by the American naturalist James Clark (68), who also discovered that the ciliated chambers of Sponges are lined by collared cells of the same peculiar structure as the individual Choanoflagellata, and hence was led to regard the Sponges as colonies of Choanoflagellata. Saville Kent (69) has added much to our knowledge of the group, and by his discovery of Proterospongia (see Fig. XXI. 15, and description) has rendered the derivation of the Sponges from the Flagellata a tenable hypothesis.]

Further remarks on the Flagellata.—Increased attention has been directed of late years to the Flagellata in consequence of the researches of Cienkowski, Bütschli, James Clark, Saville Kent, and Stein. They present a very wide range of tructure, from the simple amœboid forms to the elaborate olonies of Volvox and Proterospongia. By some they are egarded as the parent-group of the whole of the Protozoa; but, whilst not conceding to them this position, but removng to the Proteomyxa those Flagellata which would justify uch a view, we hold it probable that they are the ancesral group of the mouth-bearing Corticata, and that the Cilata and Dinoflagellata have been derived from them. One eneral topic of importance in relation to them may be ouched on here, and that is the nature of the flagellum nd its movements. Speaking roughly, a flagellum may be aid to be an isolated filament of vibratile protoplasm, whilst cilium is one of many associated filaments of the kind. The movement, however, of a flagellum is not the same as hat of any cilium; and the movement of all flagella is not dentical. A cilium is simply bent and straightened alterately, its substance probably containing, side by side, a ontractile and an elastic fibril. A flagellum exhibits lashing movements to and fro, and is thrown into serpentine waves during these movements. But two totally distinct kinds of flagella are to be distinguished, viz., (*a*) the pulsellum, and (*b*) the tractellum. An example of the pulsellum is seen in the tail of a spermatozoon which drives the body in front of it, as does the tadpole's tail. Such a "pulsellum" is the cause of the movement of the Bacteria. It is never found in the Flagellata. So little attention has been paid to this fact that affinities are declared by recent writers to exist between Bacteria and Flagellata. The flagellum of the flagellata is totally distinct from the pulsellum of the Bacteria. It is carried in front of the body and draws the body after it, being used as a man uses his arm and hand when swimming on his side. Hence it may be distinguished as a "tractellum." Its action may be best studied in some of the large Euglenoidea, such as Astasia. Here it is stiff at the base, and is carried rigidly in front of the animal, but its terminal third is reflected and exhibits in this reflected condition swinging and undulatory movements tending to propel the reflected part of the flagellum forward, and so exerting a traction in that direction upon the whole animal. It is in this way (by reflection of its extremity) that the flagellum or tractellum of the Flagellata also acts so as to impel food-particles against the base of the flagellum where the oral aperture is situated.

Many of the Flagellata are parasitic (some hæmatozoic, see Lewis, 70); the majority live in the midst of putrefying organic matter in sea and fresh waters, but are not known to be active as agents of putrefaction. Dallinger and Drysdale have shown that the spores of Bodo and others will survive an exposure to a higher temperature than do any known Schizomycetes (Bacteria), viz., 250° to 300° Fahr., for ten minutes, although the adults are killed at 180°.

Class III. **DINOFLAGELLATA**, Bütschli.

Characters.—Corticate Protozoa of a bilaterally asymetrical form, sometimes flattened from back to ventral surface (Diplopsalis, Glenodinium), sometimes from the front to the hinder region (Ceratium, Peridinium), sometimes from right to left (Dinophysis, Amphidinium, Prorocentrum)—the anterior region and ventral surface being determined by the presence of a longitudinal groove and a large flagellum projecting from it. In all except the genus Prorocentrum (Fig. XXII. 6) there is as well as a longitudinal groove a transverse groove (hence Dinifera) in which lies horizontally a second flagellum (Klebs and Bütschli), hitherto mistaken for a girdle of cilia. The transverse groove lies either at the anterior end of the body (Dinophysis, Fig. XXII. 3, 4; Amphidinium) or at the middle. In Gymnodinium it takes a spiral course. In Polykrikos (a compound metameric form) there are eight independent transverse grooves.

The Dinoflagellata are either enclosed in a cuticular shell (Ceratium, Peridinium, Dinophysis, Diplopsalis, Glenodinium, Prorocentrum, etc.) or are naked (Gymnodinium and Polykrikos). The cuticular membrane (or shell) consists of cellulose or of a similar substance (*cf.* Labyrinthulidea) and not, as has been supposed, of silica, nor of chitin-like substance; it is either a simple cyst or perforated by pores, and may be built up of separate plates (Fig. XXII. 10).

The cortical protoplasm contains trichocysts in Polykrikos.

The medullary protoplasm contains often chlorophyll and also diatomin and starch or other amyloid substance. In these cases (Ceratium, some species of Peridinium, Glenodinium, Prorocentum, *Dinophysis acuta*) nutrition appears to be holophytic. But in others (Gymnodinium and Polykrikos) the substances are absent and food-particles are found in the medullary protoplasm which have been taken in from the exterior through a mouth; in these nutrition is holozoic. In others which are devoid of chlorophyll and diatomin, etc., there is found a vesicle and an orifice connected with the exterior near the base of the flagellum (*cf.* Flagellata) by which water and dissolved or minutely granular food-matter is introduced into the medullary protoplasm (*Protoperidinium pellucidum*, *Peridinium divergens*, *Diplopsalis lenticula*, *Dinophysis lævis*). It is important to note that these divergent methods of nutrition are exhibited by different species of one and the same genus, and possibly by individuals of one species in successive phases of growth (?).

No contractile vacuole has been observed in Dinoflagellata.

The nucleus is usually single and very large, and has a peculiar labyrinthine arrangement of chromatin substance.

Transverse binary fission is the only reproductive process as yet ascertained. It occurs either in the free condition (Fig. XXII. 2) or in peculiar horned cysts (Fig. XXII. 8). Conjugation has been observed in some cases (by Stein in Gymnodinium).

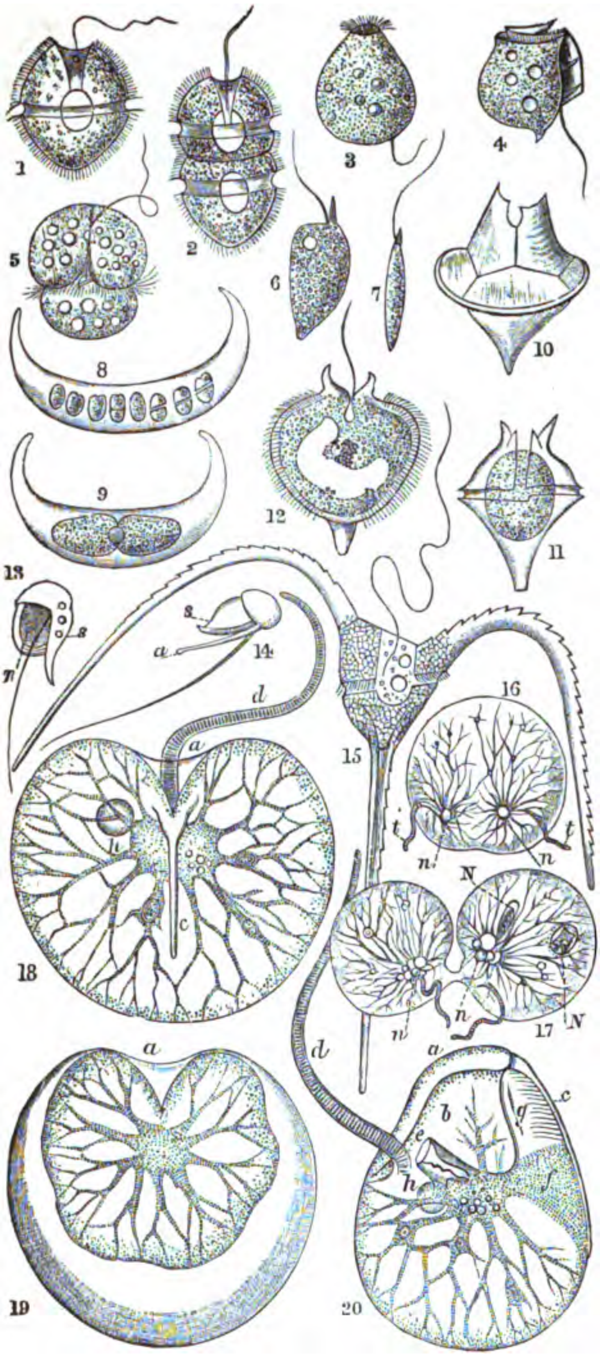

FIG. XXII.—**Dinoflagellata and Rhynchoflagellata.** *N. B.* In all these figures the apparent girdle of cilia is, according to Klebs's and Bütschli's recent discovery, to be interpreted as an encircling flagellum lying in the transverse groove. 1. *Peridinium uberrimum*, Allman; × 300 (fresh-water ponds, Dublin). Probably (according to Bütschli) the processes on the surface are not cilia nor flagellum. Both the longitudinal and the transverse groove are well seen. 2. The same species in transverse fission. 3. *Dinophysis ovata*, Cl. and L.; × 350 (salt water, Norwegian coast). 4. *Dinophysis acuminata*, Cl. and L.; × 350 (salt water, Norwegian coast). 5. *Gymnodinium* sp.; × 600. 6. *Prorocentrum micans*, Ehr.; × 300 (salt water). 7. Dorsal aspect of the same species. 8, 9. Cysts of Peridinia; the contents of 8 divided into 8 minute naked Peridinia; × 300. 10. Empty cuirass of *Ceratium divergens*, Cl. and L.; × 500; showing the form and disposition of its component plates. 11. The same species with the animal contracted into a spherical form. The transverse groove well seen. 12. The same species in the normal state. The apparent girdle of cilia is really an undulating flagellum lying in the transverse groove. 13, 14. Young stages of *Noctiluca miliaris*. *n*, nucleus; *s*, the so-called spine (superficial ridge of the adult); *a*, the big flagellum; the unlettered filament is a flagellum which becomes the oral flagellum of the adult. 15. *Ceratium tripos*, Müll. The transverse groove well seen. The cilia really are a single horizontal flagellum. 16, 17. Two stages in the transverse fission of *Noctiluca miliaris*, Suriray. *n*, nucleus; N, food-particles; *t*, the muscular flagellum. 18. *Noctiluca miliaris*, viewed from the aboral side (after Allman, *Quart. Jour. Mic. Sci.*, 1872). *a*, the entrance to the atrium or flagellar fossa (= longitudinal groove of Dinoflagellata); *c*, the superficial ridge; *d*, the big flagellum (= the flagellum of the transverse groove of Dinoflagellata); *h*, the nucleus. 19. The animal acted upon by iodine solution, showing the protoplasm like the "primordial utricle" of a vegetable cell shrunk away from the structureless firm shell or cuirass. 20. Lateral view of Noctiluca, showing *a*, the entrance to the groove-like atrium or flagellar fossa in which *b* is placed; *c*, the superficial ridge; *d*, the big flagellum; *e*, the mouth and gullet, in which is seen Krohn's oral flagellum (= the chief flagellum or flagellum of the longitudinal groove of Dinoflagellata); *f*, broad process of protoplasm extending from the superficial ridge *c* to the central protoplasm; *g*, duplicature of the shell in connection with the superficial ridge; *h* nucleus.

Mostly marine, some fresh-water. Many are phosphorescent.

The Dinoflagellata are divisible into two orders, according to the presence or absence of the transverse groove.

ORDER 1. ADINIDA, Bergh.

Characters.—Body compressed laterally; both longitudinal and transverse flagellum placed at the anterior pole; a transverse groove is wanting; a cuticular shell is present.

Genera.—*Prorocentrum*, Ehr. (Fig. XXII. 6, 7); *Exuviella*, Cienk. (=*Dinopyxis*, Stein; *Cryptomonas*, Ehr.).

ORDER 2. DINIFERA, Bergh.

Characters.—A transverse groove is present and usually a longitudinal groove. The animals are either naked or loricate.

Fam. 1. DINOPHYIDA, Bergh. Body compressed; the transverse groove at the anterior pole; the longitudinal groove present; longitudinal flagellum directed backwards; loricate.

Genera.—*Dinophysis*, Ehr. (Fig. XXII. 3, 4); *Amphidinium*, Cl. & L.; *Amphisolenia*, Stein; *Histioneis*, Stein; *Citharistes*, Stein; *Ornithocercus*, Stein.

Fam. 2. PERIDINIDA, Bergh. Body either globular or flattened; transverse groove nearly equatorial; longitudinal groove narrow or broad; loricate.

Genera.—*Protoperidinium*, Bergh; *Peridinium* (Ehr.), Stein (Fig. XXII. 1, 2); *Protoceratium*, Bergh; *Ceratium*, Schrank (Fig. XXII. 15); *Diplopsalis*, Bergh; *Glenodinium*, Ehr.; *Heterocapsa*, Stein; *Gonyaulax*, Diesing; *Goniodoma*, Stein; *Blepharocysta*, Ehr.; *Podolampas*, Stein; *Amphidoma*, Stein; *Oxytoxum*, Stein; *Ptychodiscus*, Stein; *Pyrophacus*, Stein; *Ceratocorys*, Stein.

Fam. 3. GYMNODINIDA, Bergh. As Peridinida but no lorica (cuticular shell).

Genera. — *Gymnodinium* (Fig. XXII. 5), Stein; *Hemidinium*, Bergh.

Fam. 4. POLYDINIDA, Bütschli. As Gymnodinida, but with several independent transverse grooves.

Genus.—*Polykrikos*, Bütschli.

Further Remarks on the Dinoflagellata.—This small group is at the moment of the printing of the present article receiving a large amount of attention from Bergh (**81**), Klebs (**83**), and Bütschli (**82**), and has recently been greatly extended by the discoveries of Stein (**80**),—the last work of the great illustrator of the Ciliate Protozoa before his death. The constitution of the cell-wall or cuticle from cellulose, as well as the presence of chlorophyll and diatomin, and the holophytic nutrition of many forms recently demonstrated by Bergh, has led to the suggestion that the Dinoflagellata are to be regarded as plants, and allied to the Diatomaceæ and Desmidiaceæ. Physiological grounds of this kind have, however, as has been pointed out above, little importance in determining the affinities of Protozoa. Bütschli (**82**) in a recent very important article has shown in confirmation of Klebs that the Dinoflagellata do not possess a girdle of cilia as previously supposed, but that the structure mistaken for cilia is a second flagellum which lies horizontally in the transverse groove. Hence the name Cilioflagellata is superseded by Dinoflagellata (Gr. dinos, the round area where oxen tread out on a threshing floor).

Bütschli further suggests that the Dinoflagellata with their two flagella and their I-shaped combination of longitudinal and transverse grooves may be derived from the Cryptomonadina (see page 883). In the latter a groove-like recess is present in connection with the origin of the two

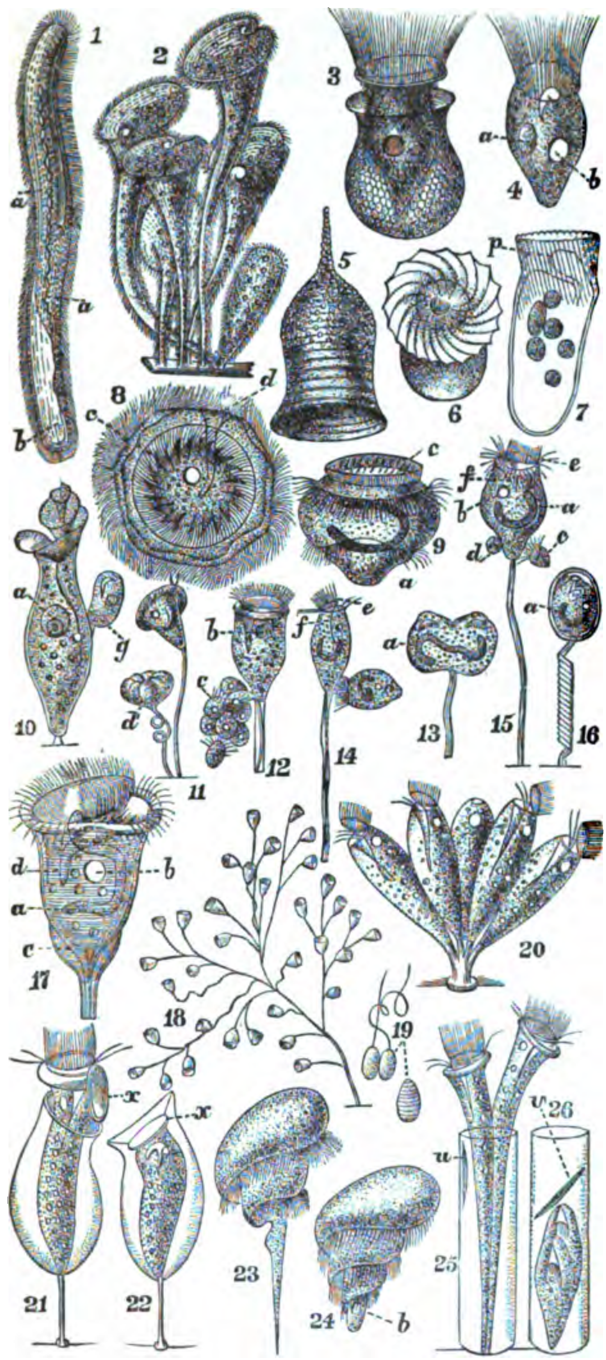

FIG. XXIII. Ciliata.—1. *Spirostomum ambiguum*, Ehr.; one of the Heterotricha; × 120. Observe on the right side the oral groove and special heterotrichous band of long cilia. *a*, moniliform nucleus; *b*, contractile vacuole. 2. *Stentor polymorphus*, Müller; one of the Heterotricha; × 50; group of individuals with the area fringed by the heterotrichous cilia expanded trumpetwise. 3. *Tintinnus lagenula*, C. and L.; one of the Heterotricha; × 300. 4. *Strombidium Claparedii*, S. K.; one of the Peritricha; × 200. 5. Empty shell of *Codonella campanella*, Haeck; one of the Heterotricha; × 180. 6, 7. *Torquatella typica*, Lankester. *p*, the supra-oral lobe seen through the membranous collar. 8, 9. View of the base and of the side of *Trichodina pediculus*, Ehr.; one of the Peritricha; × 300. *a*, nucleus; *c*, corneous collar; *d*, mouth. 10. *Spirochona gemmipara*, Stein; one of the Peritricha; × 850. *a*, nucleus; *g*, bud. 11. *Vorticella citrina*, Ehr.; 150 (Peritricha). At *d* multiple fission of an individual cell to form "microgonidia." 12. *Vorticella microstoma*, Ehr. (Peritricha); × 300. At *e* eight "microgonidia" formed by fission of a single normal individual. 13. Same species, binary fission. *a*, elongated nucleus. 14. *Vorticella nebulifera*, Ehr.; free-swimming zooid resulting from fission in the act of detaching itself and swimming away, possessing a posterior circlet of cilia. *e*, ciliated disk; *f*, pharynx. 15. *Vorticella microstoma*, Ehr.; normal zooid with two microgonidia (or microzooids) *c*, *d*, in the act of conjugation. *a*, nucleus; *b*, contractile vacuole; *e*, ciliated disk; *f*, pharynx. 16. *Vorticella microstoma*, Ehr., with stalk contracted and body enclosed in a cyst. *a*, nucleus. 17. *Vorticella nebulifera*, Ehr. *a*, nucleus; *b*, contractile vacuole; *c*, muscular region of the body continuous with the muscle of the stalk; *d*, pharynx (the basal continuation of the oral vestibule which receives at a higher point the fœcal excreta and the ejected liquid from the contractile vacuole). 18. *Carchesium spectabile*, Ehr.; retractile colony; × 50. 19. Trichocysts of *Epistylis flavicans*, Ehr., as figured by Greeff. 20. *Opercularia stenostoma*, Stein; × 200; a small colony. Observe the ciliation of the oral vestibule and the upstanding ciliate disk (opercular-like). 21, 22. *Pyxicola affinis*, S. K.; one of the stalked loricate Peritricha, in expanded and retracted states. *x*, the true operculum. 23, 24. *Gyrocoris oxyura*, Stein; one of the free-swimming Peritricha, with spiral equatorial cilia-band; × 250. *b*, contractile vacuole. 25, 26. *Thuricola valvata*, Str. Wright; one of the sessile tubicolous Peritricha. Two individuals are as a result of fission temporarily occupying one tube; *u*, the valve attached to the tube like the door of the trap-door spider's nest and the valve of the Gasteropod Clausilium.

flagella. Bütschli thinks the large proboscis-like flagellum of Noctiluca (Rhynchoflagellata) represents the horizontal flagellum of Dinoflagellata, whilst the prominent longitudinal flagellum of the Dinoflagellata is represented in that animal by the small flagellum discovered by Krohn within the gullet (see Fig. XXII. 20, *e*). The young form of Noctiluca (Fig. XXII. 14) has the longitudinal flagellum still of large size.

The phosphorescence of many Dinoflagellata is a further point of resemblance between them and Noctiluca.

Bergh has shown that there is a considerable range of form in various species of Dinoflagellata (Ceratium, etc.), and has also drawn attention to the curious fact that the mode of nutrition (whether holophytic or holozoic) differs in allied species. Possibly it may be found to differ according to the conditions of life in individuals of one and the same species.

The drawings in Fig. XXII. were engraved before the publication of Bütschli's confirmation of Klebs's discovery as to the non-existence of cilia in the transverse groove. The hair-like processes figured by Allman (**91**) external to the transverse groove in his *Peridinium uberrimum* (Fig. XXII. 1, 2) cannot, however, be explained as a flagellum. Bütschli inclines to the opinion that their nature was misinterpreted by Allman, although the latter especially calls attention to them as cilia, and as rendering his *P. uberrimum* unlike the Peridinium of Ehrenberg, in which the cilia (horizontal flagellum) are confined to the transverse groove.

CLASS IV. **RHYNCHOFLAGELLATA,** Lankester.

Characters.—Corticate Protozoa of large size ($\frac{1}{80}$th inch) and globular or lenticular form, with a firm cuticular membrane and highly vacuolated (reticular) protoplasm. In Noctiluca a deep groove is formed on one side of the spherical body, from the bottom of which springs the thick transversely striated proboscis or "big flagellum." Near this is the oral aperture and a cylindrical pharynx in which is placed the second or smaller flagellum (corresponding to the longitudinal flagellum of Dinoflagellata).

Nutrition is holozoic. No contractile vacuole is present; granule-streaming is observed in the protoplasm. An alimentary tract and anus have been erroneously described. The nucleus is spherical and not proportionately large (see for details Fig. XXII. 18 to 20).

Reproduction by transverse fission occurs, also conjugation and, either subsequently to that process or independently of it, a formation of spores (Cienkowski, **87**), the protoplasm gathering itself, within the shell-like cuticular membrane, into a cake which divides rapidly into numerous flagellated spores (flagellulæ). These escape and gradually develop into the adult form (Fig. XXII. 13. 14).

The proboscis-like large flagellum is transversely striated, and exhibits energetic but not very rapid lashing movements.

Noctiluca is phosphorescent, the seat of phosphorescence being, as determined by Allman (**86**), the cortical layer of protoplasm underlying the cuticular shell or cell-wall as the primordial cuticle of a vacuolated vegetable cell underlies the vegetable cell-wall.

Genera.—Only two genera (both marine) are known: *Noctiluca*, Suriray (**90**) (Fig. XXII. 17–20); *Leptodiscus*, Hertwig (**88**).

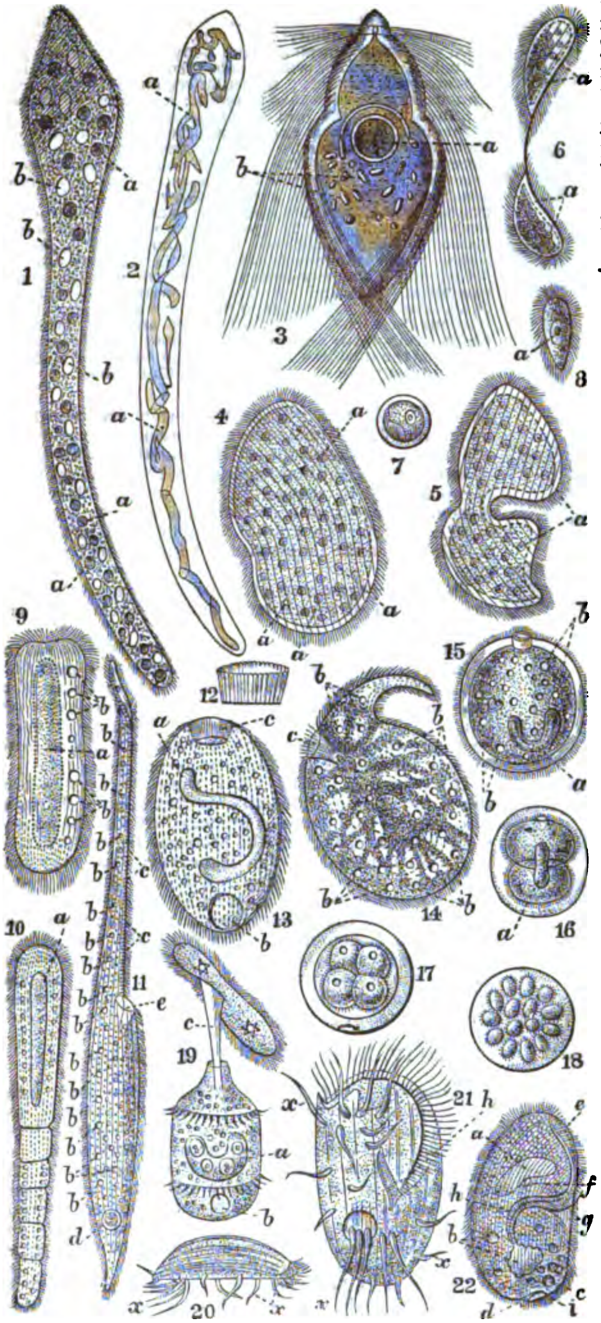

Fig. XXIV. Ciliata.—1. *Ophalinopsis sepiolæ*, Foett.; a parasitic Holotrichous mouthless Ciliate from the liver of the Squid. *a*, nuclei; *b*, vacuoles (non-contractile). 2. A similar specimen treated with picrocarmine, showing a remarkably branched and twisted nucleus; *a*, in place of several nuclei. 3. *Trichonympha agilis*, Leidy; parasitic in the intestine of the Termites (White Ants); × 600. *a*, nucleus; *b*, granules (food ?). 4. *Opalina ranarum*, Purkinje; a Holotrichous mouthless Ciliate parasitic in the Frog's rectum; adult; × 100. *a*, *a*, the numerous regularly dispersed nuclei. 5. The same; an individual in process of binary fission. *a*, nuclei. 6. The same; the process of fission has now reduced the individuals to a relatively small size. 7. Smallest fission produced fragment encysted, expelled from the Frog in this state and swallowed by Tadpoles. 8. Young uninucleate individual which has emerged from the cyst within the Tadpole, and will now multiply its nuclei and grow to full size before in turn undergoing retrogressive fission. 9. *Anoplophrya naidos*, Duj.; a mouthless Holotrichous Ciliate parasitic in the worm Nais; × 200 *a*, the large axial nucleus; *b*, contractile vacuoles. 10. *Anoplophrya prolifera*, C. and L.; from the intestine of Clitellio. Remarkable for the adhesion in a metameric series of incomplete fission-products. *a*, nucleus. 11. *Amphileptus gigas*, C. and L.; one of the Holotricha; × 100. *b*, contractile vacuoles; *c*, trichocysts (see Fig. XXIII. 19); *d*, nucleus; *e*, pharynx. 12, 13. *Prorodon niveus*, Ehr.; one of the Holotricha; × 75. *a*, nucleus; *b*, contractile vacuole; *c*, pharynx with horny fasicular lining. 12. The fasciculate cuticle of the pharynx isolated. 14. *Trachelius ovum*, Ehr. (Holotricha); × 80; showing the reticulate arrangement of the medullary protoplasm. *b*, contractile vacuoles; *c*, the cuticle-lined pharynx. 15, 16, 17, 18. *Ichthyophthirius multifiliis*, Fouquet; one of the Holotricha; × 120. Free individual and successive stages of division to form spores. *a*, nucleus, *b*, contractile vacuoles. 19. *Didinium nasutum*, Müll.; one of the Peritricha; × 200. The pharynx is everted and has seized a Paramœcium as food, *a*, nucleus; *b*, contractile vacuole; *c*, everted pharynx. 20. *Euplotes charon*, Müll.; one of the Hypotricha; lateral view of the animal when using its great hypotrichous processes, *x*, as ambulatory organs. 21. *Euplotes harpa*, Stein (Hypotricha); × 150 *h*, mouth; *x*, hypotrichous processes (limbs). 22. *Nyctotherus cordiformis*, Stein; a Heterotrichous Ciliate parasitic in the intestine of the Frog. *a*, nucleus; *b*, contractile vacuole; *c*, food particle; *d*, anus; *e*, heterotrichous band of large cilia; *f*, *g*, mouth; *h*, pharnyx; *i*, small cilia.

Further Remarks on the Rhynchoflagellata.—The peculiar and characteristic feature of Noctiluca appears to be found in its large transversely-striated flagellum, which, according to Bütschli, is not the same as the longitudinal flagellum of the Dinoflagellata, but probably represents the horizontal flagellum of those organisms in a modified condition; hence the name here proposed—Rhynchoflagellata.

Noctiluca is further remarkable for its large size and cyst-like form, and the reticular arrangement of its protoplasm, like that of a vegetable cell. This is paralleled in *Trachelius ovum* among the Ciliata (Fig. XXIV. 14), where the same stiffening of the cuticle allows the vacuolation of the subjacent protoplasm to take place. The remarkable *Leptodiscus medusoides* of R. Hertwig (88) appears to be closely related to Noctiluca.

It would no doubt be not unreasonable to associate the Dinoflagellata and the Rhynchoflagellata with the true Flagellata in one class. But the peculiarities of the organization of the two former groups is best emphasized by treating them as separate classes derived from the Flagellata. Neither group leads on to the Ciliata or to any other group, but they must be regarded as forming a lateral branch of the family tree of Corticata. The relationship of Noctiluca to Peridinium was first insisted upon by Allman, but has quite recently been put in a new light by Bütschli, who identifies the atrial recess of Noctiluca (Fig. XXII. 20, b) with the longitudinal furrow or groove of the Dinoflagellata, and the large and minute flagella of the former with the transverse and longitudinal flagella respectively of the latter. The superficial ridge *c* of Noctiluca appears to represent the continuation of the longitudinal groove.

The phosphorescence of the sea, especially on northern coasts, is largely caused by Noctiluca, but by no means exclusively, since Medusæ, Crustaceans, Annelids, and various Protozoa often take part in the phenomenon. Not unfrequently, however, the phosphorescence on the British coasts seems to be solely due to Noctiluca, which then occurs in millions in the littoral waters.

Class V. CILIATA, Ehrenberg (*Infusoria* sensu stricto)

Characters.—Corticata of relatively large size, provided with either a single band of cilia surrounding the anteriorly placed oral aperture or with cilia disposed more numerously over the whole surface of the body. The cilia are distinguished from the flagella of Flagellata by their smaller size and simple movements of alternate flexion and erection; they serve always at some period of growth as locomotor organs, and also very usually as organs for the introduction of food particles into the mouth. Besides one larger oblong nucleus a second (the paranucleus) is invariably (?) present (Fig. XXV. 2), or the nucleus may be dispersed in small fragments. Conjugation of equal-sized individuals, not resulting in permanent fusion, is frequent. The conjugated animals separate and their nuclei and paranuclei undergo peculiar changes; but no formation of spores, either at this or other periods, has been decisively observed (Fig. XXV. 8 to 15). Multiplication by transverse fission is invariably observed in full-grown individuals (Fig. XXV. 16), and conjugation appears to take place merely as an interlude in the fissiparous process; consequently young or small Ciliata are (with few exceptions) unknown. Possibly spore-formation may hereafter be found to occur at rare intervals more generally than is at present supposed (Fig. XXIV. 15, 18). A production of microgonidia by rapid fission occurs in some Peritricha (Fig. XXIII. 11, 12, 14, 15), the liberated microgonidia conjugating with the normal individuals, which also can conjugate with one another.

The Ciliata, with rare exceptions (parasites), possess one

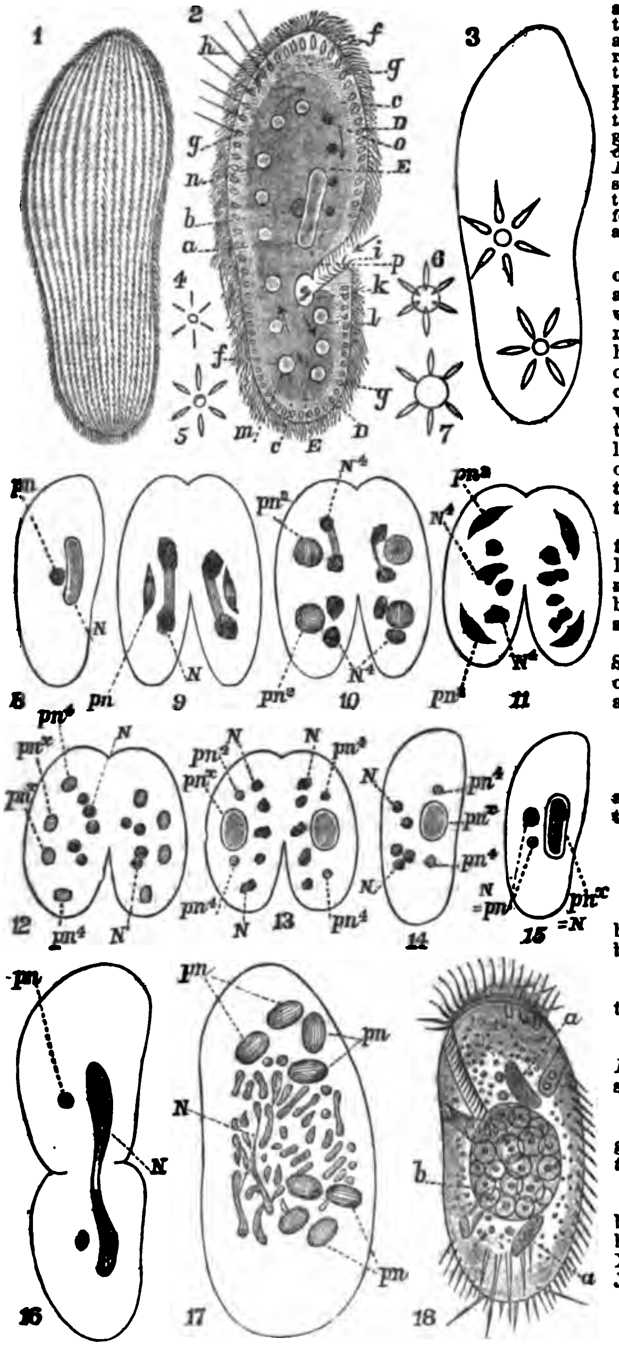

Fig. XXV. Ciliata (conjugation. etc.). 1. Surface view of Holotrichous Ciliate, showing the disposition of the cilia in longitudinal rows. 2. Diagrammatic optical section of a Ciliate Protozoon, showing all structures except the contractile vacuoles. *a*, nucleus; *b*, paranucleus (so-called nucleolus); *c*, cortical substance; D, extremely delicate cuticle; E, medullary (more fluid) protoplasm; *f*, cilia; *g*, trichocysts; *h*, filaments ejected from the trichocysts; *i*, oral aperture; *k*, drop of water containing food-particles, about to sink into the medullary substance and form a food-vacuole: *l*, *m*, *n*, *o*, food-vacuoles, the successive order of their formation corresponding to the alphabetical sequence of the letters; the arrows indicate the direction of the movement of rotation of the medullary protoplasm; *p*, pharynx. 3. Outline of a Ciliate (Paramœcium), to show the form and position of the contractile vacuoles. 4–7. Successive stages in the periodic formation of the contractile vacuoles. The ray-like vacuoles discharge their contents into the central vacuole, which then itself bursts to the exterior. 8–15. Diagrams of the changes undergone by the nucleus and paranucleus of a typical Ciliate during and immediately after conjugation: N, nucleus; *pn*, paranucleus; 8, condition before conjugation; 9, conjugation effected; both nucleus and paranucleus in each animal elongate and become fibrillated; 10, two spherical paranuclei pn^2 in each, two dividing or divided nuclei N^4; 11, the spherical paranuclei have become fusiform; 12, there are now four paranuclei in each (pn^4 and pn^x), and a nucleus broken into four or even more fragments; 13, the two paranuclei marked pn^x in 12 have united in each animal to form the new nucleus pn^x; the nuclear fragments are still numerous; 14, after cessation of conjugation the nuclear fragments N and the two unfused paranuclear pieces pn^4 are still present; 15, from a part or all of the fragments the new paranucleus is in process of formation, the new nucleus (pn^x—N) is large and elongated. 16. Diagram of a Ciliate in process of transverse fission. 17. Condition of the nucleus N, and of the paranucleus *pn* in *Paramœcium aurelia* after cessation of conjugation as observed by Bütschli. 18. *Stylonichia mytilus* (one of the Hypotricha), showing endoparasitic unicellular organisms *b*, formerly mistaken for spores; *a*, nuclei (after conjugation and breaking up).

or more contractile vacuoles (Fig. XXV. 3). They always possess a delicate cuticle and a body-wall which, although constant, in form is elastic. They may be naked and free-swimming, or they may form horny (Fig. XXIII. 21, 25) or silicious cup-like shells or gelatinous envelopes, and may be stalked and form colonies like those of Choanoflagellata, sometimes with organic connection of the constituent units of the colony by a branching muscular cord (Vorticellidæ). Many are parasitic in higher animals, and of these some are mouthless. All are holozoic in their nutrition, though some are said to combine with this saprophytic and holophytic nutrition.

The Ciliata are divisible into four orders according to the distribution and character of their cilia. The lowest group (the Peritricha) may possibly be connected through some of its members, such as Strombidium (Fig. XXIII. 4), with the Flagellata through such a form as Lophomonas (Fig. XXI. 9).

In the following synopsis, chiefly derived from Saville Kent's valuable treatise (71), the characters of the families and the names of genera are not given at length owing to the limitation of our space.

ORDER 1. PERITRICHA, Stein (72).

Characters.—Ciliata with the cilia arranged in one anterior circlet or in two, an anterior and a posterior; the general surface of the body is destitute of cilia.

Sub-order 1. NATANTIA (animals never attached).

Fam. 1. TORQUATELLIDÆ.

Genus.—*Torquatella*, Lankester, like *Strombidium*, but the cilia adherent so as to form a vibratile membranous collar (Fig. XXIII. 6, 7.)

Fam. 2. DICTYOCYSTIDÆ. Animals loricate.

Fam. 3. ACTINOBOLIDÆ. Illoricate, with retractile tentacula.

Fam. 4. HALTERIIDÆ.

Genera.—*Strombidium*, Cl. & L. (Fig. XXIII. 4); *Halteria*, Dujard., with a supplementary girdle of springing hairs; *Didinium*, Stein (Fig. XXIV. 19).

Fam. 5. GYROCORIDÆ.

Genera.—*Gyrocoris*, Stein, with an equatorial ciliary girdle spirally disposed (Fig. XXIII. 23, 24); *Urocentrum*, Nitzsch, girdle annular.

Fam. 6. URCEOLARIDÆ.

Genera.—*Trichodina*, Ehr.; two ciliate girdles; body shaped as a pyramid with circular sucker-like base, on which is a toothed corneous ring (Fig. XXIII. 8, 9); *Licnophora*, Clap.; *Cyclochæta*, Hat. Jacks.

Fam. 7. OPHRYOSCOLECIDÆ.

Genera.—*Astylozoon*, Engelm.; *Ophryoscolex*, Stein.

Sub-order 2. SEDENTARIA, animals always attached or sedentary during the chief part of the life history.

Fam. 1. VORTICELLIDÆ. Animals ovate, campanulate, or sub-cylindrical; oral aperture terminal, eccentric, associated with a spiral fringe of adoral cilia, the right limb of which descends into the oral aperture, the left limb encircling a more or less elevated protrusible and retractile ciliary disk.

Sub-family 1. Vorticellinæ; animalcules naked.

α.—Solitary forms.

Genera.—*Gerda*, Cl. and L.; *Scyphidia*, Dujard.; *Spirochona*, Stein (sessile with peristome in the form of a spirally convolute membraneous expansion, Fig. XXIII. 10); *Pyxidium*, Kent (with a non-retractile stalk); *Vorticella*, Linn. with a hollow stalk in which is a contractile muscular filament.)

β.—Forming dendriform colonies.

Genera.—*Carchesium*, Ehr. (Fig. XXIII. 18, with contractile stalks); *Zoothamnium*, Ehr. (contractile stalks); *Epistylis*, Ehr. (stalk rigid); *Opercularia*, Stein (stalk rigid, ciliated disk oblique; an elongated peristomial collar, Fig. XXIII. 20).

Sub-family 2. Vaginicolinæ; animalcules secreting firm cup-like or tube-like membranous shells.

Genera.—*Vaginicola*, Lamarck (no internal valve); *Thuricola*, Kent (with a door-like valve to the tube, Fig. XXIII. 25, 26); *Cothurina*, Ehr. (lorica or shell pediculate; no operculum); *Pyxicola*, Kent (lorica pedunculate, animal carrying dorsally a horny operculum, Fig. XXIII. 21, 22).

Sub-family 3. Ophrydina; animalcules secreting a soft gelatinous envelope.

Genera.—*Ophionella*, Kent; *Ophrydium*, Ehr.

ORDER 2. HETEROTRICHA, Stein.

Characters.—A band or spiral or circlet of long cilia is developed in relation to the mouth (the heterotrichous band) corresponding to the adoral circlet of Peritricha; the rest of the body is uniformly beset with short cilia.

α.—Heterotrichal band circular.

Genera.—(selected).—*Tintinnus*, Schranck (Fig. XXIII. 3); *Trichodinopis*, Cl. and L.; *Codonella*, Haeck. (with a peri-oral fringe of lappet-like processes); *Calceolus*, Diesing.

β.—Heterotrichal band spiral.

Genera (selected).—*Stentor*, Oken (Fig. XXIII. 2); *Blepharisma*, Perty (with an undulating membrane along the oral groove); *Spirostomum*, Ehr. (oral groove linear and elongate, Fig. XXIII. 1) *Leucophrys*, Ehr. (oral groove very short).

γ.—Heterotrichal band in the form of a simple straight or oblique adoral fringe of long cilia.

Genera (selected).—*Bursaria*, Müller; *Nyctotherus*, Leidy (with well-developed alimentary tract and anus, Fig. XXIV. 22); *Balantidium*, Cl. and L. (*B. coli* parasitic in the human intestine).

ORDER 3. HOLOTRICHA, Stein.

Characters.—There is no special adoral fringe of larger cilia, nor a band-like arrangement of cilia upon any part of the body; short cilia of nearly equal size are uniformly disposed all over the surface. The adoral cilia sometimes a little longer than the rest.

α.—With no membraniform expansion of the body-wall.

Genera.—*Paramœcium*, Ehr. (Fig. XXV. 1, 2); *Prorodon*, Ehr. (Fig. XXIV. 13); *Coleps*, Ehr.; *Enchelys*, Ehr.; *Trachelocerca*, Ehr.; *Trachelius*, Ehr.; *Amphileptus*, Ehr.; *Icthyophthirius*, Fouquet (Fig. XXIV. 15).

β.—Body with a projecting membrane, often vibratile.

Genera.—*Ophryoglena*, Ehr.; *Colpidium*, Stein; *Lembus*, Cohn; *Trichonympha*, Leidy (an exceptionally modified form, parasitic, Fig. XXIV. 3).

γ.—Isolated parasitic forms, devoid of a mouth.

Genera.—*Opalina*, Perkinje (nuclei numerous, no contractile vacuole, Fig. XXIV. 4 to 8); *Benedenia*, Foett.; *Opalinopsis*, Foett. (Fig. XXIV. 1, 2); *Anoplophrya*, Stein (large axial nucleus, numerous contractile vacuoles in two linear series, Fig. XXIV. 9, 10); *Haptophrya*, Stein; *Hoplitophrya*, Stein.

ORDER 4. HYPOTRICHA, Stein.

Characters.—Ciliata in which the body is flattened and the locomotive cilia are confined to the ventral surface, and are often modified and enlarged to the condition of muscular appendages (setæ so-called). Usually an adoral band of cilia, like that of Heterotricha. Dorsal surface smooth or provided with tactile hairs only. Mouth and anus conspicuously developed.

α.—Cilia of the ventral surface uniform fine, and vibratile.

Genera.—*Chilodon*, Ehr.; *Loxodes*, Ehr.; *Dysteria*, Huxl.; *Huxleya*, Cl. and L.

β.—Cilia of the ventral surface variously modified as setæ (muscular appendages), styles, or uncini.

Genera.—*Stylonichia*, Ehr. (Fig. XXV. 18); *Oxytricha*, Ehr.; *Euplotes*, Ehr. (Fig. XXIV. 20, 21).

Further remarks on the Ciliata.—The Ciliata have recently formed the subject of an exhaustive treatise by Mr. Saville Kent (71) which is accessible to English readers. On the other hand Prof. Bütschli has not yet dealt with them in his admirable critical treatise on the Protozoa. Hence a large space has not been devoted in this article to the systematic classification and enumeration of their genera. See (79) and (93).

One of the most interesting features presented by the group is the presence in many of a cell anus as well as a cell mouth (Fig. XXIV. 22 *d*). In those devoid of an anus the undigested remnants of food are expelled either by a temporary aperture on the body-surface or by one opening into the base of the pharynx. In many parasitic Ciliata, as in higher animal parasites, such as the Cestoid worms, a mouth is dispensed with, nutriment being taken by general imbibition and not in the solid form. Many Ciliata develop chloroplyll corpuscles of definite biconcave shape, and presumably have so far a capacity for vegetal nutrition. In *Vorticella viridis* the chlorophyll is uniformly diffused in the protoplasm and is not in the form of corpuscles (72).

The formation of tubes or shells and in connection therewith of colonies is common among the Peritricha and Heterotricha. The cuticle may give rise to structures of some solidity in the form of hooks or tooth-like processes, or as a lining to the pharynx (Fig. XXIV. 12).

The phenomena connected with the conjugation and reproduction are very remarkable, and have given rise to numerous misconceptions. They are not yet sufficiently understood. It cannot be surely asserted that any Ciliate is at the present time known to break up, after encystment or otherwise, into a number of spores, although this was at one time supposed to be the rule. Icthyophthirius (Fig. XXIV. 15 to 18) and some Vorticellæ (76) have been stated, even recently, to present this phenomenon; but it is not impossible that the observations are defective. The only approach to a rapid breaking up into spores is the multiple formation (eight) of microgonidia or microzooids in Vorticellidæ (Fig. XXIII. 11, 12); otherwise the result of the most recent observations appears to be that the Ciliata multiply only by binary fission, which is very frequent among them (longitudinal in the Peritricha, transverse to the long axis in the others).

Several cases of supposed formation of spores within an adult Ciliate and of the production endogenously of numerous "acineti-form young" have been shown to be cases of parasitism, minute unicellular parasites, *e. g.*, parasitic Acinetæ (such as Sphærophrya described and figured in (Fig. XXVI.) being mistaken for the young.

The phenomenon of conjugation is frequent in the Ciliata, and is either temporary, followed by a separation of the fused individuals, as in most cases, or permanent, as in the case of the fertilization of normal individuals by the microgonidia of Vorticellidæ.

Since the process of conjugation or copulation is not followed by a formation of spores, it is supposed to have merely a fertilizing effect on the temporarily conjoined individuals, which nourish themselves and multiply by binary fission more actively after the process than before (hence termed "rejuvenescence)."

Remarkable changes have been from time to time observed in the nuclei of Ciliata during or subsequently to conjugation, and these were erroneously interpreted by Balbiani (73) as indicating the formation of spermatozoa and ova. The nuclei exhibit at one period great elongation and a distinct fibrillation, as in the dividing nuclei of tissue cells (compare Fig. I. and Fig. XXV. 9, 11, 17). The fibrillæ were supposed to be spermatozoids, and this erroneous view was confirmed by the observation of rod-like Bacteria (Schizomycetes) which in some instances infest the deeper protoplasm of large Ciliata.

The true history of the changes which occur in the nuclei of conjugating Ciliata has been determined by Bütschli (74) in some typical instances, but the matter is by no means completely understood. The phenomena present very great obstacles to satisfactory examination on account of their not recurring very frequently and passing very rapidly from one phase to another. They have not been closely observed in a sufficiently varied number of genera to warrant a secure generalization. The following scheme of the changes passed through by the nuclei must be regarded as necessarily referring to only a few of the larger Heterotricha, Holotricha and Hypotricha and is only probably true in so far as details are concerned, even for them. It is at the same time certain that some such series of changes occurs in all Ciliata as the sequence of conjugation.

In most of the Ciliata by the side of the large oblong nucleus is a second smaller body (or even two such bodies) which has been very objectionably termed the nucleolus (Fig. XXV. 8), but is better called the "paranucleus" since it has nothing to do with the nucleolus of a typical tissue-cell. When conjugation occurs and a "syzygium" is formed both nucleus and paranucleus in each conjugated animal elongate and show fibrillar structure (Fig. XXV. 10). Each nucleus and paranucleus now divides into two, so that we get two nuclei and two paranuclei in each animal. Elongation and fibrillation are then exhibited by each of these new elements and subsequently fission, so that we get four nuclei and four paranuclei in each animal (11, 12). The fragments of the original nucleus (marked N in the figures) now become more dispersed and broken into further irregular fragments. Possibly some of them are ejected (so-called "cell excrement"); possibly some pass over from one animal to the other. Two of the pieces of the four-times-divided paranucleus now reunite (Fig. XXV. 13) and form a largish body which is the new nucleus. The remaining fragments of paranucleus and the broken-down nucleus now gradually disappear, and probably as a remnant of them we get finally a few corpuscles which unite to form the new paranucleus (14, 15). The conjugated animals which have separated from one another before the later stages of this process are thus reconstituted as normal Ciliata, each with its nucleus and paranucleus. They take food and divide by binary fission until a new period of conjugation arrives, when the same history is supposed to recur.

The significance of the phenomena is entirely obscure. It is not known why there should be a paranucleus or what it may correspond to in other cells—whether it is to be regarded simply as a second nucleus or as a structurally and locally differentiated part of an ordinary cell-nucleus, the nucleus and the paranucleus together being the complete equivalent of such an ordinary nucleus. An attempt has been made to draw a parallel between this process and the essential features of the process of fertilization (fusion of the spermatic and ovicell nuclei) in higher animals; but it is the fact that concerning neither of the phenomena compared have we as yet sufficiently detailed knowledge to enable us to judge conclusively as to how far any comparison is possible. Whilst there is no doubt as to the temporary fusion and admixture of the protoplasm of the conjugating Ciliata, it does not appear to be established that there is any transference of nuclear or paranuclear matter from one individual to the other in the form of solid formed particles.

Conjugation resulting merely in rejuvenescence and ordinary fissive activity is observed in many Flagellata as well as in the Ciliata.

A noteworthy variation of the process of binary fission occurring in the parasite Opalina deserves distinct notice here, since it is intermediate in character between ordinary binary fission and that multiple fission which so commonly in Protozoa is known as spore-formation. In Opalina (Fig. XXIV. 4) the nucleus divides as the animal grows, and we find a great number of regularly disposed separate nuclei in its protoplasm. (The nuclei of many other Ciliata have recently been shown to exhibit extraordinary branched and even "fragmented" forms; compare Fig. XXIV. 2). At a certain stage of growth binary fission of the whole animal sets in and growth ceases. Consequently the products of fission become smaller and smaller (Fig. XXIV. 6). At last the fragments contain each but two, three or four nuclei. Each fragment now becomes encased in a spherical cyst Fig. XXIV. 7). If this process had occurred rapidly we should have had a uninucleate Opalina breaking up at once nto fragments (as a Gregarina does), each fragment being a spore and enclosing itself in a spore-case. The *Opalina anarum* lives in the rectum of the Frog and the encysted pores are formed in the early part of the year. They pass ut into the water and undergo no change unless swallowed y a Tadpole, in the intestine of which they forthwith develop. From each spore-case escapes a uninucleate embryo Fig. XXIV. 8), which absorbs nourishment and grows. As t grows its nucleus divides, and so the large multinucleate orm from which we started is reattained.

This history has important bearings, not only on the nature f sporulation, but also on the question of the significance f the multinucleate condition of cells. Here it would seem hat the formation of many nuclei is merely an anticipation f the retarded fissive process.

It is questionable how far we are justified in closely associating Opalina, in view of its peculiar nuclei, with the ther Ciliata. It seems certain that the worm-parasites ometimes called Opalinæ, but more correctly Anaplophrya, &c., have no special affinity with the true Opalina. They ot only differ from it in having one large nucleus, but in aving numerous very active contractile vacuoles (75).

Recently it has been shown, more especially by Gruber 4); that many Ciliata are multinucleate and do not possess merely a single nucleus and a paranucleus. In Oxytricha he nuclei are large and numerous (about forty), scatered through the protoplasm, whilst in other cases the ucleus is so finely divided as to appear like a powder or ust diffused uniformly through the medullary protoplasm Trachelocerca, Choenia). Carmine staining, after treatent with absolute alcohol, has led to this remarkable disovery. The condition described by Foettinger (85) in his palinopsis (Fig. XXIV. 1, 2) is an example of this pulveration of the nucleus. The condition of pulverization had d in some cases to a total failure to detect any nucleus in e living animal, and it was only by the use of reagents at the actual state of the case was revealed. Curiously hough, the pulverized nucleus appears periodically to form itself by a union of the scattered particles into one solid nucleus just before binary fission of the animal takes place, and on the completion of fission the nuclei in the two new individuals break up into little fragments as before. The significance of this observation in relation to the explanation of the proceedings of the nuclei during conjugation cannot be overlooked. It also leads to the suggestion that the animal cell may at one time in the history of evolution have possessed not a single solid nucleus but a finely molecular powder of chromatin-substance scattered uniformly through its protoplasm, as we find actually in the living Trachelocerca.

Some of the Ciliata (notably the common Vorticellæ) have been observed to enclose themselves in cysts, but it does not appear that these are anything more than "hypnocysts," from which the animal emerges unchanged after a period of drought or deficiency of food. At the same time there are observations which seem to indicate that in some instances a process of spore-formation may occur within such cysts (76).

The differentiation of the protoplasm into cortical and medullary substance is very strongly marked in the larger Ciliata. The food-particle is carried down the gullet by ciliary currents and is forced together with an adherent drop of water into the medullary protoplasm. Here a slow rotation of the successively formed food vacuoles is observed (Fig. XXV. 2, *l*, *m*, *n*, *o*), the water being gradually removed as the vacuole advances in position. It was the presence of numerous successively formed vacuoles which led Ehrenberg to apply to the Ciliata the not altogether inappropriate name "Polygastrica." The chemistry of the digestive process has not been successfully studied, but A. G. Bourne (8) has shown that when particles stained with water-soluble anilin blue are introduced as food into a Vorticella the coloring matter is rapidly excreted by the contractile vacuole in a somewhat concentrated condition.

The differentiation of the protoplasm of Ciliata in some special cases as "muscular" fibre cannot be denied. The contractile filament in the stalk of Vorticella is a muscular fibre and not simply undifferentiated contractile protoplasm; that is to say, its change of dimensions is definite and recurrent and is not rhythmic, as is the flexion of a cilium. (Perhaps in ultimate analysis it is impossible to draw a sharp line between the contraction of one side of a cilium which causes its flexion and the rhythmical contraction of some muscular fibres.) The movements of the so-called "setæ" of the Hypotricha are also entitled to be called "muscular," as are also the general contractile movements of the cortical substance of large Ciliata. Haeckel (77) has endeavored to distinguish various layers in the cortical substance, but, whilst admitting that, as in the Gregarinæ, there is sometimes a distinct fibrillation of parts of this layer, we cannot assent to the general distinction of a "myophane" layer as a component of the cortical substance.

Beneath the very delicate cuticle which, as a mere superficial pellicle of extreme tenuity, appears to exist in all Ciliata we frequently find a layer of minute oval sacs, which contain a spiral thread: the threads are everted from the sacs when irritant reagents are applied to the animal (Fig. XXV. 2, *g*, *h*). These were discovered by Allman (78), and by him were termed "trichocysts." They appear to be identical in structure and mode of formation with the nematocysts of the Cœlentera and Platyhelmia. Similar trichocysts (two only in number) are found in the spores of the Myxosporidia (see *ante*, page 879).

The comparative forms of the nucleus and of the contractile vacuoles, as well as of the general body-form, etc., of Ciliata may be learnt from an examination of Figs. XXIII., XXIV., XXV., and the explanations appended to them.

CLASS VI. ACINETARIA, Lankester (*Tentaculifera*, Huxley).

Characters.—Highly specialized Corticate Protozoa, probably derived from Ciliata, since their young forms are provided with a more or less complete investment of cilia. They are distinguished by having no vibratile processes on the surface of the body in the adult condition, whilst they have few or many delicate but firm tentacle-like processes, which are either simply adhesive or tubular and suctorial. In the latter case they are provided at their extremity with a sucker-disk and have contractile walls, whereas in the former case they have more or less pointed extremities. The Acinetaria are sedentary in habit, even if not, as is usual, permanently fixed by a stalk. The nucleus is frequently arboriform. Reproduction is effected by simple binary fission, and by a modified fission (bud-fission) by which (as in Reticularia and Arcella) a number of small bud-like

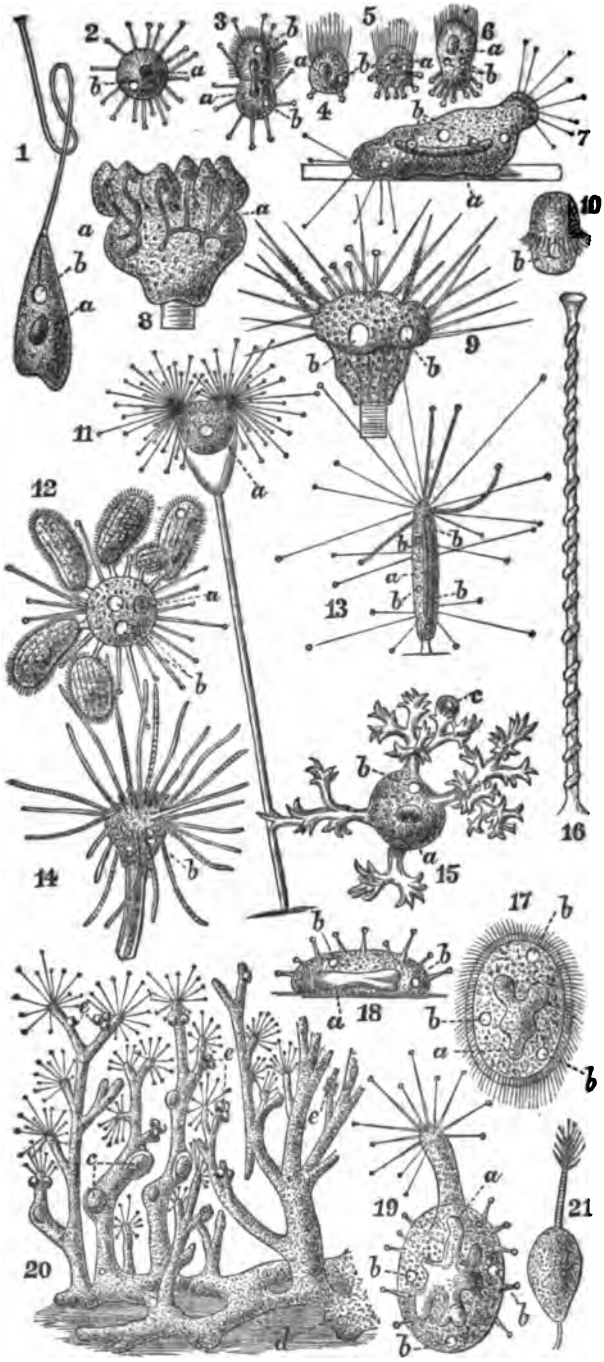

FIG. XXVI.—**Acinetaria.** 1. *Rhyncheta cyclocum*, Zenker. *a*, nucleus; *b*, contractile vacuole; only a single tentacle, and that suctorial; × 150. Parasitic on Cyclops. 2. *Sphærophrya urostylæ*, Maupas; normal adult; × 200. *a*, nucleus; *b*, contractile vacuole. Parasitic in Urostyla. 3. The same dividing by transverse fission, the anterior moiety with temporarily developed cilia. *a*, nucleus; *b*, contractile vacuole. 4, 5, 6. *Sphærophrya stentorea*, Maupas; × 200. Parasitic in Stentor, and at one time mistaken for its young. 7. *Trichophrya epistylidis*, Cl. and L.; × 150 *a*, nucleus; *b*, contractile vacuole. 8. *Hemiophrya gemmipara*, Hertwig; × 400. Example with six buds, into each of which a branch of the nucleus *a* is extended. 9. The same species, showing the two kinds of tentacles (the suctorial and the pointed), and the contractile vacuoles *b*. 10. Ciliated embryo of *Podophrya Steinii*, Cl. and L.; × 300. 11. *Acineta grandis*, Saville Kent; × 100; showing pedunculated lorica, and animal with two bunches of entirely suctorial tentacles. *a*, nucleus. 12. *Sphærophrya magna*, Maupas; × 800. It has seized with its tentacles, and is in the act of sucking out the juices of six examples of the ciliate *Colpoda parvifrons*. 13. *Podophrya elongata*, Cl. and L.; × 150. *a*, nucleus; *b*, contractile vacuole. 14. *Hemiophrya Benedenii*, Fraip.; × 200; the suctorial tentacles retracted. 15. *Dendrocometes paradoxus*, Stein; × 350. Parasitic on *Gammarus pulex*. *a*, nucleus; *b*, contractile vacuole; *c*, captured prey. 16. A single tentacle of Podophrya; × 800, (Saville Kent.) 17–20. *Dendrosoma radians*, Ehr.;—17, free-swimming ciliated embryo, × 600; 18, earliest fixed condition of the embryo, × 600; 19, later stage, a single tentaculiferous process now developed, × 600; 20, adult colony; *c*, enclosed ciliated embryos; *d*, branching stolon; *e*, more minute reproductive (?) bodies. 21. *Ophryodendron pedicellatum*, Hincks; × 300.

warts containing a portion of the branched parental nucleus are nipped off from the parent, often simultaneously (Fig. XXVI. 8). These do not become altogether distinct, but are for a time enclosed by the parental cell each in a sort of vacuole or brood-chamber, where the young Acinetarian develops a coat or band of cilia and then escapes from the body of its parent (Fig. XXVI. 10, 17). After a brief locomotive existence, it becomes sedentary, develops its tentacles, and loses its cilia.

The Acinetaria have one or more contractile vacuoles. Their nutrition is holozoic.

The surface of the body in some cases is covered only by a delicate cuticle, but in other cases a definite membranous shell or cup (often stalked) is produced. Fresh-water and marine. See Fraipont (89).

ORDER 1. SUCTORIA, Kent.

A greater or less proportion or often all of the tentacles are suctorial and terminated with sucker-like expansions.

Genera.—*Rhyncheta*, Zenker (stalkless, naked, with only one tentacle; epizoic on Cyclops; Fig. XXVI. 1); *Urnula*, C. and L.; *Sphærophrya*, C. and L. (naked, spherical, with distinctly capitate tentacles only; never with a pedicle; parasitic within Ciliata, supposed young; Fig. XXVI. 2–6, 12); *Trichophrya*, C. and L. (as *Sphærophrya*, but oblong and temporarily fixed without a pedicle); *Podophrya*, Ehr. (naked, solitary, globose, ovate or elongate, fixed by a pedicle; tentacles all suctorial, united in fascicles or distributed irregularly; Fig. XXVI. 10, 13, 16); *Hemiophrya*, S. Kent (as *Podophrya*, but the tentacles are of the two kinds indicated in the definition of the group; Fig. XXVI. 8, 9, 14); *Podocyathus*, S. Kent (secreting and inhabiting stalked membranous cups or loricæ; tentacles of the two kinds); *Solenophrya*, C. and L. (with a sessile lorica; tentacles only suctorial); *Acineta*, Ehr. (as *Solenophrya*, but the lorica is supported on a pedicle; Fig. XXVI. 11); *Dendrocometes*, Stein (cuticle indurated; solitary, sessile, discoid; tentacles peculiar, viz., not contractile, more or less branched, rootlike, and perforated at the extremities and suctorial in function; Fig. XXVI. 15). *Dendrosoma*, Ehr. (forming colonies of intimately fused individuals, with a basal adherent protoplasmic stolon and upstanding branches, the termination of which bear numerous capitate suctorial tentacles only; Fig. XXVI. 17–20).

ORDER 2. NON-SUCTORIA, Lankester (=*Actinaria*, Kent).

Characters.—Tentacles filiform, prehensile, not provided with a sucker.

Genera.—*Ephelota*, Str. Wright (solitary, naked, pedunculate, with many flexible inversible tentacles); *Actinocyathus*, S. Kent; *Ophryodendron*, C. and L. (sessile, with a long, extensile, anterior proboscis bearing numerous flexible tentacles at its distal extremity: Fig. XXVI. 21); *Acinetopsis*, Robin (ovate, solitary, secreting a stalked lorica; from the anterior extremity of the animal is developed a proboscis-like organ which does not bear tentacles).

Further remarks on the Acinetaria.—The independence of the Acinetaria was threatened some years ago by the erroneous view of Stein (79) that they were phases in the life-history of Vorticellidæ. Small parasitic forms (Sphærophrya) were also until recently regarded erroneously as the "acinetiform young" of Ciliata.

They now must be regarded as an extreme modification of the Protozoon series, in which the differentiation of organs in a unicellular animal reaches its highest point. The sucker-tentacles of the Suctoria are very elaborately constructed organs (see Fig. XXVI. 16). They are efficient means of seizing and extracting the juices of another Protozoon which serves as food to the Acinetarian. The structure of Dendrosoma is remarkable on account of its multicellular character and the elaborate differentiation of the reproductive bodies.

The ciliation of the embryos or young forms developed from the buds of Acinetaria is an indication of their near tral connection with the Ciliata. The cilia are differently disposed on the young of the various genera (see Fig. XXVI. 10, 17).

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(E. R. L.)

PROUDHON, PIERRE JOSEPH (1809-1865), a well-known revolutionary writer, was born in 1809 at Besançon, France, the native place also of the socialist Fourier. His origin was of the humblest, his father being a brewer's cooper; and the boy herded cows and followed other simple pursuits of a like nature. But he was not entirely self-educated; at sixteen he entered the college of his native place, though his family was so poor that he could not procure the necessary books, and had to borrow them from his mates in order to copy the lessons. There is a story of the young Proudhon returning home laden with prizes, but to find that there was no dinner for him. At nineteen he became a working compositor; afterwards he rose to be a corrector for the press, reading proofs of ecclesiastical works, and thereby acquiring a very competent knowledge of theology. In this way also he came to learn Hebrew, and to compare it with Greek, Latin and French; and it was the first proof of his intellectual audacity that on the strength of this he wrote an "Essai de grammaire générale." As Proudhon knew nothing whatever of the true principles of philology, his treatise was of no value. In 1838 he obtained the *pension Suard*, a bursary of 1500 francs a year for three years, for the encouragement of young men of promise, which was in the gift of the academy of Besançon. In 1839 he wrote a treatise "On the Utility of Keeping the Sunday," which contained the germs of his revolutionary ideas. About this time he went to Paris, where he lived a poor, ascetic and studious life—making acquaintance, however, with the socialistic ideas which were then fomenting in the capital. In 1840 he published his first work *Qu'est-ce que la Propriété?* His famous answer to this question, "La propriété, c'est le vol," naturally did not please the academy of Besançon, and there was some talk of withdrawing his *pension*; but he held it for the regular period. For his third memoir on property, which took the shape of a letter to the Fourierist, M. Considérant, he was tried at Besançon but was acquitted. In 1846 he published his greatest work, the *Système des contradictions économiques ou Philosophie de la Misère*. For some time Proudhon carried on a small printing establishment at Besançon, but without success; afterwards he became connected as a kind of manager with a commercial firm at Lyons. In 1847 he left this employment, and finally settled in Paris, where he was now becoming celebrated as a leader of innovation. He regretted the sudden outbreak of the revolution of February (1848), because it found the social reformers unprepared. But he threw himself with ardor into the conflict of opinion, and soon gained a national notoriety. He was the moving spirit of the *Représentant du Peuple* and other journals, in which the most advanced theories were advocated in the strongest language; and as member of assembly for the Seine department he brought forward his celebrated proposal of exacting an impost of one-third on interest and rent, which of course was rejected. His attempt to found a bank which should operate by granting gratuitous credit was also a complete failure; of the five million francs which he required only seventeen thousand were offered. The violence of his utterances led to an imprisonment at Paris for three years, during which he married a young working woman. As Proudhon aimed at economic rather than political innovation, he had no special quarrel with the second empire, and he lived in comparative quiet under it till the publication of his work, *De la Justice dans la Révolution et dans l'Église* (1858), in which he attacked the church and other existing institutions with unusual fury. This time he fled to Brussels to escape imprisonment. On his return to France his health broke down, though he continued to write. He died at Passy in 1865.

Personally Proudhon was one of the most remarkable figures of modern France. His life was marked by the severest simplicity and even Puritanism; he was affectionate in his domestic relations, a most loyal friend, and strictly upright in conduct. He was strongly opposed to the prevailing French socialism of his time because of its utopianism and immorality; and, though he uttered all manner of wild paradox and vehement invective against the dominant ideas and institutions, he was remarkably free from feelings of personal hate. In all that he said and did he was the son of the people, who had not been broken to the usual social and academic discipline; hence his roughness, his one-sidedness, and his exaggerations; but he is always vigorous, and often brilliant and original.

It would of course be impossible to reduce the ideas of such an irregular thinker, to systematic form. In later years Proudhon himself confessed that "the great part of his publications formed only a work of dissection and ventilation, so to speak, by means of which he slowly makes his way towards a superior conception of political and economic laws." Yet the groundwork of his teaching is clear and firm; no one could insist with greater emphasis on the demonstrative character of economic principles as understood by himself. He strongly believed in the absolute truth of a few moral ideas, with which it was the aim of his teaching to mould and suffuse political economy. Of these fundamental ideas, justice, liberty, and equality were the chief. What he desiderated, for instance, in an ideal society was the most perfect equality of remuneration. It was his principle that service pays service, that a day's labor balances a day's labor—in other words, that the duration of labor is the just measure of value. He did not shrink from any of the consequences of this theory, for he would give the same remuneration to the worst mason as to a Phidias; but he looks forward also to a period in human development when the present inequality in the talent and capacity of men would be reduced to an inappreciable minimum. From the great principle of service as the equivalent of service is derived his axiom that property is the right of *aubaine*. The *aubain* was a stranger not naturalized; and the right of *aubaine* was the right in virtue of which the sovereign claimed the goods of such a stranger who had died in his territory. Property is a right of the same nature, with a like power of appropriation in the form of rent, interest, etc. It reaps without labor, consumes without producing, and enjoys without exertion. Proudhon's aim, therefore, was to realize a science of society resting on principles of justice, liberty, and equality thus understood; "a science absolute, rigorous, based on the nature of man and of his faculties, and on their mutual relations; a science which we have not to invent, but to discover." But he saw clearly that such ideas with their necessary accompaniments could only be realized through a long and laborious process of social transformation. As we have said, he strongly detested the prurient immorality of the schools of Saint-Simon and Fourier. He attacked them not less bitterly for thinking that society could be changed off-hand by a ready-made and complete scheme of reform. It was "the most accursed lie," he said, "that could be offered to mankind." In social change he distinguishes between the transition and the perfection or achievement. With regard to the transition he advocated the progressive abolition of the right of *aubaine*, by reducing interest, rent, etc. For the goal he professed only to give the general principles; he had no ready-made scheme, no utopia. The positive organization of the new society in its details was a labor that would require fifty Montesquieus. The organization he desired was one on collective principles, a free association which would take account of the division of labor, and which would maintain the personality both of the man and the citizen. With his strong and fervid feeling for human dignity and liberty, Proudhon could not have tolerated any theory of social change that did not give full scope for the free development of man. Connected with this was his famous paradox of *anarchy*, as the goal of the free development of society, by which he meant that through the ethical progress of men government should become unnecessary. "Government of man by man in every form," he says, "is oppression. The highest perfection of society is found in the union of order and *anarchy*."

Proudhon's theory of property as the right of *aubaine* is substantially the same as the theory of capital held by Marx and most of the later socialists. Property and capital are defined and treated as the power of exploiting the labor of other men, of claiming the results of labor without giving an equivalent. Proudhon's famous paradox, "La propriété, c'est le vol," is merely a trenchant expression of this general principle. As slavery is assassination inasmuch as it destroys all that is valuable and desirable in human personality, so property is theft inasmuch as it appropriates the value produced by the labor of others in the form of rent, interest, or profit without rendering an equivalent. For property Proudhon would substitute individual possession, the right of occupation being equal for all men (see SOCIALISM).

The principal works of Proudhon have already been mentioned. A complete edition, including his posthumous writings was published at Paris, 1875. See *P. J. Proudhon, sa vie et sa correspondence*, by Sainte-Beuve (Paris, 1875), an admirable work, unhappily not completed; also *Revue des Deux Mondes*, Jan., 1866, and Feb., 1878. (T. K.)

PROUT, SAMUEL (1783–1852), water-color painter, was born at Plymouth on September 17, 1783. His education in art was obtained by a patient and enthusiastic study of nature. He spent whole summer days, in company with the ill-fated Haydon, in drawing the quiet cottages, rustic bridges, and romantic watermills of the beautiful valleys of Devon. He even made a journey through Cornwall, to try his hand in furnishing sketches for Britton's *Beauties of England*. On his removal in 1803 to London, which became his headquarters after 1812, a new scene of activity opened up before Prout. He now endeavored to correct and improve his style by the study of the works of the rising school of landscape. To gain a living he painted marine pieces for Palser the printseller, received pupils, and published many drawing books for learners. He was likewise one of the first who turned to account in his profession the newly-invented art of lithography. In spite of all this industry, however, it was not until about 1818 that Prout discovered his proper sphere. Happening at that time to make his first visit to the Continent, and to study the quaint streets and marketplaces of Continental cities, he suddenly found himself in a new and enchanting province of art. All his faculties, having found their congenial element, sprung into unwonted power and activity. His eye readily caught the picturesque features of the architecture, and his hand recorded them with unsurpassed felicity and fine selection of line. The composition of his drawings was exquisitely natural; their color exhibited "the truest and happiest association in sun and shade"; the picturesque remnants of ancient architecture were rendered with the happiest breadth and largeness, with the heartiest perception and enjoyment of their time-worn ruggedness; and the solemnity of great cathedrals was brought out with striking effect. Encouraged by this success, Prout continued most enthusiastically to pursue that path upon which he had unexpectedly come. At the time of his death, 10th February, 1852, there was scarcely a nook in France, Germany, Italy, and the Netherlands where his quiet, benevolent, observant face had not been seen searching for antique gables and sculptured pieces of stone. In Venice especially there was hardly a pillar which his eye had not lovingly studied and his pencil had not dexterously copied.

See a memoir of Prout, by John Ruskin, in *Art Journal* for 1849, and the same author's *Notes on the Fine Art Society's Loan Collection of Drawings by Samuel Prout and William Hunt*. 1879–80.

PROVENÇAL LANGUAGE AND LITERATURE. I. LANGUAGE.—Provençal is a name used to comprehend all the varieties of Romanic speech formerly spoken and written, and still generally used by country people, in the south of France. The geographical limits of this infinitely varied idiom cannot be defined with precision, because it is conterminous on the north, south, and east with idioms of the same family, with which almost at every point it blends by insensible gradations. Roughly speaking, it may be said to be contained between the Atlantic on the west, the Pyrenees and Mediterranean on the south, and the Alps on the east, and to be bounded on the north by a line proceeding from the Gironde to the Alps, and passing through the departments of Gironde, Dordogne, Haute Vienne, Creuse, Alliere, Loire, Rhone, Isère, and Savoie. These limits are to some extent conventional. True, they are fixed in accordance with the mean of linguistic characters; but it is self-evident that according to the importance attached to one character or another they may be determined differently.

1. *Different Names.*—Though the name Provençal is generally adopted to designate the Romanic idiom of this region, it must not be supposed that this name has been imposed by general *consensus*, or that it rests upon any very firm historical basis. In the southern part of Gaul, Romanic developed itself, so to say, in the natural state of language. Contrary to what took place in other Romanic countries, no local variety here raised itself to the rank of the literary idiom *par excellence.* While in Italy the Florentine, in France the French dialect proper (that is to say, the dialect of the Île de France), succeeded little by little in monopolizing literary use, to the exclusion of the other dialects, we do not find that either the Marseillais or the Toulousain idiom was ever spoken or written outside of Marseilles or Toulouse. In consequence of this circumstance, no name originally designating the language of a town or of a small district came to be employed to designate the language of the whole of southern France; and on the other hand the geographical region described above, having never had any special name, was not able to give one to the idiom.

In the Middle Ages the idiom was spoken of under various appellations: *Romans* or *lenga Romana* was that most generally used. It is notably that employed by the authors of the *Leys d'Amors*, a treatise on grammar, poetry, and rhetoric, composed at Toulouse in the 14th century. But this term, which is capable of being applied, and which, in fact, has been applied, to each of the Romanic languages individually, is too general to be retained. It is, however, that which was revived in the beginning of the present century by Raynouard, the author of the *Lexique roman.* It is now abandoned. In the 13th century a poet born in Catalonia, on the southern slope of the Pyrenees, Raimon Vidal of Besalù, introduced the name of *Limousin* language, probably on account of the great reputation of some Limousin troubadours, but he took care to define the expression, which he extended beyond its original meaning, by saying that in speaking of *Limousin* he must be understood to include Saintonge, Quercy, Auvergne, etc. (*Rasos de trobar*, ed. Stengel, p. 70). This expression found favor in Spain, and especially in Catalonia, where the little treatise of Raimon Vidal was extensively read. The most ancient lyric poetry of the Catalans (13th and 14th centuries), composed on the model of the poetry of the troubadours, was often styled in Spain *poesia lemosina*, and in the same country *lengua lemosina* long designated at once the Provençal and the old literary Catalan.

The name Provençal as applied to language is hardly met with in the Middle Ages, except in the restricted sense of the language of Provence proper, *i.e.*, of the region lying south of Dauphiné on the eastern side of the Rhone. Raimon Feraut, who composed, about 1300, a versified life of St. Honorat, uses it, but he was himself a native of Provence. We can also cite the title of a grammar, the *Donatz Proensals*, by Hugh Faidit (about 1250); but this work was composed in north Italy, and we may conceive that the Italians living next to Provence employed the name Provençal somewhat vaguely without inquiring into the geographical limits of the idiom so called. In fact the name Provençal became traditional in Italy, and in the beginning of the 16th century Bembo could write, "Era per tutto il Ponente la favella *Provenzale*, ne tempi ne quali ella fiorí, in prezzo et in istima molta, et tra tutti gli altri idiomi di quelle parti, di gran lunga primiera. Conciosiacosa che ciascuno, o Francese, o Fiamingo, o Guascone, o Borgognone, o altramente di quelle nationi che egli si fosse, il quale bene scrivere e specialmente verseggiar volesse, quantunque egli Provenzale non fosse, lo faceva Provenzalmente" (*Prose*, ed. 1529, fol. viii.).[1] This passage, in which the primacy of the Provençal tongue is manifestly exaggerated, is interesting as showing the name Provençal employed, though, with little precision, in the sense in which we now apply it.

Another designation, which is supported by the great authority of Dante, is that of *langue d'oc.* In his treatise *De Vulgari Eloquio* (bk i. chaps. viii. and ix.), the Florentine poet divides the languages of Latin origin into three idioms, which he characterizes by the affirmative particles used in each *oc*, *oïl*, *si*; "nam alii *oc*, alii *oïl*, alii *si* affirmando loquuntur, ut puta Hispani, Franci, et Latini." As is seen, he attributes the affirmation *oc* to the Spaniards, which is of course erroneous, but there is no doubt that to the Spaniards he joined more correctly the inhabitants of southern France, for in the *Vita nuova*, chap. xxv., he speaks of the *lingua d'oc* as having been long celebrated for its poets, which can apply only to the language of the troubadours. The name *langue d'oc* occurs also as early as the end of the 13th century, in public acts, but with a different sense, that of the province of Languedoc, as constituted after the union of the county of Toulouse to the French king's dominion in 1271. In the royal acts of the end of the 13th and of the 14th century *partes linguæ occitanæ* or *pays de langue d'oc* designates the union of the five seneschalates of Périgueux, Carcassone, Beaucaire, Toulouse, and Rhodez, that is to say, the province of Languedoc, such as it existed till 1790. Some scholars, following the example of Dante, still actually use the term *langue d'oc* in opposition to *langue d'oui*, but these names have the inconvenience that they take such a secondary fact as the form of the affirmative particle as an essential character. Moreover it can hardly help to distinguish the other Romanic languages, as *langue de si* would cause a confusion between Italian and Spanish. Provençal, without being entirely satisfactory, since in principle it applies solely to the language of Provence, is, notwithstanding, the least objectional name that can be adopted. In addition to its being in some sort consecrated by the use made of it by the Italians, who were the first after the Renaissance to study the works of the troubadours, it must not be forgotten that, just as the Roman *Provincia*, in which the name originated, extended across the south of Gaul from the Alps to Toulouse and the Pyrenees, so still in the Middle Ages *Provincia*, *Provinciales*, were understood in a very wide sense to designate not only Provence strictly so called, *i.e.*, the present departments of Alpes Maritimes, Basses Alpes, Var, Bouches du Rhône, but also a very considerable part of Languedoc and the adjacent countries. Thus in the 12th century the chronicler Albert of Aix-la-Chapelle (Albertus Aquensis) places the town of Puy (Haute Loire) *in Provincia.*

2. *General Characters of the Language in its Ancient State.*—The Provençal language, within the limits above indicated, cannot be said to have any general characters really peculiar to it. Such of its characters

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[1] "The Provençal speech in the times in which it flourished was prized and held in great esteem all over the West, and among all the other idioms of that region was by far the foremost: so that every one, whether Frenchmen, Fleming, Gascon, Burgundian, or of what nation soever, who wished to write and versify well, although he was not a Provençal, did it in the Provençal language."

as are found in all the varieties of the language are met with also in neighboring idioms; such as are not found elsewhere are not general characters, that is to say, are manifested only in certain varieties of Provençal. In reality "Provençal language" does not designate, properly speaking, a linguistic unity; it is merely a geographical expression.

Tonic or Accented vowels.—Latin *a* is preserved in an open syllable amāre, *amar*, amātum, *amat*, as well as in a closed syllable carnem, *carn*. This character is common also to the Romanic of Spain and Italy; but it is one of the best distinguishing marks between Provençal and French, for, to the north, this *a*, when in an open syllable, does not pass beyond a line which would run approximately through Blaye, Coutras (Gironde), Riberac, Nontron (Dordogne), Bellac Haute Vienne), Boussac (Creuse), Montluçon, Gannat (Allier), Montbrison (Loire). Starting eastward from Lyons or thereabouts, there appears a notable linguistic fact which is observable in varied proportions in the departments of Ain, Isère, and Savoie, and in Romanic Switzerland. This is, that accented Latin *a* in an open syllable, when preceded by a *mouillure* or palatalization (whatever the origin of this), becomes *e*; on the contrary, when there is no *mouillure*, it remains *a*. Thus we find in the *Meditations* of Marguerite d'Oingt (Lyons, about 1300) *ensennier*, *deleitier*, as against *desirrar*, *recontar*, *regardar*. Of these two endings, the former, *-ier*, is that which is found regularly in French, the second that which is regular in Pr. Pure Pr. would have *-ar* in both cases (*ensenhar*, *deleitar*, *desirrar*, etc.); Fr. would have *-ier* (*enseignier*, *delitier*) and *-er* (*desirer*). Prof. Ascoli has given the name of *Franco-provençal* (*franco-provenzale*) to the varieties of Romanic in which we find this duality of treatment of Latin *a*, according as it was or was not preceded by a palatalized sound. Lat. ē, ĭ become close *e* (Ital., *e chiuso*; Fr. *é*): habēre *aver*, crēdot *cre*, mē(n)sem *mes*, fĭdem *fe*, pĭlum *pel*. This character is not only common to Italian and Spanish, but also extends over the French domain on its western side as far as Brittany. Certain exceptions noticed in French do not occur in Pr.: thus mercēdem, cēra, pr(eh)e(n)sum, venēnum, which give in Fr. *merci*, *cire*, *pris*, *venin*, where we should have expected *mercei*, *ceire*, *preis*, *venein*, give regularly in Pr. *merce*, *cera*, *pres*, *vere*. Lat. ĕ preserves, as in Italy, the sound of open *e* (Ital , *e aperto*): pĕdem, *pe*, lĕvat, *leva*, lĕporem, *lebre*, In certain determinate cases, this *e* from about the 13th century onwards may diphthongize to *ie*: ĕgo, *eu* then *ieu*, hĕri, *er*, *ier*, fĕrit, *fer*, *fier*. Lat. ī is preserved, as in all the Romanic languages: amīcum, *ami*, rīpa, *riba*. Lat. ĭ is treated like ī long when it precedes (with hiatus) another vowel: pĭum, pĭa, *piu*, *pia*, vĭa, *via*, ligat, *lia*. Lat. ō, ŭ result in one and the same sound, that of Italian *u*, Fr *ou* (Eng. *oo*). The same phenomenon takes place in the north of Italy, and in the Romanic of Switzerland. This sound, which is styled by the *Donat Proensal* the *o estreit* (close *o*), is usually symbolized in the early texts by simple *o*, and is thus confounded in spelling, though not in pronunciation, with the open *o* (*o larc* of the *Donatz Proensals*) which comes from Lat. ŏ. Lat. ū becomes ü (*i.e.*, Fr. *u*), as all over France, and also in North Italy and Catalonia: mūrum, *mur* (=mür), dūrum, *dur* (=dür). Lat. *au* is rigorously preserved over the whole extent of the Pr. domain: aurum, *aur*, alauda, *alauza*, pauperem, *paubre*. At present the preservation of Lat. *au* does not extend much outside the Prov. domain; it is, however, found in certain parts of the Ladino zone in Switzerland (upper Rhine Valley), and in Friuli, and it is to be supposed to have been once general over the whole of that zone. It is attested as late as the 16th century in the Vaudois valleys of Piedmont, and there are also examples of it in old Catalan. Elsewhere the diphthong has regularly become open *o* (aurum, It. and Sp. *oro*, Fr. *or*, etc.).

Atonic Vowels.—The atonic vowels (*i.e.*, vowels of the unaccented syllables) which precede the accented syllable present no very characteristic phenomenon; but it is otherwise with those that follow the accented syllable, the *post-tonic* vowels. The Pr. is one of the Romanic idioms which, like the French, but unlike the Castilian and the dialects of central and northern Italy, admit of only one syllable after the accent. But the rules are not quite the same as in French. In French the only vowel which can stand after the accented syllable is "*e* feminine," otherwise called "*e* mute." In Prov. *a* and *e* are the most frequent vowels in this position, but *i* and *o* also occur. In French the first of the two post-tonic vowels of a Lat. proparoxytone always disappears; in Prov. it tends to be preserved, when followed by one of the consonants *n*, *r*, *l*, *d*: te·rminum, *te·rmen*, ho·minem, *o·men*, a·ngelum, *a·ngel*, se·calem, *se·guel*, cre·scere, *crei·sser*, te·pidum, *te·bez*. Finally, Prov. presents in certain words coming from Lat. proparoxytones the trace of forms which (like Ital.) admitted two atonic vowels after the accented syllable: thus we have *porte·gue* and *po·rgue* (po·rticum), *Fabre·ga*, a place name, and *fa·rga* (fa·brica), *perte·ga* and *pe·rga* (pe·rtica), *femo·na* and *fe·mna* (fe·mina). We have also *lagre·ma* (la·cryma), but a form accented like Fr. *larme* does not exist. There seems to be no doubt that these forms in which a displacement of the Latin accent is observed were at an earlier period pronounced as proparoxytones (*pe·rtega*, *fa·brega*, *po·rtega*, *fe·mena*, *la·grema*).

Consonants.—The boundary usually recognised between Prov. and French is founded upon linguistic characters furnished by the vowels, especially *a*; if it had been determined by characters furnished by the consonants, the line of demarcation would have to be drawn farther south, because the consonantal system which is regarded as proper to French really extends in its main features over the northern zone of the Provençal region as defined above. As with the vowels, only a few of the salient facts can here be indicated. *C* initial, or second consonant of a group, before *a* (caballum, mercātum), preserves its Lat. sound (=*k*) in the greater part of the Prov. region. But in the northern zone it takes the sound of *tch* (Eng. *ch* in *chin*) as in O. Fr., and this sound is still pretty well preserved, although there is here and there a tendency to the present sound of *ch* in Fr. (=*sh* Eng.). The place names Castellum, Castanētum, Casale, give *Chastel*, *Chastanet*, *Chazal*, in Dordogne, Haute Vienne, Corrèze, Puy de Dôme, Cantal, Haute Loire, the north of Lozère, of Ardèche, of Drome, of Isère, and of Hautes Alpes, and *Castel*, *Castanet*, *Casal*, farther to the south. Analogously, *g* initial, or second consonant of a group, followed by *a*, becomes *j* (*i.e.*, *dj*=O. Fr. and Eng. *j* in *jam*) in the same zone; Garrica is *Jarrija*, *Jarria* in Dordogne, Corrèze, Cantal, Haute Loire, Isère, and *Garriga* farther south. Between two vowels *t* becomes *d*: *edat*, *emperador*, *nadal*, *amada* (ætatem, imperatōrem, natāle, amāta). This was also the case in O. Fr. until the course of the 11th century (*honurede*, *emperedur*, *lavadures*, etc., in the *Life of St. Alexis*). But in the northern zone this *d* representing a Lat. *t* fell away as early as in Fr.; in an 11th-century text from the environs of Valence, we read *muraor*, *coroaa* (*muratōrem, corrogāta), Fr. *corvée* (P. Meyer, *Recueil d'anciens textes*, Provençal section, No. 40). In the south, *d* between two vowels was preserved almost everywhere until about the middle of the 12th century, when it became *z* (as in Fr. and Eng. *zero*): *cruzel*, *azorar*, *auzir*, *vezer* (crudēlem, adorāre, audīre, vidēre). In the 14th and 15th centuries this *z*, like every *z* or *s* soft of whatever origin, was liable to become *r* (lingual, not uvular): *aurir*, *veren* (audire, videntem). In Béarn and Gascony *d* remained; but in the northern zone Lat. *d*, instead of changing into *z*, *r*, disappeared as in Fr. and quite as early. The poem of Boetius, of which the MS. is of the 11th century, shows in this respect great hesitation: *e.g.*, *d* preserved in *chadent*, *credet*, *tradar*, *veder* (cadentem, *credĕdit, *tradāre, vidēre); *d* fallen away in *creessen*, *feeltat*, *truazo*, *veut*, *fiar* (*cre·dessent, fidelitātem, *traditionem, *vidūtum, p. ple. of vidēre, fidāre). One of the most general facts in Pr. is the habit of rejecting Lat. final *t*, of which examples to any number are presented by the verbs. In Fr. this *t* was formerly retained when it followed a vowel which remained, *aimet*, *entret* (amat, intrat), and still remains (in writing at least) when, in Latin, it follows a consonant, *aiment*, *fait*, *vit* (amant, facit, *fact, vivit, *vivt); but in Pr. the *t* is dropped in all cases, even in the most ancient texts: *aman*, *fai*, *viu*. Yet in the northern zone we find the *t* retained in the 3d per. pl. of verbs, *-ant*, *-ont* (Lat. -ant, -unt). *H* has gone completely (or at least only appears through orthographic tradition, and very intermittently, (*h*)*erba*, (*h*)*onor*, (*h*)*umil*, etc., not only in words of Lat. origin, which is the case in O. Fr., but even in Teutonic words (*anta*, *ardit*, *arenc*, *ausberc*, *elm*, Fr. *honte*, *hardi*, *hareng*, *haubert*, *heaume*, with *h* aspirated. By this feature, the northern limits of which are not yet well determined, the Provençal attaches itself to the Romanic of the southern countries. N final, or standing in Lat. between two vowels of which the second is to be dropped, disappears in the whole central part of the Pr. domain: *gran gra*, *ben be*, *en e*, *ven ve*, *fin fi*, *un u* (granum, bene, in, venit, finem, unum). The forms with *n* belong to the eastern part (left of the Rhone), the western part (Gascony, but not Béarn), and the region of the Pyrenees. It is possible that this loss of *n* went along with a lengthening of final vowel; at least, in Béarnese when the *n* falls away the vowel is doubled: *caperaa*, *besii*, *boo* (capellānum, vicīnum, bonum), etc.

These are the most important characteristics of the consonants, in relation to the extent of space over which they prevail. Others, which appear only within a more limited area, are perhaps more curious on account of their strangeness. It will suffice to mention a few which belong to the district bounded on the west and south by the Atlantic, the Basque provinces, and the Pyrenees, and which extends northward and eastward towards the Garonne and its affluents, as far as the Gironde. (This includes Béarn, Bigorre, and Gascony.) Here the sound *v* no longer exists, being replaced generally by *b*; between two vowels, in Gascony, by *u* with the sound of Eng. *w*. Initial *r* assumes a prosthetic *a*: *arram, arre, Arrobert* (rāmum, rem, Robertum). *Ll* between two vowels becomes *r*: *aperar, caperan*, or (Béarn) *caperaa, bera, eru*, (apellare, capellanum, bella, ella). On the contrary, at the end of words (viz., in Romanic) *ll* becomes *g* or *t*, *d*; the former change seems to belong rather to Hautes and Basses Pyrénées, Landes, the latter to Gironde, Lot et Garonne, Gers: *eg, ed, et* (ille), *arrasteg, -ed, -et* (rastellum), *casteg, -ed, -et* (castellum), *capdeg, -ed, -et* (capitellum), whence Fr. *cadet* (in 16th century *capdet*, originally a Gascon word). For further details upon the consonants in this region of southwest France, see *Roumania*, iii. 435–38, v. 368–69.

Flection.—Old Provençal has, like old French, a declension consisting of two cases for each number, derived from the Latin nominative and accusative. In certain respects this declension is more in conformity with etymology in Provençal than in old French, having been less influenced by analogy. The following are the types of this declension, taking them in the order of the Lat. declensions. 1. Words in *-a* coming from Lat. 1st decl., increased by certain words coming from Lat. neuter plurals treated in Prov. as feminine singulars; one form only for each number; sing. *causa*, pl. *causas*. 2. Words of the Lat. 2d decl., with a few from the 4th; two forms for each number; sing. subject *cavals* (caballus), object *caval* (caballum); pl. subject *caval* (caballi), object *cavals* (caballos). 3. Words of Lat. 3d decl. Here there are three Lat. types to be considered. The first type presents the same theme and the same accentuation in all the cases *e.g.*, canis. The second presents the same accentuation in the nominative singular and in the other cases, but the theme differs: co'mes, co'mitem. In the third type the accentuation changes: pecca'tor, peccatō'rem. The first type is naturally confounded with nouns of the 2d decl.: sing. subj. *cans* or *cas*, obj. *can* or *ca*. The second and third types are sometimes followed in their original variety; thus *coms* answers to co'mes, and *co'mte* to co'mitem. But it has often happened that already in vulgar Latin the theme of the nominative singular had been refashioned after the theme of the oblique cases. They said in the nom. sing. heredis, parentis, principis, for heres, parens, princeps. Consequently the difference both of theme and of accentuation which existed in Lat. between nominative and accusative has disappeared in Pr. This reconstruction of the nominative singular after the theme of the other cases takes place in all Lat. words in *-as* (except *abbas*), in those in *-io*, in the greater part of those in *-or*, at least in all those which have an abstract meaning. Thus we obtain *bontats* (bonitatis for bonitas) and *bontat* (bonitatem), *ciutats* (civitatis for civitas) and *ciutat* (civitatem), amors (amoris for amor) and *amor* (amorem). All present participles in the subject case singular are formed in this way upon refashioned Latin nominatives: *amans* (amantis for amans) *amant* (amantem). It is to be remarked that in regard to feminine nouns Pr. is more etymological than Fr. In the latter feminine nouns have generally only one form for each number; *bonté* for the subj. as well as for the obj. case, and not *bontés* and *bonté*; in Pr. on the contrary *bontats* and *bontat*. Still, in a large number of nouns the original difference of accentuation between the nominative singular and the other cases has been maintained, whence there result two very distinct forms for the subj. and obj. cases. Of these words it is impossible to give a full list here; we confine ourselves to the exhibition of a few types, remarking that these words are above all such as designate persons: *a'bas aba't, pa'stre pasto'r, sor soro'r, cantai're cantado'r* (cantàtor, -ōrem), *emperai're emperado'r, bar baro', compa'nh companho', lai're lairo'* (latro, -ōnem). To this class belong various proper names: *E'ble Eblo', Gui Guio', Uc Ugo'*. A few have even come from the 2d decl., thus *Pei're Peiro', Pons Ponso', Ca'rle Carlo'*, as if the Latin types had been Petro, -ōnem, Ponso, -ōnem, Carlo, -ōnem. We may mention also geographical adjectives, such as *Bret Breto', Bergo'nhs Bergonho', Gasc Gasco'*, etc. The plural of the 3d decl. is like that of the second: subj. *aba't, soro'r, cantado'r, emperado'r, baro', companho', lairo'*; obj. *aba'ts, soro'rs cantado'rs, emperado'rs baro's, companho's, lairo's*, as if the Lat. nominative pl. had been abbāti, sorōri, cantatōri, etc. It is barely possible that such forms actually existed in vulgar Latin; no trace of them, however, is found in the texts, save in the glosses of Cassel (8th c.), sapienti for sapientes, and in a great many ancient charters parentorum, which implies a nominative parenti. The words of the 4th and 5th declensions present no points requiring mention here.

This declension of two cases is a notable character of the whole Romanic of Gaul, north as well as south, *i.e.*, French as well as Provençal. It must be noted, however, that in the southwest it existed only in a very restricted fashion. In the old texts of Gascony it is no longer general in the 13th century. In Béarn it appears to have been completely unknown, the nouns and adjs. having only one form, usually that of the obj. case. In Catalan poetry its application is often laid down in the 18th century, but as the charters and documents free from literary influence show no trace of it, its introduction into the poetry of this country may be assumed to be an artificial fact. In the region where it is best observed, *i.e.*, in the centre and north of the Provençal territory, it tends to disappear from ordinary use already in the 18th century. The poet grammarian Raimon Vidal of Besalù, who flourished about the middle of the century, points out in various troubadours transgressions of the rules of declension, and recognizes that in conversation they are no longer observed. The general tendency was to retain only a single form, that of the obj. case. For certain words, however, it was the subj. form which survived. Thus in modern Pr. the words in the ending *-ai're* (answering to Lat. -ator) are as frequent as those in *-ado'* (repr. -atōrem). But there is a slight difference of meaning between these two suffixes.

Adjectives, generally speaking, agree in flexion with the nouns. But there is one fact particular to adjectives and past participles which is observed with more or less regularity in certain 12th and 13th century texts. There is a tendency to mark more clearly than in the substantives the flexion of the subj. pl., chiefly when the adj. or participle is employed predicatively. This is marked by the addition of an *i*, placed, according to the district, either after the final consonant, or else after the last vowel so as to form a diphthong with it. The following are examples from an ancient translation of the New Testament (MS. in library of the Palais Saint-Pierre, Lyons, end of 13th century): "Dic a vos que no siatz *consirosi*" (ne solliciti sitis, Mat. vi. 25); "que siatz *visti* d' els" (ut videamini ab eis, Mat. vi. 1); "e davant los reis els princeps seretz *menadi*" (et ad præsides et ad reges ducemini, Mat. x. 18). In charters of the 12th and 13th centuries we find in the subj. case pl., and especially in this predicative use, *pagaig, certifiaih, acossailhaih*, representing pagati, certificati, adconsiliati.

It is in the verbs that the individuality of the different Romanic idioms manifests itself most distinctly. At a very early date the etymological data were crossed, in various directions and divers manners according to the country, by analogical tendencies. The local varieties became little by little so numerous in the Romanic conjugation that it is not easy to discover any very characteristic features observed over a territory so vast as that of which the limits have been indicated at the commencement of this article. The following are, however, a few.

The infinitives are in *-ar, -ér, -re, -ir*, corresponding to the Lat. -āre, -ēre, -ĕre, -īre, respectively; as in the whole Romanic domain, the conjugation in *-ar* is the most numerous. The table of verbs, which forms part of the Pr. grammar called the *Donatz Proensals* (13th century) contains 473 verbs in *-ar*, 101 in *-ér* and *-re*, 115 in *-ir*. In the *-ar* conjugation we remark one verb from another conjugation *far* (*cf.* It. *fare*) from facere. The conjugations in *-ér* and *-re* encroach each upon the territory of the other. The three Lat. verbs cadĕre, capĕre, sapĕre have become *-ér* verbs (*case'r, cabe'r, sabe'r*) as in Fr. *cheoir, -cevoir, savoir*; and several other verbs waver between the two: *crede'r, creér*, and *crei're* (cre'dĕre), *quere'r* and *que'rre* (quærĕre). This fluctuation is most frequent in the case of verbs which belonged originally to the *ēre* conjugation: *arde'r* and *a'rdre, plase'r* and *plai're, tase'r* and *tai're* (ardēre, placēre, tacēre). Next to the *-ar* conjugation, that in *ir* is the one which has preserved most formative power. As in the other Romanic languages, it has welcomed a large number of German verbs, and has attracted several verbs which etymologically ought to have belonged to the conjugations in *-ér* and *-re*: *emplir* (implēre), *jauzir* (gaudēre), *cosir* (consuēre), *erebir* (eripĕre), *fugir* (fugĕre), *sequir* (* sequĕre = sequi).

Except in the *-ar* conjugation, the ending of the infinitive does not determine in a regular manner the mode of forming the different tenses. The present participles are divided into two series: those in *-an* (obj. sing.) for the first conj., those in *-en* for the others. In this the Pr. distinguishes itself very clearly from the French, in which all present participles have *-ant*. There is also in Pr. a participial form or verbal adjective which is not met with in any other Romanic language, except Romanian, where moreover it is employed in a different sense; this is a form in *-do·r, -doi·ra*, which supposes a Lat. type -tōrius, or -tūrius; the sense is that of a future participle, active for the intransitive verbs, passive for the transitive: *endevenido·r, -doi·ra*, "that is to happen"; *fazedo·r, -doi·ra*, "that is to be done"; *punido·r, -doi·ra*, "to be punished." In conjugation properly so called, we may remark the almost complete disappearance of the Lat. preterite in *-āvi*, of which traces are found only in texts written in the neighborhood of the French speaking region, and Béarn. In return, a preterite which seems to have been suggested by the Latin dĕdi, has increased and become the type of the tense almost everywhere in the *-ar* conjugation, and in many verbs in *-ĕr* and *-re: amei·, ame·st, ame·t, ame·m, ame·tz, ame·ron.* In Fr. there is a form like this, or at least having the same origin, only in a small number of verbs, none of which belong to the first conjugation, and in these only in the 3rd. pers. sing. and pl. (*perdié perdierent; entendié, entendierent*, etc.). It is well known that reduplicated preterites had greatly multiplied in vulgar Latin: there have been recovered such forms as ascendiderat, ostendedit, pandiderunt, adtendedit, incendiderat, etc. (see Schuchardt, *Vokalismus des Vulgarlateins*, i. 35, iii. 10; *cf. Romania*, ii. 477). But, in order to explain the Pr. form *-ei, -est, -et* (with open è), we must suppose a termination not in -ĭdi or -ēdi, but in -ĕ·di. In the western region the 3d pers. sing. is generally in *-ec*, probably by analogy with preterites like *bec, crec, dec, sec*, formed after the Lat. type in -ui. Another notable peculiarity, of which Old Fr. shows only rare traces, in texts of a very remote period, is the preservation of a preterite in *-ara*, or *-era*, derived from the Lat. pluperfect, *ama·ra* or *ame·ra*, "I loved." The former comes directly from Lat. amâram, the latter has been influenced by the ordinary preterite in *-ei*. This preterite is used with the sense of a simple past, not of a pluperfect, and consequently is an exact doublet of the ordinary preterite, which explains how it was at length eliminated almost everywhere by the latter, of which it was a mere synonym. But it remained in general use with the sense of a past conditional: *ama·ra* or *ame·ra*, "I should have loved," *fora*, "I should have been."

3. *Existing State of the Provençal.*—In consequence of political circumstances (see notice of Provençal Literature below), the Provençal ceased to be used for administrative as well as literary purposes about the 15th century, in some places a little sooner, in others later (notably in Béarn, where it continued to be written as the language of ordinary use till the 17th century). The poems in local dialect composed and printed in the 16th century and on to our own day have no link with the literature of the preceding period. Reduced to the condition of a *patois*, or popular dialect simply, the idiom experienced somewhat rapid modifications. Any one who should compare the poems of Goudelin of Toulouse (1579–1649) with those of a Toulousain troubadour of the 13th century would be astonished at the changes which the language has undergone. Yet this impression would probably be exaggerated. In order to make a rigorously accurate comparison of the language of the two epochs, it would have to be written in the two cases with the same orthographic system, which it is not. The first writers of Provençal, about the 10th or 11th century, applied to the language the Latin orthography, preserving to each letter, as far as possible, the value given to it in the contemporary pronunciation of Latin. To express certain sounds which did not exist in Latin, or which were not there clearly enough noted, there were introduced little by little, and without regular system, various conventional symbolizations such as *lh* and *nh* to symbolize the sound of *l* and *n mouillée.* From this method of proceeding there resulted an orthographic system somewhat wanting in fixity, but which from its very instability lent itself fairly well to the variations which the pronunciation underwent in time and locality. But, the tradition having been interrupted about the 15th century, those who afterwards by way of pastime attempted composition in the patois formed, each for himself apart, an orthography of which many elements were borrowed from French usage. It is evident that differences already considerable must be exaggerated by the use of two very distinct orthographical systems. Nevertheless, even if we get quit of the illusion which makes us at first sight suppose differences of sound where there are merely different ways of spelling the same sound, we find that between the 14th and 16th century the language underwent everywhere, Béarn (for reasons already given) excepted, great modifications both in vocabulary and grammar. The Provençal literature having gradually died out during the 14th century, the vocabulary lost immediately the greater part of the terms expressing general ideas or abstract conceptions. To supply the place of these, the authors who have written in the patois of the south during the last few centuries have been obliged to borrow from French, modifying at the same time their form, a multitude of vocables which naturally have remained for the most part unintelligible to people who know only the patois. In this case the adoption of foreign words was excusable; but it did not stop here. Little by little, as primary instruction (now compulsory) was diffused, and introduced first in the towns and afterwards in the villages a certain knowledge of French, words purely French have been introduced into use in place of the corresponding dialect words. Thus, one hears constantly in Provence *pè·ro, mè·ro, frè·ro*, forms adapted from French, instead of *paire, maire, fraire; cacha* (*catsha·* = Fr. *cacher*) instead of *escoundre*, etc.

In the phonology, the modifications are of the natural order, and so have nothing revolutionary. The language has developed locally tendencies which certainly already existed during the flourishing period, although the ancient orthography did not recognize them. Of the vowels, *a* tonic is generally preserved; *an* in an open syllable becomes *è* (open) in part of the departments of Aveyron, Lot, Dordogne, Corrèze, Cantal, and south of Haute Loire: *gro* (granum), *mo* (manum), *po* (panem). This nasalized *a* must have had a particular sound already in Old Pr., for it is qualified in the *Donatz Proensals* (ed. Stengel, p. 49) as *a estreit* (= close or narrow *a*). A feature almost general is the passage of post-tonic *a* into *o*: *terro, amavo, amado* (terra, amabat, amata). In Var and the Maritime Alps examples of this change occur as early as the end of the 15th century. But even yet there are a few cantons, notably Montpellier and its neighborhood, where the ancient post-tonic *a* is preserved. It is remarkable that the Latin diphthong *au*, which had become simple *o* in almost all Romanic lands at the date of the most ancient texts, is to this day preserved with a very distinct diphthongal sound everywhere in the south of France.

In the morphology, the leading feature of modern Provençal is the ever greater simplification of grammatical forms. Not only have the two forms (nominative and objective) in each number, in nouns and adjectives, been reduced to one—this reduction manifested itself in ordinary use already in the 14th century—but in many places there no longer remains any distinction between the singular and the plural. In a great part of the south *ieu* (ego) does duty as an objective, *me* or *mi* having disappeared. In part of Drôme it is the other way, *mi* being substituted in the nominative for *ieu*, which it has completely displaced. It is perhaps in *conjugation* that the greatest changes from the older form of the language are seen. Analogy, basing itself upon one or another much used form, has acted with immense force, tending to make general in the whole conjugation, without any regard to the original classes to which the various verbs belonged, certain terminations, chiefly those which were accented, and thus appeared to the popular instinct to have more significance. The result, if the tendency were carried the full length, would be the reduction of all the three conjugations to one. Perhaps before this point is reached the patois of the south will themselves have disappeared. As the endless modifications which the language undergoes, in vocabulary and grammar alike, develop themselves in different directions, and each over an area differently circumscribed, the general aspect of the language becomes more and more confused, without the possibility of grouping the endless varieties within dialectal divisions, there being no case in which a certain number of phonetic or morphological facts present themselves within the same geographical limits. The custom has been adopted of roughly designating these varieties by the name of the ancient provinces in which they appear. *Limousin* (divided into *High* and *Low Li-*

mousin), *Marchese*, *Auvergnese*, *Gascon*, *Béarnese*, *Rouergat*, *Languedocian*, *Provençal*, etc.; but these divisions, though convenient in use, correspond to no actualities. Nîmes and Montpellier are in Languedoc, and Arles and Tarascon are in Provence; nevertheless the dialect of Nîmes resembles that of Arles and Tarascon more than that of Montpellier.

Texts.—For the history of the Provençal in all its varieties there are many more materials than for any other Romanic language, not excepting even Italian or French. The literary texts go back to the 10th or 11th century (see below). For phonetic purposes many of these texts are of secondary value, because the MSS. in which they have reached us, and several of which, especially for the poetry of the troubadours, are of Italian origin, have altered the original forms to an extent which it is not easy to determine; but we possess a countless number of charters, *coutumes*, regulations, accounts, registers of taxation, which are worthy of absolute confidence,—first, because these documents are in most cases originals, and, secondly, because, none of the dialectal varieties having raised itself to the rank of the literary language, as happened in France with the central (Parisian) variety and in Italy with the Florentine, writers never had the temptation to abandon their own idiom for another. It is proper to add that Provençal possesses two ancient grammars of the 13th century (the earliest compiled for any Romanic idiom)—the *Donats Proensals* and *Razos de trobar* (see p. 901). Although very short, especially the second, which is a collection of detached observations, they furnish valuable data. The 14th-century *Leys d' Amors* (see p. 902) presents the language in rather an artificial state—the language which ought to be written rather than the language actually existing.

Bibliography.—1. *Ancient Condition.*—There does not exist any comprehensive work upon the Provençal whence to obtain a precise idea of the history of the language at its different epochs. Diez's *Grammatik der romanischen Sprachen* is still the groundwork. It gives, especially in the 3d ed. (1869–72), the last revised by the author, the results of extensive researches conveniently arranged. But Diez had only a slender knowledge of the language in its present state, and in his time phonology had made little progress. The French translation of MM. G. Paris, A. Brachet, and Morel-Fatio (Paris, 1873–76) was to be completed by a supplementary volume, which was announced at vol. ix. p. 560 of the present work, but this expedient has had to be abandoned, it having been recognized that what was wanted was not a supplement but a general recast. The "Recherches philologiques sur la langue romane," and "Résumé de la grammaire romane," published by Raynouard at the beginning of vol. i. of his *Lexique roman* (1838), are entirely out of date. The "Tableau sommaire des flexions provençales," published by M. Bartsch, in the *Chrestomathie provençale* (4th ed., 1880), is incomplete and often erroneous. The actual state of our knowledge of ancient Provençal must be sought in a great number of scattered dissertations or monographs, which will be found especially in the *Mémoires* of the Société de Linguistique de Paris, 1868 (*Phonétique provençale, O*, pp. 145–61), in the *Romania* (1872–85), and in the *Revue de la Société pour l'étude des langues romanes*, to which may be added some doctoral dissertations published in Germany, and the special studies upon the language of particular texts prefaced to editions of these. As to dictionaries, the *Lexique roman, ou Dictionnaire de la langue des Troubadours*, by Raynouard (Paris, 6 vols. 8vo, 1836–44), can always be used with advantage, but the numerous special vocabularies appended by editors to texts published by them cannot be neglected. These yield a considerable number of words, either wanting or wrongly explained in the *Lexique roman*. 2. *Modern Form.*—The most useful grammatical works (all done with insufficient knowledge of phonology, and under the preconceived idea that there exist dialects with definite circumscription) are J. B. Andrews, *Essai de grammaire du dialecte mentonais* [Mentone] (Nice, 1878), see also his "Phonétique mentonaise," in *Romania*, xii. 394; Cantagrel, *Notes sur l'orthographie et la prononciation langue-dociennes*, prefixed to *La Canson de la Lauseto*, by A. Mir (Montpellier, 1876); Chabaneau, *Grammaire limousine* (Paris, 1876), referring especially to the variety of Nontron, in the north of Périgord (Dordogne); Constans, *Essai sur l'histoire du sous-dialecte du Rouergue* (Montpellier and Paris, 1880); Lespy, *Grammaire béarnaise* (2d ed., Paris, 1880); A. Luchaire, *Études sur les idiomes pyrénéens de la region française* (Paris, 1879); Moutier, *Grammaire dauphinoise, Dialecte de la vallée de la Drôme* (Montelimar, 1882); Ruben, "Étude sur le patois du Haut Limousin," prefixed to *Poems* by J. Foucaud, in the Limousin patois (Limoges, 1866). As to dictionaries we may mention, among others, Andrews, *Vocabulaire français-mentonais* (Nice, 1877); Azaïs, *Dictionnaire des idiomes romans du midi de la France* (Montpellier, 1877, 3 vols. 8vo), taking for its basis the dialect of Béziers; Chabrand and De Rochas d'Aiglun, *Patois des Alpes, Cottiennes et en particulier du Queyras* (Grenoble and Paris, 1877); Couzinié, *Dictionnaire de la langue romano-castraise* (Castres, 1850); Garcin, *Nouveau dictionnaire provençal français* (Draguignan, 1841, 2 vols.); Honnorat, *Dictionnaire provençal-français* (Digne, 1846–7, 2 vols. 4to); De Sauvages, *Dictionnaire languedocien-français* (new ed., Alais, 1820, 2 vols.); Vayssier, *Dictionnaire patois-français du département de l'Aveyron* (Rodez, 1879). From 1880 the *Dictionnaire provençal-français* of Fr. Mistral, in 2 vols. 4to, has been in progress; more than the half has appeared. This dictionary takes as its basis the variety of Maillane (in the north of Bouches-du-Rhône), the author's native district, and gives in as complete a manner as possible all the forms used in the south of France. It is by far the best of all the dictionaries of the southern dialects which have yet been published, and when finished it will almost enable the student to dispense with all the others.

II. PROVENÇAL LITERATURE.—Provençal literature is much more easily defined than the language in which it is expressed. Starting in the 11th and 12th centuries in several centres, it thence gradually spread out, first over the greater portion, though not the whole, of southern France, and then into the north of Italy and Spain. It nowhere merged in the neighboring literatures. At the time of its highest development (12th century) the art of composing in the vulgar tongue did not exist, or was only beginning to exist, to the south of the Alps and the Pyrenees. In the north, in the country of French speech, vernacular poetry was in full bloom: but between the districts in which it had developed—Champagne, Île de France, Picardy, and Normandy—and the region in which Provençal literature had sprung up, there seems to have been an intermediate zone formed by Burgundy, Bourbonnais, Berry, Touraine, and Anjou which, far on in the Middle Ages, appears to have remained barren of vernacular literature. In its rise Provençal literature stands completely by itself, and in its development it long continued to be absolutely original. It presents at several points genuine analogies with the sister-literature of northern France; but these analogies are due principally to certain primary elements common to both and only in a slight degree to mutual reaction.

It must be inquired, however, what amount of originality could belong to any, even the most original, Romanic literature in the Middle Ages. In all Romanic countries compositions in the vernacular began to appear while the custom of writing in Latin was still preserved by uninterrupted tradition. Even during the most barbarous periods, when intellectual life was at its lowest, it was in Latin that sermons, lives of saints more or less apocryphal, accounts of miracles designed to attract pilgrims to certain shrines, monastic annals, legal documents, and contracts of all kinds were composed. When learning began to revive, as was the case in northern and central France under the influence of Charlemagne and later in the 11th century, it was Latin literature which naturally received increased attention, and the Latin language was more than ever employed in writing. Slowly and gradually the Romanic languages, especially those of France, came to occupy part of the ground formerly occupied by Latin, but even after the Middle Ages had passed away the parent tongue retained no small portions of its original empire. Consequently Romanic literatures in general (and this is especially true of Provençal as it does not extend beyond the mediæval period) afford only an incomplete representation of the intellectual development of each country. Those literatures even which are most truly national, as having been subjected to no external influence, are only to a limited extent capable of teaching us what the nation was. They were, in short, created in the interests of the illiterate part of the people, and to a considerable degree by those who were themselves illiterate. But that does not make them less interesting.

Origin.—It was in the 11th century, and at several places in the extensive territory whose limits have been described in the foregoing account of the Provençal language, that Provençal literature first made its appearance. It took poetic form; and its oldest monuments show a relative perfection and a variety from which it may be concluded that poetry had already received a considerable development. The oldest poetic text, if the date and origin be correctly determined, is said to be a Provençal refrain attached to a Latin poem recently published (*Zeitschrift für deutsche Philologie*, 1881, p. 335) from a Vatican MS., written, it is asserted, in the 10th century. But it is useless to linger over these few words, the text of which seems corrupt, or at least has not yet been satisfactorily interpreted. The honor of being the oldest literary monument of the Provençal language must be assigned to a fragment of two hundred and fifty-seven decasyllabic verses preserved in an Orleans MS. and frequently edited and annotated since it was first printed by Raynouard in 1817 in his *Choix des poésies originales des*

Troubadours. The writing of the MS. is of the first half of the 11th century. The peculiarities of the language point to the north of the Provençal region, probably Limousin or Marche. It is the beginning of a poem in which the unknown author, taking Boetius's treatise *De Consolatione Philosophiæ* as the groundwork of his composition, adopts and develops its ideas and gives them a Christian cast of which there is no trace in the original. Thus from some verses in which Boetius contrasts his happy youth with his afflicted old age he draws a lengthy homily on the necessity of laying up from early years a treasure of good works. The poem is consequently a didactic piece composed by a "clerk" knowing Latin. He doubtless preferred the poetic form to prose because his illiterate contemporaries were accustomed to poetry in the vulgar tongue, and because this form was better adapted to recitation; and thus his work, while a product of erudition in as far as it was an adaptation of a Latin treatise, shows that at the time when it was composed a vernacular poetry was in existence. A little later, at the close of the same century, we have the poems of William IX., count of Poitiers, duke of Guienne. They consist of eleven very diverse strophic pieces, and were consequently meant to be sung. Several are love songs; one relates a *bonne fortune* in very gross terms; and the most important of all—the only one which can be approximately dated, being composed at the time when William was setting out for Spain to fight the Saracens—expresses in touching and often noble words the writer's regret for the frivolity of his past life and the apprehensions which oppressed him as he bade farewell, perhaps for ever, to his country and his young son. We also know from Ordericus Vitalis that William IX. had composed various poems on the incidents of his ill-fated expedition to the Holy Land in 1101. And it must further be mentioned that in one of his pieces (*Ben voil que sapchon li plusor*) he makes a very clear allusion to a kind of poetry which we know only by specimens of later date, the *partimen*, or, as it is called in France, the *jeu parti*. William IX. was born in 1071 and died in 1127. There is no doubt that the most prolific period of his literary activity was his youth. On the other hand there is no reason to believe that he created the type of poetry of which he is to us the oldest representative. It is easy to understand how his high social rank saved some of his productions from oblivion whilst the poems of his predecessors and contemporaries disappeared with the generations who heard and sang them; and in the contrast in form and subject between the Boetius poem and the stanzas of William IX. we find evidence that by the 11th century Provençal poetry was being rapidly developed in various directions. Whence came this poetry? How and by whose work was it formed? That it has no connexion whatever with Latin poetry is generally admitted. There is absolutely nothing in common either in form or ideas between the last productions of classical Latinity, as they appear in Sidonius Apollinaris or Fortunatus, and the first poetic compositions in Romanic. The view which seems to meet with general acceptance, though it has not been distinctly formulated by any one, is that Romanic poetry sprang out of a popular poetry quietly holding its place from the Roman times, no specimen of which has survived,—just as the Romanic languages are only continuations with local modifications of vulgar Latin. There are both truth and error in this opinion. The question is really a very complex one. First as to the form: Romanic versification, as it appears in the Boetius poem and the verses of William IX., and a little farther north in the poem of the *Passion* and the *Life of St. Leger* (10th or 11th century), has with all its variety some general and permanent characteristics; it is rhymed, and it is composed of a definite number of syllables certain of which have the syllabic accent. This form has evident affinity with the rhythmic Latin versification, of which specimens exist from the close of the Roman empire in ecclesiastical poetry. The exact type of Romanic verse is not found, however, in this ecclesiastical Latin poetry; the latter was not popular, and it may be assumed that that there was a popular variety of rhythmic poetry from which Romanic verse is derived.

Again, as regards the substance, the poetic material, we find nothing in the earliest Provençal which is strictly popular. The extremely personal compositions of William IX. have nothing in common with folklore. They are subjective poetry addressed to a very limited and probably rather aristocratic audience. The same may be said of the Boetius poem, though it belongs to the quite different species of edifying literature; at any rate it is not popular poetry. Vernacular compositions seem to have been at first produced for the amusement, or in the case of religious poetry for the edification, of that part of lay society which had leisure and lands, and reckoned intellectual pastime among the good things of life. Gradually this class, intelligent, but with no Latin education, enlarged the circle of its ideas. In the 12th century and still more in the 13th, historical works and popular treatises on contemporary science were composed for its use in the only language it understood; and vernacular literature continued gradually to develop partly on original lines and partly by borrowing from the literature of the "clerks." But in the 11th century vernacular poetry was still rather limited, and has hardly any higher object than the amusement and edification of the upper classes. An aristocratic poetry like the oldest Provençal cannot be the production of shepherds and husbandmen; and there is no probability that it was invented or even very notably improved by William IX.

From what class of persons then did it proceed? Latin chroniclers of the Middle Ages mention as *joculares*, *joculatores*, men of a class not very highly esteemed whose profession consisted in amusing their audience either by what we still call jugglers' tricks, by exhibiting performing animals, or by recitation and song. They are called *joglars* in Provençal, *jouglers* or *jougleors* in French. A certain Barnaldus, styled *joglarius*, appears as witness in 1058 to a charter of the chartulary of Saint Victor at Marseilles. In 1106 the act of foundation of a *salva terra* in Rouergue specifies that neither knight nor man-at-arms nor *joculator* is to reside in the village about to be created. These individuals—successors of the *mimi* and the *thymelici* of antiquity, who were professional amusers of the public—were the first authors of poetry in the vernacular both in the south and in the north of France. To the upper classes who welcomed them to their castles they supplied that sort of entertainment now sought at the theatre or in books of light literature. There were certain of them who, leaving buffoonery to the ruder and less intelligent members of the profession, devoted themselves to the composition of pieces intended for singing and consequently in verse. In the north, where manners were not so refined and where the taste for warlike adventure prevailed, the jongleurs produced *chansons de geste* full of tales of battle and combat. In the courts of the southern nobles, where wealth was more abundant and a life of ease and pleasure was consequently indulged in, they produced love songs. There is probably a large amount of truth in the remark made by Dante in chapter xxv. of his *Vita Nuova*, that the first to compose in the vulgar tongue did so because he wished to be understood by a lady who would have found it difficult to follow Latin verses.[1] And in fact there are love songs among the pieces by William of Poitiers; and the same type preponderates among the compositions of the troubadours who came immediately after him. But it is worthy of note that in all this vast body of love poetry there is no epithalamium nor any address to a marriageable lady. The social conditions of the south of France in the feudal period explain in great measure the powerful development of this kind of poetry, and also its peculiar characteristics—the profound respect, the extreme deference of the poet towards the lady whom he addresses. Rich heiresses were married young, often when hardly out of their girlhood, and most frequently without their fancy being consulted. But they seem after marriage to have enjoyed great liberty. Eager for pleasure and greedy of praise, the fair ladies of the castle became the natural patronesses of the *mesnie* or household of men-at-arms and jongleurs whom their husbands maintained in their castles. Songs of love addressed to them soon became an accepted and almost conventional form of literature; and, as in social position the authors were generally far below those to whom they directed their amorous plaints, this kind of poetry was always distinguished by great reserve and an essentially respectful style. From the beginning the sentiments, real or assumed, of the poets are expressed in such a refined and guarded style that some historians, overestimating the virtue of the ladies of that time, have been misled to the belief that the love of the troubadour for the mistress of his thoughts was generally platonic and conventional.

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[1] "E lo primo che comenciò a dire sicome poeta volgare si mosse peròche volle fare intendere le sue parole a donna alla quale era malagevole ad intendere i versi latini."

The conditions under which Romanic poetry arose in the south of France being thus determined as accurately as the scarcity of documents allows, we now proceed to give a survey of the various forms of Provençal literature, chronological order being followed in each instance. By this arrangement the wealth of each form will be better displayed; and, as it is rare in the south of France for the same person to distinguish himself in more than one of them, there will be generally no occasion to introduce the same author in different sections.

Poetry of the Troubadours.—Though he was certainly not the creator of the lyric poetry of southern France, William, count of Poitiers, by personally cultivating it gave it a position of honor, and indirectly contributed in a very powerful degree to insure its development and preservation. Shortly after him centres of poetic activity make their appearance in various places—first in Limousin and Gascony. In the former province lived a viscount of Ventadour, Eble, who during the second part of William of Poitiers's life seems to have been brought into relation with him, and according to a contemporary historian, Geffrei, prior of Vigeois, *erat valde gratiosus in cantilenis*. We possess none of his compositions; but under his influence Bernart of Ventadour was trained to poetry, who, though only the son of one of the serving-men of the castle, managed to gain the love of the lady of Ventadour, and, when on the discovery of their amour he had to depart elsewhere, received a gracious welcome from Eleanor of Guienne, consort (from 1152) of Henry II. of England. Of Bernart's compositions we possess about fifty songs of elegant simplicity, some of which may be taken as the most perfect specimens of love poetry Provençal literature has ever produced. Bernart must therefore have been in repute before the middle of the 12th century; and his poetic career extended well on towards its close. At the same period, or probably a little earlier, flourished Cercamon, a poet certainly inferior to Bernart, to judge by the few pieces he has left us, but nevertheless of genuine importance among the troubadours both because of his early date and because definite information regarding him has been preserved. He was a Gascon, and composed, says his old biographer, "pastorals" according to the ancient custom (*pastorelas a la uzanza antiga*). This is the record of the appearance in the south of France of a poetic form which ultimately acquired large development. The period at which Cercamon lived is determined by a piece where he alludes very clearly to the approaching marriage of the king of France, Louis VII., with Eleanor of Guienne (1137). Among the earliest troubadours may also be reckoned Marcabrun, a pupil of Cercamon's, from whose pen we have about forty pieces, those with dates ranging from 1135 to 1148 or thereabout. This poet has great originality of thought and style. His songs, several of which are historical, are free from the commonplaces of their class, and contain curious strictures on the corruptions of the time.

We cannot here do more than enumerate the leading troubadours and briefly indicate in what conditions their poetry was developed and through what circumstances it fell into decay and finally disappeared: Peter of Auvergne (Peire d'Alvernha), who in certain respects must be classed with Marcabrun; Arnaut Daniel, remarkable for his complicated versification, the inventor of the *sestina*, a poetic form for which Dante and Petrarch express an admiration difficult for us to understand; Arnolt of Mareuil (Arnaut de Maroill), who while less famous than Arnaut Daniel, certainly surpasses him in elegant simplicity of form and delicacy of sentiment; Bertran de Born, now the most generally known of all the troubadours on account of the part he played both by his sword and his *sirventescs* in the struggle between Henry II. of England and his rebel sons; Peire Vidal of Toulouse, a poet of varied inspiration, who grew rich with gifts bestowed on him by the greatest nobles of his time; Guiraut de Borneil, *lo maestre dels trobadors*, and at any rate master in the art of the so-called "close" style (*trobor clus*), though he has also left us poems of charming simplicity; Gaucelm Faidit, from whom we have a touching lament (*planh*) on the death of Richard Cœur de Lion; Folquet of Marseilles, the most powerful thinker among the poets of the south, who from being a troubadour became first a monk, then an abbot, and finally bishop of Toulouse.

It is not without interest to discover from what class of society the troubadours came. Many of them, there is no doubt, had a very humble origin. Bernart of Ventadour's father was a servant, Peire Vidal's a maker of furred garments, Perdigon's a fisher. Others belonged to the bourgeoise: Peire d'Alvernha, for example, Peire Raimon of Toulouse, Elias Fonsalada. More rarely we see traders' sons becoming troubadours; this was the case with Folquet of Marseilles and Aimeric de Pegulhan. A great many were clerics, or at least studied for the church,—for instance, Arnaut of Mareuil, Hugh of Saint Circq (Uc de Saint Circ), Aimeric de Belenoi, Hugh Brunet, Peire Cardinal; some had even taken orders—the monk of Montaudon, the monk Gaubert of Puicibot. Ecclesiastical authority did not always tolerate this breach of discipline. Gui d'Uissel, canon and troubadour, was obliged by the injunction of the pontifical legate to give up his song-making. One point is particularly striking—the number of nobles (usually poor knights whose incomes were insufficient to support their rank) who became troubadours, or even, by a greater descent, jongleurs—Raimon de Miraval, Pons de Capdoill, Guillem Azemar, Cadenet, Peirol, Raimbaut de Vacqueiras, and many more. There is no doubt they betook themselves to poetry not merely for their own pleasure, but for the sake of the gifts to be obtained from the nobles whose courts they frequented. A very different position was occupied by such important persons as William of Poitiers, Raimbaut of Orange, the viscount of Saint Antonin, William of Berga, and Blacatz, who made poetry for their own amusement, but contributed not a little, by thus becoming troubadours, to raise the profession.

The profession itself was entirely dependent on the existence and prosperity of the feudal courts. The troubadours could hardly expect to obtain a livelihood from any other quarter than the generosity of the great. It will consequently be well to mention the more important at least of those princes who are known to have been patrons and some of them practicers of the poetic art. They are arranged approximately in geographical order, and after each are inserted the names of those troubadours with whom they were connected.

France.—Eleanor of Guienne, Bernart of Ventadour (Ventadorn); Henry Curtmantle, son of Henry II. of England, Bertran de Born; Richard Cœur de Lion, Arnaut Daniel, Peire Vidal, Folquet of Marseilles, Gaucelm Faidit; Ermengarde of Narbonne (1143–1192), Bernart of Ventadour, Peire Rogier, Peire d'Alvernha; Raimon V., count of Toulouse (1143–1194), Bernart of Ventadour, Peire Rogier, Peire Raimon, Hugh Brunet, Piere Vidal, Folquet of Marseilles, Bernart of Durfort; Raimon VI., count of Toulouse (1194–1222), Raimon de Miraval, Aimeric de Pegulham, Aimeric de Belenoi, Ademar lo Negre; Alphonse II., count of Provence (1185–1209), Elias de Barjols; Raimon Berenger IV., count of Provence (1209–1245), Sordel; Barrel, viscount of Marseilles (died c. 1192), Peire Vidal, Folquet of Marseilles; William VIII., lord of Montpellier (1172–1204), Piere Raimon, Arnaut de Mareuil, Folquet of Marseilles, Guiraut de Calanson, Aimeric de Sarlat; Robert, dauphin of Auvergne (1169–1234), Peirol, Perdigon, Pierre de Maensac, Gaucelm Faidit; Guillaume du Baus, prince of Orange (1182–1218), Raimbaut de Vacqueiras, Perdigon; Savaric de Mauléon (1200–1230), Gaucelm de Puicibot, Hugh of Saint Circq; Blacatz, a Provençal noble (1200?–1236), Cadenet, Jean d'Aubusson, Sordel, Guillem Figueira; Henry I., count of Rodez (1208-1222?), Hugh of Saint Circq; perhaps Hugh IV., count of Rodez (1222?–1274), and Henry II., count of Rodez (1274–1302), Guiraut Riquier, Folquet de Lunel, Serveri de Girone, Bertran Cartonel; Nunyo Sanchez, count of Roussillon (died in 1241), Aimeric de Belenoi; Bernard IV., count of Astarac (1249–1291), Guiraut Riquier, Amanieu de Sescas.

Spain.—Alphonse II., king of Aragon (1162–1196), Peire Rogier, Peire Raimon, Peire Vidal, Cadenet, Guiraut de Cabreira, Elias de Barjoles, the monk of Montaudon, Hugh Brunet; Peter II., king of Aragon (1196–1213), Raimon de Miraval, Aimeric de Pegulhan, Perdigon, Ademar lo Negre, Hugh of Saint Circq; James I., king of Aragon (1213–1276), Piere Cardinal, Bernart Sicart de Maruejols, Guiraut Riquier, At de Mons; Peter III., king of Aragon (1276–1285), Paulet of Marseilles, Guiraut Riquier, Serveri de Girone; Alphonso IX., king of Leon (1138–1214), Peire Rogier, Guiraut de Borneil, Aimeric de Pegulhan, Hugh of Saint Circq; Alphonso X., king of Castile (1252–1284), Bertran de Lamanon, Bonifaci Calvo, Guiraut Riquier, Folquet de Lunel, Arnaut Plages, Bertran Carbonel.

Italy.—Boniface, Marquis of Montferrat (1192–1207), Peirre Vidal, Raimbaut de Vacqueiras, Elias Cairel, Gaucelm Faidit (?); Frederick II. emperor (1215–1250), Jean d'Aubusson, Aimeric de Pegulhan, Guillem Figueira; Azzo VI., marquis of Este (1196–1212), Aimeric de Pegulhan, Rambertin de Buvalel; Azzo VIII., marquis of Este (1215–1264) Aimeric de Pegulhan.

The first thing that strikes one in this list is that, while the troubadours find protectors in Spain and Italy, they do not seem to have been welcomed in French speaking countries. This, however, must not be taken too absolutely. Provençal poetry was appreciated in the north of France. There is reason to believe that when Constance, daughter of one of the counts of Arles, was married in 998 to Robert, king of France, she brought along with her Provençal jongleurs. Poems by troubadours are quoted in the French romances of the beginning of the 13th century; some of them are transcribed in the old collections of French songs, and the preacher Robert de Sorbon informs us in a curious passage that one day a jongleur sang a poem by Folquet of Marseilles at the court of the king of France. But in any case it is easy to understand that, the countries of the *langue d'oui* having a full developed literature of their own suited to the taste of the people, the troubadours generally preferred to go to regions where they had less to fear in the way of competition.

The decline and fall of troubadour poetry was mainly due to political causes. When about the beginning of the 13th century the Albigensian war had ruined a large number of the nobles and reduced to lasting poverty a part of the south of France, the profession of troubadour ceased to be lucrative. It was then that many of those poets went to spend their last days in the north of Spain and Italy, where Provençal poetry had for more than one generation been highly esteemed. Following their example, other poets who were not natives of the south of France began to compose in Provençal, and this fashion continued till, about the middle of the 13th century, they gradually abandoned the foreign tongue in northern Italy, and somewhat later in Catalonia, and took to singing the same airs in the local dialects. About the same time in the Provençal region the flame of poetry had died out save in a few places—Narbonne, Rodez, Foix, and Astarac—where it kept burning feebly for a little longer. In the 14th century composition in the language of the country was still practiced; but the productions of this period are mainly works for instruction and edification, translations from Latin or sometimes even from French, with an occasional romance. As for the poetry of the troubadours, it was dead forever.

Form.—Originally the poems of the troubadours were intended to be sung. The poet usually composed the music as well as the words; and in several cases he owed his fame more to his musical than to his literary ability. Two manuscripts preserve specimens of the music of the troubadours; but, as the subject has not as yet been investigated, we are still ignorant of one of the elements of their success. The following are the principal poetic forms which they employed. The oldest and most usual generic term is *vers*, by which is understood any composition intended to be sung, no matter what the subject. At the close of the 12th century it became customary to call all verse treating of love *canso*—the name *vers* being then more generally reserved for poems on other themes. The *sirventesc* differs from the *vers* and the *canso* only by its subject being for the most part devoted to moral and political topics. Peire Cardinal is celebrated for the *sirventescs* he composed against the clergy of his time. The political poems of Bertran de Born are *sirventescs*. There is reason to believe that originally this word meant simply a poem composed by a *sirvent* (Lat. *serviens*) or man-at-arms. The *sirventesc* is very frequently composed in the form, sometimes even with the rhymes, of a popular song, so that it might be sung to the same air. The *tenson* is a debate between two interlocutors, each of whom has a stanza in turn. The *partimen* (Fr. *jeu parti*) is also a poetic debate, but it differs from the tenson in so far that the range of debate is limited. In the first stanza one of the partners proposes two alternatives; the other partner chooses one of them and defends it, and the opposite side remains to be defended by the original propounder. Often in a final couplet a judge or arbiter is appointed to decide between the parties. This poetic game is mentioned by William, count of Poitiers, at the end of the 11th century. The *pastoreta*, afterwards *pastorela*, is in general an account of the love adventures of a knight with a shepherdess. All these classes have one form capable of endless variations, five or more stanzas and one or two envois. The *dansa* and *balada*, intended to mark the time in dancing, are pieces with a refrain. The *alba*, which has also a refrain, is, as the name indicates, a waking or morning song at the dawning of the day. All those classes are in stanzas. The *descort* is not thus divided, and consequently it must be set to music right through. Its name is derived from the fact that, its component parts not being equal, there is a kind of "discord" between them. It is generally reserved for themes of love. Other kinds of lyric poems, sometimes with nothing new about them except the name, were developed in the south of France; but those here mentioned are the more important.

Narrative Poetry.—Although the strictly lyric poetry of the troubadours forms the most original part of Provençal literature, it must not be supposed that the remainder is of trifling importance. Narrative poetry, especially, received in the south of France a great development, and, thanks to recent discoveries, a considerable body of it has already become known. Several classes must be distinguished: the *chanson de geste* legendary or historic, the romance of adventure, and the novel. Northern France remains emphatically the native country of the *chanson de geste*; but, although in the south different social conditions, a more delicate taste, and a higher state of civilization prevented a similar profusion of tales of war and heroic deeds, Provençal literature has some highly important specimens of this class. The first place belongs to *Girart de Roussillon*, a poem of ten thousand verses, which relates the struggles of Charles Martel with his powerful vassal the Burgundian Gerard of Roussillon. It is a literary production of rare excellence and of exceptional interest for the history of civilization in the 11th and 12th centuries.

Gerard of Roussillon belongs only within certain limits to the literature of southern France. The recension which we possess appears to have been made on the borders of Limousin and Poitou; but it is clearly no more than a recast of an older poem no longer extant, probably either of French or at least Burgundian origin. To Limousin also seems to belong the poem of *Aigar* and *Maurin* (12th century), of which we have unfortunately only a fragment so short that the subject cannot be clearly made out. Of less heroic character is the poem of *Daurel and Beton* (end of the 12th or beginning of the 13th century), connected with the cycle of Charlemagne, but by the romantic character of the events more like a regular romance of adventure. We cannot, however, form a complete judgment in regard to it, as the only MS. in which it has been preserved is defective at the close, and that to an amount there is no means of ascertaining. Midway between legend and history may be classified the Provençal *Chanson of Antioch*, a fragment of which, 700 verses in extent, has been recently recovered in Madrid and published in *Archives de l'Orient Latin*, vol. ii. To history proper belongs the chanson of the crusade against the Albigensians, which, in its present state, is composed of two poems one tacked to the other: the first, containing the events from the beginning of the crusade till 1213, is the work of a certain William of Tudela, a moderate supporter of the crusaders; the second, from 1213 to 1218, is by a vehement opponent of the enterprise. The language and style of the two parts are no less different than the opinions. Finally, about 1280 a native of Toulouse named Guillaume Anelier composed, in the chanson de geste form, a poem on the war carried on in Navarre by the French in 1276 and 1277. It is an historical work of little literary merit. All these poems are, as chansons de geste ought to be, in stanzas of indefinite length, with a single rhyme. *Gerard of Roussillon*, *Aigar and Maurin*, and *Daurel and Beton* are in verses of ten, the others in verses of twelve syllables. The peculiarity of the versification in *Gerard* is that the pause in the line occurs after the sixth syllable, and not, as is usual, after the fourth. Like the chanson de geste, the romance of adventure is but slightly represented in the south; but it is to be borne in mind that many works of this class must have perished, as is rendered evident by the mere fact that, with few exceptions, the narrative poems which have come down to us are each known by a single manuscript only. We possess but three Provençal romances of adventure: *Jaufré* (composed in the middle of the 13th century, and dedicated to a king of Aragon, possibly James I.), *Blandin of Cornwall*, and *Guillem de la Barra*. The first two are connected with the Arthurian cycle: *Jaufré* is an elegant and ingenious work; *Blandin of Cornwall* the dullest and most insipid one can well imagine. The romance of *Guillem de la Barra* tells an unlikely story also found in Boccaccio's *Decameron* (2d Day, viii). It is rather a poor poem; but as a contribution to literary history it has the advantage of being dated. It was completed in 1318, and is dedicated to a noble of Languedoc called Sicart de Montaut. Connected with the romance of adventure is the novel (in Provençal *novas*, always in the plural,) which is originally an account of an event "newly" happened. The novel must have been at first in the south what, as we see by the *Decameron*, it was in Italy, a society pastime,—the wits in turn relating anecdotes, true or imaginary, which they think likely to amuse their auditors. But before long this kind of production was treated in verse, the form adopted being that of the romances of adventure—octosyllabic verses rhyming in pairs. Some of those novels which have come down to us may be ranked with the most graceful works in Provençal literature; two are from the pen of the Catalan author Raimon Vidal de Besalù. One, the *Castia-gilos* (the Chastisement of the Jealous Man), is a treatment, not easily matched for elegance, of a frequently handled theme—the story of the husband who, in order to entrap his wife, takes the disguise of a lover whom she is expecting and receives with satisfaction blows intended, as he thinks, for him whose part he is playing; the other, *The Judgment of Love*, is the recital of a question of the law of love, departing considerably from the subjects usually treated in the novels. Mention may also be made of the novel of *The Parrot* by Arnaut de Carcassonne, in which the principal character is a parrot of great eloquence and ability, who succeeds marvellously in securing the success of the amorous enterprises of his master. Novels came to be extended to the proportions of a long romance. *Flamenca*, which belongs to the novel type, has still over eight thousand verses, though the only MS. of it has lost some leaves both at the beginning and at the end. This poem, composed in all probability in 1234, is the story of a lady who by very ingenious devices, not unlike those employed in the *Miles Gloriosus* of Plautus, succeeds in eluding the vigilance of her jealous husband. No analysis can be given here of a work the action of which is so highly complicated; suffice it to remark that there is no book in mediæval literature which betokens so much quickness of intellect and is so instructive in regard to the manners and usages of polite society in the 13th century. We know that novels were in great favor in the south of France, although the specimens preserved are not very numerous. Statements made by Francesco de Barberino (early part of 14th century), and recently brought to light, give us a glimpse of several works of this class which have been lost. From the south of France the novel spread into Catalonia, where we find in the 14th century a number of novels in verse very similar to the Provençal ones, and into Italy, where in general the prose form has been adopted.

Didactic and Religious Poetry.—Compositions intended for instruction, correction, and edification were very numerous in the south of France as well as elsewhere, and, in spite of the enormous losses sustained by the Provençal literature, much of this kind still remains. But it is seldom that such works have much originality or literary value. Originality was naturally absent, as the aim of the writers was mainly to bring the teaching contained in Latin works within the reach of lay hearers or readers. Literary value was not of course excluded by the lack of originality, but by an unfortunate chance the greater part of those who sought to instruct or edify, and attempted to substitute moral works for secular production in favor with the people, were persons of limited ability. It is needless to enumerate all the lives of saints, all the treatises of popular theology and morals, all the books of devotion, all the pious canticles, composed in Provençal during the Middle Ages. Enough to recall the Boetius poem (unfortunately a mere fragment) already mentioned as one of the oldest documents of the language and really a remarkable work. From the multitude of saints' lives we may single out that of St. Honorat of Lerins by Raimon Feraud (about 1300), which is distinguished by variety and elegance of versification, but is almost entirely a translation from Latin. Among poems strictly didactic one stands out by reason of its great extent (nearly thirty-five thousand verses) and the somewhat original conception of its scheme— the *Breviari d'amor*, a vast encyclopædia, on a theological basis, composed by the Minorite friar Matfre Ermengaut of Béziers between 1288 and 1300 or thereabout.

Drama.—Twenty years ago it might have been questioned whether dramatic representation was known in the south of France, but within that time several short dramatic pieces have been published or described; and a considerable number of actual theatrical representations have been found mentioned in the local records. Everything of this kind that we know of belongs to the religious drama, the oldest form in every mediæval literature. The period at which a purely secular theatre takes its rise in most quarters is the 15th century; and by that time there was hardly any Provençal literature left. We possess in Provençal mysteries of Saint Agnes, of the Passion, of the Marriage of the Virgin, all belonging to the close of the 13th century or of the first half of the 14th. In the 15th century there is a fragment of a mystery of St. James. Provence properly so-called, especially the eastern portion of it, seems to have been particularly fond of representations of this sort, to judge by the entries in the local records. At the close of the 15th and the beginning of the 16th century many mysteries were played in the part of Dauphiné which corresponds to the present department of Hautes-Alpes. Five mysteries of this district, composed and played somewhere about 1500 (the mysteries of St. Eustace, of St. Andrew, of St. Pons, of Sts. Peter and Paul, and of St. Anthony of Vienne), have come down to us, and are now (1885) being edited. The influence of the contemporary French sacred drama may to some extent be traced in them.

Prose.—Prose composition in the south of France belongs to a comparatively late stage of literary development; and the same remark applies to the other Romanic countries, particularly to northern France, where prose hardly comes into fashion till the 13th century, the prose of the preceding century being little else than translations of the books of the Bible (especially the Psalter).

As early as the 12th century we find in the south sermons, whose importance is more linguistic than literary. To the 13th century belong certain lives of the troubadours intended to be prefixed to, and to explain, their poems. They were written before 1250, when the first anthologies of troubadour poetry were compiled; and some of them are the work of the troubadour Hugh of St. Circq. To the same period must be assigned *Las Rasos de trobar* of the troubadour Raimon Vidal de Besalù (an elegant little treatise touching on various points of grammar and the poetic art), and also the *Donats Proensals* of Hugh Faidit, a writer otherwise unknown, who drew up his purely grammatical work at the request of two natives of northern Italy. Of about the same date are two translations of the New Testament, one of which, preserved in MS. at Lyons, seems to have been made for Albigensians. A remarkable work, both in style and thought, is the *Life of St. Douceline*, who lived at the close of the 13th century near Marseilles, and founded an order of Beguines. In the 14th century compositions in prose grew more numerous. Some rare local chronicles may be mentioned, the most interesting being that of Mascaro, which contains the annals of the town of Béziers from 1338 to 1390. Theological treatises and pious legends translated from Latin and French also increase in number. The leading prose work of this period is the treatise on grammar, poetry, and rhetoric known by the name of *Leys d' Amors*. It was composed in Toulouse, shortly before 1350, by a group of scholars, and was intended to fix the rules of the language with a view to the promotion of a poetical renaissance. For this purpose an academy was founded which awarded prizes in the shape of flowers to the best compositions in verse. We still possess the collection of the pieces crowned by this academy during the 14th century, and a large part of the 15th (*Flors del gay saber*). Unfortunately they are rather academic than poetic. The *Leys d' Amors*, which was to be the starting point and rule of the new poetry is the best production of this abortive renaissance. The decay of Provençal literature arrived too soon to allow of a full development of prose. The 14th and 15th centuries were in no respect a prosperous period for literature in the south of France. In the 15th century people began to write French both in verse and prose; and from that time Provençal literature became a thing of the past.

Bibliography.—Fauriel, *Histoire de la poésie provençale* (Paris, 1846, 3 vols. 8vo), is quite antiquated. Not only are three-fourths of the works in Provençal poetry ignored, but the very idea of the book is vitiated by the author's system (now abandoned), based on the supposition that in the south of France there was an immense epic literature. The articles on the troubadours in the *Histoire littéraire de la France*, by Ginguené, E. David, etc., must be consulted with extreme caution. F. Diez's *Die poesie der Troubadours* (Zwickau, 1827, 8vo.; new ed. by Bartsch, 1883) and his *Leben und Werke der Troubadours* (Zwickau, 1829, 8vo; new ed. by Bartsch, 1882) are of great excellence for the time at which they appeared. For the history of Provençal literature in Spain, see Milay Fontanals, *De los trovadores en España* (Barcelona, 1861, 8vo); for Italy, Cavedoni, *Ricerche storiche intorno ai trovatori provenzali* (Modena, 1844, 8vo); A. Thomas, *Francesco Barberino et la littérature provençale en Italie* (Paris, 1888, 8vo); O. Schultz, "Die Lebensverhältnisse der italienischen Trobadors," in *Zeits. für romanische Philologie* (1883). For the bibliography consult especially Bartsch, *Grundriss zur Geschichte der provenzalischen Literatur* (Elberfeld, 1872, 8vo). For texts the reader may be referred to Raynouard, *Choix de poésies originales des Troubadours* (1816–21, 6 vols. 8vo), and *Lexique roman, ou dict. de la langue des troubadours*, of which vol. i. (1838) is entirely taken up with texts; and Rochegude, *Parnasse occitanien* (Toulouse, 1819, 8vo). All the pieces published by Raynouard and Rochegude have been reprinted without amendment by Mahn. *Die Werke der Troubadours in provenz. Sprache* (Berlin, 8vo, vol. i. 1846, ii. 1855–64, iii. 1880, iv., containing an edition of the troubadour Guiraut Riquier, 1884). The same editor's *Gedichte der Troubadours* (Berlin, 1856–73) is a collection conspicuous for its want of order and of accuracy (see *Romania*, iii. 303). Among editions of individual troubadours may be mentioned—*Peire Vidal's Lieder*, by Karl Bartsch (Berlin, 1857, 12 mo); *Les derniers troubadours de la Provence*, by Paul Meyer (Paris, 1871, 8vo); *Der Troubadour Jaufre Rudel, sein Leben und seine Werke*, by A. Stimming (Kiel, 1873, 8vo); *Bertran de Born, sein Leben und seine Werke*, by A. Stimming (Halle, 1879, 8vo); *Guilhem Figueira, ein provenzalischer Troubadour*, by E. Levy, (Berlin, 1880, 8vo); *Das Leben und die Lieder des Troubadours Peire Rogier*, by Carl Appel (Berlin, 1882, 8vo); *La vita e le opere del trovatore Arnaldo Daniello*, by U. A. Canello (Halle, 1883, 8vo). Among editions of Provençal works of a miscellaneous kind are—Bartsch, *Denkmäler der provenzalischen Literatur* (Stuttgart, 1856, 8vo); H. Suchier, *Denkmäler der provenz. Literatur und Sprache* (Halle, 1883–85, 2 vols. 8vo); Fr. Armitage, *Sermons du XII siècle en vieux provençal* (Heilbronn, 1884, 12 mo); Paul Meyer, *La Chanson de la Croisade contre les Albigeois*, (Paris, 1875–79, 2 vols. 8vo); Id., *Dauriel et Beton, Chanson de geste provençale* (Paris, 1880, 8vo); Id., *Le Roman de Flamenca* (Paris, 1865, 8vo); E. Stengel, *Die beiden ältesten provenzal. Grammatiken, lo Donatz proensals und las Razos de trobar* (Marburg, 1878, 8vo); Bartsch, *Sancta Agnes, provenz. geistliches Schauspiel* (Berlin, 1867, 8vo); *Le Breviari d'amor de Matfre Ermengaud*, published by the Archæological Society of Béziers (Béziers, 1862–80, 2 vols. 8vo); A. L. Sardou, *La Vida de Sant Honorat, légendeen envers provençaux par Raymond Feraud* (Nice [1875], 8vo.) Documents and dissertations on various points of Provençal literature will be found in almost all the volumes of *Romania* (Paris, in progress since 1872, 8vo), and the *Revue des Langues romanes* (Montpellier, in progress since 1870, 8vo). See also the other journals devoted in Germany and Italy to the Romanic languages, *passim*. (P. M.)

PROVENCE (*Provincia*), a province of France lying to the extreme southeast on the shores of the Mediterranean, bounded on the W. by Languedoc, on the N. by Venaissin and Dauphiné, and on the E. by Italy. It now forms the departments of Bouches-du-Rhône, Var, and Basses-Alpes, with portions of Vaucluse and Alpes Maritimes. It was divided into Upper Provence, containing the four seneschalates of Forcalquier, Castellane, Sisteron Digne, and the Valley of Barcelonnette; and Lower Provence, containing the eight seneschalates of Aix, Arles, Brignoles, Grasse, Marseilles, Draguignan, Hyères, and Toulon. In ancient as in modern times the most important city was Marseilles (Marsillia), a chief seat of trade for the Greek merchants of the Mediterranean, who extended their power along the coast and founded Agde, Antibes, Grasse, and Nice. They afterwards called in the aid of the Romans (125 B.C.) against the Ligurian inhabitants of the surrounding country, and the new-comers soon made themselves masters of the territory which later formed the provinces of Languedoc, Dauphiné, and Provence. The new province, of which the capital was Aquæ Sextiæ (Aix), was called Provincia Gallica until the total conquest of Gaul, when the name of the district was changed to Gallia Narbonensis. In the 4th century of the Christian era, when the greater part of Languedoc, or Narbonensis Prima, had become subject to the Visigoths, and the Burgundians had spread to the Viennois, Provincia came to be applied only to the country lying between the Rhone, the Durance, and the Alps which was still held by the Romans. But they could not withstand for long the advancing tide of barbarian power. Although the Visigothic king, Theodoric I. was defeated by Aetius before Arles in 425 A. D., and their united armies in turn defeated Attila in 451, yet Theodoric II. imposed the emperor Avitus on the Romans, and Euric by the capture of Arles (480) made the Visigoths masters of Provence. Their defeat at the battle of Bouglé in 507 by Clovis and Gundibald, king of the Burgundians, placed Provence at the mercy of the latter, who ceded it in 511 to Theodoric, king of the Ostrogoths, as guardian of the Visigothic king. The powers so gained were, however, resigned by his successor Witiges in 536 to Theodebert, king of the Franks, who had previously overthrown the Burgundian kingdom. On the death of Clotaire I. (561) Provence was divided between his sons Sigebert, king of Austrasia, and Gontran, king of Burgundy, Marseilles falling to the former and Arles to the latter. When Gontran died in 593 the province was united under his nephew Childebert, only to be divided again by his sons and reunited under Clotaire II. (613), until the sons of Dagobert, Sigebert II., and Clovis II. (633) parted it between them. In 719 the Saracens crossed the Pyrenees and made themselves masters of almost all Septimania, or Languedoc, and in 739 they joined with Maurontis, a Byzantine governor of Marseilles, in his attempt to drive out the Franks. Fortunately for Europe, their forces were completely defeated by Charles Martel, who again united Provence to the Frankish kingdom. On the division of the Carlovingian empire in 843 Provence fell to Lothair, who left it with the title of king to his son Charles (855), at whose death without issue in 863 it was seized by Charles the Bald. In 879 his brother-in-law Boson, son-in-law of the emperor Louis II., and governor of Vienne, was elected king by the synod of Mantale, when his united provinces became known as Cisjuran Burgundy. His son, Louis the Blind, obtained the crown of Italy (900), but was deposed by Hugo, who, in his turn obtaining the Italian kingdom, ceded Provence in 932 to Rudolph II., king of Transjuran Burgundy. The two Burgundies thus united received the name of the Kingdom of Arles, which lasted in a phantom form until 1032, but Provence was always governed by princes whose powers gradually increased, until the county was changed from a beneficiary to an hereditary fief. The line of beneficiary counts begins with Boson I. (926), who was reinvested by Rudolph II, in 934. He was succeeded by Boson II. (948), whose son William I. (968) signalized his reign by driving out from the stronghold of Fraxinet the Moorish pirates who had seized it in 889, and thence ravaged the neighboring country. His brother Rothbold, who held the fief until 1008, was followed by his nephew William II., and, as the union of the kingdom of Arles with the German empire was by this time almost nominal, the count of Provence claimed independence, and William's sons, Geoffery-Bertrand I. and William III., divided the county in 1018 as an allodial fief. William III. died in 1053 and Geoffrey-Bertrand handed over to his nephews the northern part, or the county of Forcalquier, he himself retaining the main province to which his son Bertrand II. succeeded in 1063. At his death without issue in 1093 the county was ruled by his mother Étiennette, who was followed (1100) by her daughter Gerberge, wife of Gilbert, viscount of Milhaud and Gévaudan. Their daughter Douce was married to Raymond-Bérenger, count of Barcelona, of the house of Aragon, and Provence passed to him in 1112. But his succession was not undisputed. Raymond de S. Gilles, count of Toulouse and Venaissin, a great-grandson of Rothbold, had about 1085 laid claim to the county of Forcalquier, and his pretensions were probably partly admitted. The excitement of the crusades put a stop to further action, and in 1096, accompanied by Count Gilbert, he led the Provençal contingent, which was, however, more distinguished for foraging than fighting. On his death in 1105 his claims were revived by his son Alfonse Jourdain, who succeeded in obtaining from Raymond-Bérenger an extension of the county of Vanaissin. Raymond-Bérenger I. died in 1130 and was succeeded by his son, Bérenger-Raymond, whose rights were disputed by Raymond de Baux, husband of his mother's sister Étiennette. In the war which ensued the count was killed before Melgueil, leaving a young son, Raymond-Bérenger II. (1144), to the guardianship of his uncle, Raymond-Bérenger of Aragon. The claims of Raymond de Baux were renewed by his son Hugo, on whose defeat in 1162 the emperor Frederick I. gave his niece Richilda in marriage to the young count, and invested him with the fiefs of Provence and Forcalquier. His only daughter, Douce, had been betrothed to the count of Toulouse, who accordingly on the death of Raymond-Bérenger II. (1166) claimed the county, but was defeated by Alphonso I. of Aragon, who invested his brother, Raymond-Bérenger III, on whose death in 1181 the fief reverted to Alphonso I. to pass to his son, Alphonso II. (1196). This prince died in 1209, and was succeeded by his son Raymond-Bérenger IV., who, seeing that the great cities were nests of intrigue for rivals to the throne, set himself to destroy their independence. Through all changes of rulers the cities had kept their internal freedom and old Roman self-government. The election of the governing body had always remained in the hands of the citizens, but the office of chief magistrate, after ceasing to be filled by a nominee of the Byzantine emperor, had become vested either in certain families or in the bishops. In the 12th century measures of reform were imitated from the Italian republics, the chief characteristic of which was the election for life of a stranger as chief magistrate or podestà. The power of the podestàs was too great to be broken at once, and, though the Albigenses in Avignon capitulated in 1226, and Nice, Grasse, Toulon, and Marseilles afterwards submitted to Raymond-Bérenger IV., it was left to his son-in-law, CHARLES OF ANJOU (see vol. v. pp. 366–367) to replace the podestàs by governors of his own nomination (1246). Charles died in 1285, leaving the states of Anjou, Provence, and Naples to his son, Charles II., under whose rule peace and prosperity to some extent revived. But the efforts of his son Robert (1309) in the cause of the Guelphs called for increased taxation, and he left a troubled heritage to his granddaughter Joan of Naples (1343). To avenge the murder of his brother Andrew, the husband of Joan, at whose instigation the crime had been committed, Louis of Hungary marched into Italy (1347), and made himself master of the kingdom of Naples. Joan fled to Provence, and by timely concessions to her people secured their favor in her efforts to regain the Neapolitan crown. But money was needed; so Avignon, where the popes had resided since 1305, was sold to Pope Clement VI., and Joan won back Naples. An important part in the affair was played by the Provençal estates, which consisted of the three houses of clergy, nobility, and commons, and were supreme in all financial matters, however absolute the counts might be in other branches of government. This power of the purse was jealously guarded, and the subsidies granted to the prince were never considered as other than *dons gratuits*, the name by which they were called even after the union with France, when they became an annual tribute. Owing to the right of *répartition* to definite objects of the sums raised by taxation, the Provençaux were not on the whole badly governed, for, though the estates had only the right of petition for legislation, yet when the need arose they could very effectually speak with the voice of the whole people. The representation of the bulk of the nation in the tiers-état was particularly good, for the deputies, who were paid, were returned not only by the twenty-five country electorates, or vigueries, but from thirty-seven communes as well. The English constitution may therefore be indebted to Provence for the important step which was taken by the younger Simon de Montfort in first summoning the representatives of cities and boroughs to the parliament of 1265. The earliest recorded session of the estates was in 1146, and the meetings continued at intervals until 1639, when they ceased until 1787. The sessions not being annual, the powers of the estates in ordinary matters were delegated to a general assembly, composed of the archbishop of Aix, the procureurs joints, who were representatives of each of the estates of the clergy and the nobility, and the whole of the tiers-état. This assembly gradually superseded the estates until in 1639 it replaced them altogether. To meet sudden emergencies there was a "great council," which consisted of the archbishop and three consuls of Aix as procureurs du pays, and the procureurs joints of the three estates, under the presidency of the grand seneschal. This officer was the representative of the counts in judicial affairs, and during their absence from the country in military matters also. His powers were not only administrative, but to a great extent legislative, and they were therefore fated either to increase at the expense of the sovereign or to be cut down by a firm ruler. Joan chose the latter course, and deprived the grand seneschal of his powers over the state domains, and his right to remove judges and pardon capital crimes. And she not only reduced his power but appointed an Italian to the office, upon which the nation rose in revolt, and Louis of Anjou, seizing the opportunity to press his claims to the throne, led an army into Provence in 1368. The pretensions of Louis were met by Joan's offer to adopt him as her heir, and on her death in 1382 he succeeded to the county. The reign of Louis I. was passed in the unsuccessful pursuit of his claims to the kingdom of Naples, and his son, Louis II. (1384) and grandson, Louis III. (1417) continued the same unprofitable contest. René (1434), a brother of Louis III., was not less inclined to give up his rights, which had revived in force from his adoption by Joan II. of Naples, but, though fortune at first smiled on him, he was at last forced to resign his claim in favor of the house of Aragon. The count, or titular king, was an accomplished musician and a lover of literature and the arts; and, the latter part of his reign being on the whole peaceful, he was able to give free play to his inclinations. The artistic fame of his court has lasted to the present day, but it was the interest which he took in his subjects' material welfare, and his administration of wise laws, which caused his people to lament the death of René the Good. He died in 1480, and leaving only a daughter Margaret, the ill-fated wife of Henry VI. of England, bequeathed the county to his nephew Charles of Maine. Charles III. died in the following year, making Louis XI. of France his heir, and in 1486 Charles VIII. by letters patent reunited the county to the kingdom of France.

The union was confirmed by the estates with the full approval of the people; but the emperor was not inclined to relinquish without a struggle his claims to overlordship, and he found a willing tool in the constable, Charles of Bourbon, who entered Provence at the head of the imperialist army in 1524. His adventure met with failure, and the invasion by the emperor Charles V. himself in 1536 was equally unsuccessful. In 1501 Louis XIII., with the view of strengthening his own authority, replaced the "conseil eminent," which in the time of the counts had been the highest court of justice, by a "parlement," consisting at first of the grand seneschal, a president, and eleven nominated councillors. The functions of the court were strictly judicial, but before its abolition in 1790 it had often assumed legislative rights, and consequently played a conspicuous part in the civil wars of the 16th and 17th centuries. The principles of the Reformation made what little progress they did in Provence from external rather than internal causes, and the people themselves never took kindly to doctrines which in many ways assumed an extremely bizarre and heretical form. The 13th century had witnessed Simon de Montfort's crusade against the Albigenses of Languedoc, and the ruin which heresy had brought on that province cannot have given the prosperous Provençaux any great love for new doctrines. The Waldenses of the 16th century were therefore chiefly confined to the mountainous districts, but the persecutions ordered by the parlement brought the horrors of civil war on the whole country. The extreme Catholics formed the Holy League against the Protestants, and the two parties were equally at enmity with Henry III., who tried to please both without satisfying either. In time the royalists and Protestants united under the name of *Bigarrats*, but it was not until Henry IV. had come to the throne, and Marseilles, the last stronghold of the League, had submitted, that the worn-out country was again at peace. Richelieu tried to increase the taxation of the people without their consent, but the disorders of the Cascaveous were the result, and a similar attempt by Mazarin in 1647 led to disturbances in connection with the Fronde which lasted until 1652. In 1707, during the War of the Spanish Succession, the army of the allies under Prince Eugene invaded the province, and the horrors of war were followed by those of the plague of 1720, when 100,000 persons perished, Marseilles alone losing 50,000 out of a population of 90,000. The dispute between the Jesuits and Jansenists waxed warm about 1726, but the victory of the former only preceded their suppression by Pope Clement XIV. in 1773 in return for the cession of Avignon and the county of Venaissin, which had twice changed hands since their reunion with Provence in 1663. On the reconvocation of the estates in 1787 the two upper houses refused to bear their share of taxation, and in 1789, in the states-general of the kingdom, Mirabeau with his colleagues renounced the freedom and independence of the province. The division of Provence into departments in 1790 finally obliterated all traces of the ancient constitution, but the people still preserve in the soft tones of their *langue d'oc* an undying reminder of their former independence.

(H. B. B.)

PROVERBS, Book of. The title of the book of Proverbs is "The Proverbs of Solomon" (משלי שלמה, *mishlê shelómoh*, or more shortly *mishlê*. for which Origen gives the feminine form, *misloth*, Euseb., *H. E.*, vi. 25). The title in the LXX. is a literal rendering of the Hebrew, Παροιμίαι Σαλωμῶντος. In early times the book was frequently referred to both among Jews and Christians under the name of "Wisdom" or "The Wisdom that comprises all Virtues" (ἡ παναρετος σοφία, Clem, Rom., ch. 57). This name, however, was employed somewhat indiscriminately, for not only Proverbs but also Ecclesiastes and the apocryphal books Ecclesiasticus and Wisdom were also designated by it, and sometimes apparently the whole third division of the canon (Lightfoot, *Epp. of S. Clement*, p. 164, *sq.*).

The book of Proverbs as it now lies before us consists of a number of distinct parts.

1. We have, chap. i. 1–7 (or i. 1–6 as some think), a general heading and preface, giving the title of the book and the purposes to be served by its contents: "The Proverbs of Solomon, the son of David, king of Israel. To know wisdom and instruction . . . to give subtlety to the simple, to the young man knowledge and discretion . . . to understand a proverb and a figure, the words of the wise and their dark sayings." This is followed by the fundamental maxim of the Wisdom, "The fear of the Lord is the beginning of wisdom." The question to what parts of the book this preface extends is not easy to settle.

2. This general preface is followed by a lengthy passage, i. 8–ix. 18, which consists, not of detached proverbs, though a number of such proverbs are scattered through it, but of connected discourses in praise of wisdom and the benefits which she confers on those who embrace her. The speaker is one of the wise, or a type of them, who addresses his youthful pupil or friend as "my son," though at several points wisdom herself is introduced speaking, displaying her graces, offering herself to men, narrating her history, and magnifying the delights which they who follow her enjoy, as well as painting in dark colors the evils from which she preserves them. Attempts have been made to divide the passage into distinct sections, but without much success. Ewald counts three general divisions, Bertheau seven, Hooykaas eleven, and Delitzsch fifteen. The passage is in the main homogeneous, though containing at more places than one elements which at first sight might appear foreign (*e.g.*, vi. 1 *sq.*), and on the whole at least is the composition of a single author. Several of its characteristics, such as the style, and particularly the personification of wisdom in chap. viii. and elsewhere, one of the most remarkable and beautiful things in Hebrew literature, indicate that the passage belongs to an advanced stage of the Hebrew wisdom.

3. Then follows the largest section in the book, x. 1–xxii. 16, with a new heading, "The Proverbs of Solomon." This division consists of a number of verses—three hundred and seventy-four, it is said—each of which contains a single proverb or maxim in two lines, the only exception being xix. 7, which has three lines, but this is probably due to one member of a second verse having fallen out. The kind of poetical parallelism most common in these verses is the antithetic, of the type "A wise son maketh a glad father, but a foolish son is the heaviness of his mother" (x. 1). This type of parallelism prevails almost exclusively in x.–xv., after which other types are more commonly introduced. The proverbs in this collection are of a very miscellaneous character, and are thrown together without any classification or regard to subject, though occasionally a few verses are found to follow one another having reference to a common topic.

4. After this comes a small collection consisting of two parts which have been put together, xxii. 17–xxiv. 22 and xxiv. 23–34. The author of the first collection informs his son or disciple that what he addresses to him is "words of the wise" (xxii. 17); and the second small code is inscribed "These also are by the wise" (xxiv. 23). The proverbs in this collection sometimes make one verse, sometimes two or three, and even occasionally run out to a short proverbial discourse.

5. Then follows an important collection, xxv.–xxix., with the inscription, "These also are proverbs of

Solomon, which the men of Hezekiah, king of Judah, copied out" (xxv. 1). The expression "copied out" (LXX. *ἐξεγράψαντο*), lit. "transferred" or removed from one place to another, implies that the men of Hezekiah made use of written sources in forming their collection. The notice is of great historical interest. Hezekiah, besides being a wise and reforming king, had probably literary tastes; he has the reputation of having been a poet himself (Isa. xxxviii.); and his "men" were no doubt scholars and scribes about his court, who shared in his tastes and pursuits, and under his direction used their opportunities to rescue from oblivion the precious remains of the most ancient wisdom by transferring them from the small collections in which they lay hidden into a single and authorized code (*cf.* 2 Kings xviii. 37). It may perhaps be considered some corroboration of the genuine historical character of the inscription that the collection begins with a number of proverbs relating to kings. The maxims in this code, particularly in xxv.–xxvii., approach much nearer to what we should imagine the early popular proverb to have been than many of those in the other large collection; they are simple, usually contain a comparison, and have none of the abstractness which characterizes many of the maxims in x.–xxii. This may be regarded as a guarantee of their great antiquity.

6. Two small pieces then follow, evidently related to one another, xxx. and xxxi. 1–9,—the former with the inscription, "The words of Agur, the son of Jakeh," and the other with the heading, "The words of King Lemuel." The inscriptions to these two pieces are very obscure. In the former the A. V. can hardly be correct. More probably by a different division of words we should read "The words of Agur the son of Jakeh of Massa. The man said, I have wearied myself, O God, I have wearied myself, O God, and am consumed; for I am more brutish than any man," etc. The words are those of one who has striven to comprehend God and found the task above him (Ps. lxxiii. 22). Possibly the above rendering requires a slight correction in the text, already made in the Veneto-Greek version, which renders "Jakeh the Massaite" (Gen. xxv. 14?). Similarly the heading in xxxi. should probably read, "The words of Lemuel king of Massa, wherewith his mother instructed him." It is uncertain whether the names Agur and Lemuel be real or fictitious.

7. Finally the book is closed by an alphabetical poem, xxxi. 10–31, in praise of the virtuous (that is, the active, capable) woman.

The contents of these several sections are very various and not easy to classify. The proverbialists occupy themselves with life in all its aspects. Sometimes they simply catch the expression of men good or bad, or photograph their actions and thoughts; more generally they pass a verdict upon them and exhort or instruct men in regard to them. The proverbs differ from the shrewd or humorous sayings which are so called in profane literature; some of them have a certain flavor of humor, but they are mainly maxims touching practical life on its religious and moral side. Such maxims cannot be regarded as wholly or even in a very large degree the production of an individual mind. A number of them may well be by Solomon, and a greater number may belong to his age, but though the stream of wisdom began to flow in his day, its beginnings were then comparatively small; as the centuries advanced it gathered volume. In the book which now exists we find gathered together the most precious fruits of the wisdom in Israel during many hundred years, and undoubtedly the later centuries were richer, or at all events fuller, in their contributions than the earlier. The tradition, however, which connects Solomon with the direction of mind known as the wisdom cannot reasonably be set aside. The renown for wisdom which this king enjoyed among his own people, and even, though in a distorted and fantastic form, among the other peoples of the East, must have rested on some real foundation. No doubt reputations grow and veneration magnifies its hero sometimes in proportion to the indistinctness of its real knowledge of him; and objects seen in the broad light of day are very insignificant compared with the bulk which they assume when seen between us and the light still lingering on the horizon of a day that has gone down. But, making allowance for the exaggeration of later times, we should leave history and tradition altogether unexplained if we disallowed the claim of Solomon to have exercised a creative influence upon the wisdom in Israel. At the same time it is probable that this influence did not lie in the application of new methods, much less in the creation of a new direction of thought. The supposition that Solomon was the inventor of the proverbial distich or *mashal*, particularly of the antithetical distich, or that he was the first to use this in his sententious sayings on men and life, and thus the father of didactic poetry among the Hebrews, is a mere conjecture. The distich was employed long before his day and sententious maxims regarding life and men long preceded him. Moreover the conjecture is based on the very false assumption that the essence of the wisdom lay in the form of expression rather than in the matter, and that the curt, sharp, antithetical distich was its proper characteristic and belonged to it from the beginning. This assumption, made by Ewald, has been so usually accepted by writers after him that the polished pointed antithesis has been elevated into a criterion of the higher antiquity of those proverbs which possess it. Probably the opposite conclusion would be nearer the truth. The form of these antithetical proverbs betrays art, long use of the literary methods of the wise and an approach to technicality—things not to be expected in an early age. The early *mashal* was probably simple, containing a figure or comparison, as the name implies; some truth of the life of mankind thrown into an image from nature, without anything artificial or technical. Proverbs like "iron sharpeneth iron," or such fine similes as these —"a trampled fountain and a fouled spring is the righteous man who hath given way before the wicked," "a city that is broken down and hath no wall is the man whose spirit is without control" (xxv. 26, 28)—are the kind of proverbs which we should look for in this earliest time. Solomon has a place of renown in the wisdom, not because he imposed any mannerism upon it, but because he threw a vigorous mind into it. He probably formed no class: the word "wise" did not, from being an adjective, become a noun in his days. The nature of his wisdom is best illustrated by the story of the two women with the living and the dead child (1 Kings iii. 16–28). He possessed a keen insight into the operations of human nature; he knew the world and men and life. Most likely also he possessed the power of giving pointed expression to his shrewd and ready judgments; and, as it is said that he spoke of beasts and fishes and trees, he probably had an eye for the analogies between human life and the external world. From his character we should judge that his three thousand proverbs were not all religious; neither were his thousand and one songs all hymns, or some of them would have been preserved to us besides the two more than doubtful poems in the Psalter (Ps. lxxii., cxxvii.). The theme of the wisdom was life, and its aims were practical, and, if the rise of the wisdom be connected with the age of Solomon, that is due to the fact that life in the civil sense began in this age, and its principles could be discovered. Then the tribes were consolidated into one community, the state rose into existence, the channels of commerce were opened, men entered into various and complicated relations with one another, and the principles which rule such relations revealed themselves to the eye that was open to observe them.

It is not quite easy to form definite conceptions of those called the wise in Israel. They were certainly no hereditary caste like the priests; neither had they any distinct call to a vocation, like the prophets, although in later times at least they were so well recognized that they could be ranked with these two classes as influential in forming men's opinions and guiding their actions (Jer. xviii. 18). They were probably men who might be named elders, not always because of their age, but because of their superior sagacity; men who, having at heart the welfare of the state and particularly the moral soundness of the citizens, sought to gain the ear of the young and inculcate upon them the principles of right conduct. While the priests were the clergy and lawyers in Israel, and the prophets the statesmen, the wise were the moralists and educationists, whose operations touched the individual in all his relations and duties. Their methods were probably simple to begin with, and natural, without anything strictly characteristic; they were moral "reprovers," or ordinary "counsellors," and possibly at first their ethical maxims were general, touching life as a whole. By and by they surveyed life with a keener scrutiny and subjected it to a sharper analysis, bringing their moral principles to bear on its shades and sides and aspects, and applying these principles with greater inwardness so as to strike not merely at external conduct but at the disposition of the mind. And, finally, under the influence of the universalistic ideas of God and providence suggested to the minds of men in Israel by contact with the great empires of the world and observation of their destinies, when the Jewish state became involved in political movements as wide as the known world, the wise were enabled to gather together the manifold fragments into which they had analysed the moral life of man and the operation of the providence of God and to perceive that they were all but elements in one great divine system embracing all things, both the world of nature and the destinies of men. To this great scheme, which was but God fulfilling himself in many ways, they gave the name of wisdom in the abstract; it was the counterpart of the divine mind, God's fellow and architect in framing the world. This was the divine wisdom; human wisdom consisted both in intellectual comprehension of it and in moral harmony with it, and the first could be reached only through the second; the fear of the Lord is the beginning of wisdom. Illustrations of the wisdom in its earliest form may be seen in the collection xxv.–xxix., and in many proverbs in x.–xxii. (many examples of the period of most subtle analysis in the last-named collection), while the period of synthesis and what comes near to be a science of wisdom is represented in the passage i.–ix. Naturally along with this advance in thought there appeared a corresponding advance in the forms of expression in which the wisdom clothed itself: the wise acquired a method; a particular spirit began to animate their circles; their phraseology showed the impress of a particular mint, and ultimately assumed a form almost technical.

Perhaps some of the things which failed to attract the attention of the wise are more suggestive than those things with which they occupied themselves. Though sacrifice, for example, be once or twice alluded to, no importance is attached to the ritual system; the priest is not once mentioned, and the external exercises of worship appear to have little significance. But, what is more remarkable, the wise man differs as much from the prophet as he does from the lawgiver. All those ideas around which prophecy revolves, such as the idea of the kingdom of God, of a chosen people, of a Messiah or future king of the house of David, and the like, are entirely absent. The distinction between "Israel" and the "nations" has no place. The darling phraseology of the prophets—"Israel," "Jacob," "Zion," "my people," "the latter day"—and the whole terminology of particularism characteristic of prophecy and many even of the Psalms nowhere occurs. The conflict between the worship of Jehovah and that of false gods, with which the pages of prophetic writers are filled, does not receive even a passing reference. Conclusions have been drawn from these peculiarities which, though not unnatural, are scarcely warranted. It has been inferred that the wise were men whose way of thinking placed them outside of their dispensation and in antagonism to the circle of beliefs cherished in Israel and represented by the prophets and other public teachers—in short, that they took up a humanistic or naturalistic position. A position to which the name naturalistic could be given is inconceivable in Israel. There were no doubt men called wise who pursued false directions (Jer. xviii. 18), as there were false prophets; but there is nothing in the Proverbs to indicate any antagonism between their authors and either priest or prophet. On the contrary the passage iii. 9—a solitary one no doubt—"Honor the Lord with thy substance, and with the first fruits of all thine increase," shows their friendliness to the ritual. If they say on the other hand that the sacrifice of the wicked is an abomination to the Lord (xv. 8), and that by mercy and truth iniquity is atoned for (xvi. 6), this is nothing but what the prophets proclaim in a body, and means merely that obedience is better than sacrifice and the moral higher than the ritual. And even Sirach, a fervent supporter of priesthood and sacrifice (Ecclus. vii. 29 *sq.*), enunciates the same doctrine: "He that keepeth the law multiplieth offerings; he that taketh heed to the commandments sacrificeth a peace-offering. To depart from wickedness is a thing pleasing to the Lord, and to depart from unrighteousness is a propitiation" (Ecclus. xxxv. 1 *sq.*). And that the wise men feel themselves within the circle of the revealed religion is evident from their use of the name Jehovah, their frequent references to the "law," that is, *torah* or revelation, the "commandment," the "word," and the like; and such a sentence as this, "Where there is no vision (prophetic revelation, 1 Sam. iii. 1) the people cast off restraint" (xxix. 18), shows no unfriendliness to the prophets. The wise men had no quarrel with the institutions of Israel, nor with the public teachers and their operations; they occupied themselves more, however, with the life of the individual than the community, and sought to distil from the particularistic thought in Israel principles which, both in morals and religion, should be universal and applicable wherever men lived.

Still this very universalism is a remarkable thing, and a different attempt has been made to explain it. It has been suggested that the wisdom, though some beginnings of it may have appeared during the prophetic period and while the autonomy of Israel as a state continued, must be in the main elements of its literature a thing posterior to the downfall of the state and the cessation of prophecy. Only in this way it is thought is it possible to explain the complete absence of all those ideas regarding Israel as a people, its relation to the heathen, and its future destiny, which fill the pages of the earlier literature. That inspiration and exaltation of mind which marked the prophetic age has disappeared and reflection has taken its place. Enthusiasm for the state has died out because the state has perished, and is now represented by care for the individual. Prophecy has fulfilled its mission; it has lodged its principles in men's minds; it has seen itself fulfilled in the overthrow of the kingdom, but the hour of its triumph has been the hour of its death. Now follows the time of reflection upon the prophetic truths, when the mind has accepted principles and risen through prophetic teaching to universal conceptions of God and the world, and an effort is made to apply them to the individual life. In short the age of the wisdom is the period of the return from exile, when Israel was no more a nation but a community of people, when it had no king of its own but obeyed a foreign ruler, and when prophecy speedily became dumb, partly because its mission had been fulfilled and partly because the chief condition of its exercise, the existence of the state, was awanting. In this condition of things the

e arose and exercised their functions; they do not
ıde to prophetic conceptions because, so far as these
cerned the people in its nationality, they had in the
antime lost their meaning, and so far as they be-
ged to the general region of religious and ethical
th they had been accepted at least by the better
ıds among the people, and it is the aim of the wise
persuade every individual in the community to re-
ve them and live by them. The wise indeed are the
cessors of the prophets; they inculcate the same
ths as they did, but the subject whose ear they seek
gain is the individual and no more the state.

Such a theory, should it come to be accepted, would
ry its compensations with it. It would fill with the
eliest activity a period in the life of Israel where a
nce almost of death seems at present to reign. The
turies after Malachi are a great blank; if we could
pose them filled with the life and thought reflected
the charming literature of the wisdom, they would
ld in interest to no period of the nation's history.
d beyond doubt the wisdom continued to flourish in
s age, for Ecclesiastes and later down the extra-
ıonical wisdom of Sirach are the fruits of it. If we
ısider Ecclesiastes, however, we find that it is the
per successor to the book of Job; it reflects the
ural exhaustion of speculation on the great mys-
ies of God and providence which could not but
low the stormy conflict exhibited in Job. But in
two great collections of Solomonic proverbs such
ıbts regarding providence do not at all appear, and
n in the other collections (except. chap. xxx.)
y are touched on lightly. The Proverbs appear
signalize the stage of Hebrew thought anterior to
book of Job. It may be said that Sirach does not
bate such questions. This is true, but the reason
hat he consciously declines to entertain them, "Seek
t things that are too hard for thee;" "None
ll say, what is this? wherefore is that?" (Ecclus.
21, xxxix. 16), while to the proverbialists they do
t occur. Again, it is doubtful if any period in
history of Israel was marked by an absence of
se national aspirations and hopes so prominent in
prophets; and if the wise do not allude to them
is not because the hopes were dead but because
other direction of thought absorbed them. They
equally indifferent to the claims of the law. But,
whatever time the Levitical legislation arose or was
lified, it is certain that at no period was it observed
it was after the restoration. And yet there is no
usion to it in the Proverbs; the "law" referred to
not the ritual but the ethical law as in the prophets;
is the law of one's mother, of the wise, of divine
velation in general, but never specifically that of the
iest. In Sirach on the contrary the wisdom herself
identified with "the law which Moses commanded
for a heritage unto the assemblies of Jacob" (Ec-
ıs. xxiv. 23). The truth is that the wisdom is a
ection of thought differing from the main line of
ought in Israel at any time, and yet a direction
ıich we should expect and which we desiderate at
times. It is a force which was disrupting the par-
ularism of the Jehovah religion from within just as
e events of history shattered it from without, and
inging to view its inherent universalism. The pro-
ıets direct their attention mainly to the state, and
ey appear at irregular intervals. It is when the lion
ars that they give the alarm (Amos iii. 8). Their
ice is heard only when the tempest is rising, when
me crisis in the people's history is approaching. We
n hardly doubt that the intervals were filled up by
e operations of men who pursued a calmer method,
ch as the wise, who were the "reprovers" and moni-
rs frequently alluded to by the prophets themselves
Ios. iv. 4; Amos v. 10; Jer. xviii. 18). There is
me danger of pushing the principle of development
an extreme so as under the influence of too ideal a
nception of progress to divide the history and
ought of Israel into sections by drawing straight
lines across it, as Ezekiel in his vision divided the holy land into rectangular belts. No people moves forward on one line or in a mass. Alongside of the main current of thought and progress there are always minor currents running. And finally, while there are many proverbs that from their nature can hardly be placed in the period of the restoration, there are really none that from their internal character require to be dated so low. The proverb already quoted, "Where no vision is the people cast off restraint" (xxix. 18), must be contemporaneous with the prophetic period. The other, "My son, fear the Lord and the king" (xxiv. 21), would scarcely be spoken later than the monarchy (*cf.* 1 Kings xxi. 10). Many of the references to kings are no doubt general, though they are more natural under the native kingdom than at any other period (*e.g.*, xvi. 12, xx. 8); but such a saying as this, "A divine sentence is on the lips of the king, his mouth shall not transgress in judgment" (chap. xvi. 10), seems to take us back to the more ancient days in Israel when the king actually judged causes in person. And undoubtedly the national tradition at the time of the composition of Job, as we see it reflected in the speeches of that book, was that the moral wisdom was so ancient as to be of immemorial antiquity.

The questions regarding the age of the individual collections contained in the present book and the age of the book as a whole are complicated.

1. It is an unfortunate thing that the headings cannot be absolutely relied on. Such headings are often founded on tradition, or are merely suggestions of later editors or collectors. The heading of the collection xxv.–xxix., "These are also proverbs of Solomon, which the men of Hezekiah copied out," does not of course date from the men of Hezekiah, for the word "also" shows that it is due to the editor who brought the collection into our present book, in which other proverbs of Solomon, viz., x.–xxii., already stood. There is no reason, however, to doubt the historical accuracy of the inscription. This collection is at least as old as the end of the 8th century. At this period the proverbs contained in it were considered and called Solomonic. This of course does not guarantee that every proverb in the collection is by Solomon, though it guarantees the antiquity of the maxims, for the individual proverbs in a collection will always be older than the collection itself, and some of them may be of great antiquity. The term "copied out" implies that the men of Hezekiah confined themselves to written sources. We have little knowledge how the wise conducted their operations. Probably their instructions were in the main given orally. But small collections of their sayings were occasionally made by themselves or by others. Several such collections were in existence in Hezekiah's days, and his scribes gathered them into one book. The usual extent of such small codes may be inferred from some of those embodied in our present book, *e.g.*, xxii. 17–xxiv. 22, xxiv. 23–34, and xxx. There is no probability that the term "copied out" implies that the men of Hezekiah proceeded critically and made a selection from a large mass of proverbs of such as they considered Solomonic, neither can their collection have been a gleaning made from a number of small codes after the large code x.–xxii. had already been extracted from them. They can hardly have been acquainted with x.–xxii., otherwise their code would not have contained so many duplicates of maxims in that collection. It is certainly not improbable that Hezekiah's collection forms the oldest element in our book. Many of the proverbs contained in it have the stamp of antiquity. It comprises almost all the proverbs that we still use. Such sayings, as "iron sharpeneth iron," as "face answereth to face in water," "the dog is returned to his vomit," "bray a fool in a mortar," phrases like "heap coals of fire upon his head," "singing songs to a weary heart," "good news from a far country," "the curse causeless," "a whip for the horse, and a bridle for the ass, and a rod for the fool's back," are examples. Almost all the proverbs in xxv.–xxvii. contain a comparison, and some are of great beauty, as for example, "an earthen vessel glazed with silver dross, so are fervent lips and a bad heart." The youngest elements in this collection are found in xxviii.–xxix., which approach nearer the abstract and analytic manner of many of the proverbs in x.–xxii.

2. The passage i. 8–ix. is in all likelihood by one author, though some of the individual maxims contained in it may have been drawn from foreign sources (comp. vi. 9 *sq.* with

xxiv. 30 *sq.*), and does not appear to be of very high antiquity. The general preface extends at least to xxii. 16; but, while its author says, "The proverbs of Solomon, son of David" (i. 1), a new inscription, "The proverbs of Solomon," heads x. This implies that i.–ix. were not considered Solomonic; the proverbs properly so-called commenced with the tenth chapter. Several things point towards a particular age as that to which the passage belongs. (1) The passage is probably prior to the book of Job, for the personification of wisdom seems referred to in that book (xv. and xxviii., though xxviii. may be later than the main portions of the book). The age of Job is no doubt uncertain, but it can hardly be considered anterior to the exile, nor yet much later. (2) The descriptions given of wisdom taking her stand by the broadways and at the gates and addressing the thronging crowds of men (i., viii.), as well as the picture of the strange woman prowling in the streets at nightfall (vii.), suggest that the writer had the idea of a large and populous city present to his mind. This could be no other than Jerusalem, and certainly Jerusalem before its destruction. The miserable city of the restoration could not until many generations after the return have afforded materials for the ideal before the author's eye, for nearly a century after the first exiles returned great part of it was still in ruins (Neh. vii. 4). Though the author warns the youth of his day against disorderly and violent men, his references to life suggest a condition of general comfort and plenty. (3) On the other hand the personification of the wisdom marks the highest point to which Hebrew thought on the world rose, and cannot belong to an early age. It is scarcely conceivable except at a time when the operations of the wise had been long pursued. Wisdom, pausing in the work of expounding providence and the laws of human happiness, which she had long instinctively pursued with self-forgetful fascination in her task, becomes self-conscious, and turning her eyes upon herself displays her own graces and beauty before the sight of men. A philosophy of wisdom has now been reached. These facts together point to a time not very long anterior to the destruction of Jerusalem, possibly about a century after the men of Hezekiah made their collection. With this agrees the language of the piece, which, though generally good, has several marks of a somewhat late age, *e.g.*, the frequent formation of abstracts in *-uth*.

3. It is more difficult to form an opinion regarding the large code, x.–xxii. It has generally been considered the oldest collection in our book; and without doubt many of the proverbs contained in it may be old, as old as those in Hezekiah's collection, though others may be of more recent origin. From the nature of such general maxims there is little about them to suggest one age in preference to another. The grounds, however, on which these proverbs have been considered the oldest in the book hardly support such a belief. These grounds are partly the form of the proverbs and partly the nature of their contents compared with the other collections. In form the collection consists exclusively of distichs, and in large parts of antithetical distichs. But, though the distich may be the oldest form of proverb, the inference can hardly be drawn that all distichs are ancient; the distich continued the prevailing type at all times, being still largely used by Sirach, and all that we are entitled to say is that some distichs are older than any proverbs that have another form. But many of the antithetical distichs for which a high antiquity is claimed are probably comparatively modern. Their literary style is too finished and elaborate to possess a high antiquity. There is an abstractness in them, and an artificial balance of member against member and word against word which suggests high literary culture and long use of the arts of the proverbialist. Further the extremely promiscuous nature of the collection, the repetitions in it, and the frequent occurrence of proverbs which are but modifications of others are proofs that it contains elements belonging to very different periods. The conjecture that Solomon himself put forth any collection of his proverbs has little to support it. At all events neither this whole collection nor any part of it in its present shape can have come from the hand of one who was the author of any great number of the proverbs contained in it. Nor can its present confusion be sufficiently explained by supposing with Ewald that an original ancient and orderly collection has suffered mutilation and fallen into disorder through repeated transcription and strong interpolation. That collections of proverbs were particularly liable to interpolation appears from the Septuagint, but the incoherence of our present code is such that it must have characterized it from the beginning. When we find one proverb repeated verbally (xiv. 12 = xvi. 25), a number of others having the first member identical but differing in the second, and again a number more differing in the first member but identical in the second, we are led to infer that many of the proverbs before coming into the collection had a long history of oral transmission and currency, during which they underwent great changes, that like defaced coins they were thrown into the mint and came forth with a new image and superscription to circulate again among men, and that the code as a whole has been drawn largely from oral sources. While many of the maxims in such a code may be very ancient, the collection as a whole may be pretty late. Judged by contents, there is nothing in it that might not belong to the prophetic age or which would compel us to bring it in its present form below the exile. Some references in this collection, *e.g.*, those to kings, when compared with similar allusions in Hezekiah's code, are thought to reflect an earlier and a happier time. The king is spoken of in a complimentary way, while in Hezekiah's collection the evils of corrupt government are bewailed and the *misera contribuens plebs* comes to the front. But the argument that proverbs in praise of a wise monarch must have originated under wise monarchs and conversely is not particularly strong; if the men of Hezekiah had felt the force of it they would scarcely have set a number of equivocal references to kings at the head of a collection formed under the auspices of that exemplary monarch. The history of the monarchy of Israel, both north and south, was sufficiently chequered to give the people experience of every kind of rule. Solomon himself was not a model prince, and neither in his nor his successor's days were the people unfamiliar with oppressive exactions. The references to rulers in all the collections are general reflections from which historical conclusions can hardly be drawn; in xix. 10 the rise of a slave to rule over princes is spoken of, a thing unknown in Israel; and similar general allusions to rulers occur both in Ecclesiastes and in Sirach (Ecclus. vii. 4 *sq.*).[1]

4. There is nothing in the contents of the small collections xxii. 17–xxiv. 34 to suggest a date lower than the exile (*cf.* xxiv. 21). On the other hand the despair of attaining to the knowledge of God expressed in ch. xxx. reminds us of Job xxviii. and Ecclesiastes, and the passage may belong to the post-exile period. The warning against adding to the words of God (xxx. 6) might also suggest the existence of canonical writings. The section is marked by peculiarities of language and manner. If the names Agur and Lemuel be real the passage might belong to a time when Israel and the tribes towards the south began to coalesce. The alphabetical poem with which the book is closed is probably not early, though there is little in it to suggest any precise age. Ezek. xxvii. 17 compared with xxxi. 16, 24, perhaps shows that in the time of this prophet Judah did not yet engage in the kind of manufactures mentioned in the poem.

The general heading i. 1–7 must be preface to at least i. –xxii. 16; it may extend to xxiv., or to xxix., or to the end of the book. Its relation to i. 8–ix (is of importance in reference to the date of the collection x.–xxii. On the one hand it is probable that the preface comprises ver. 7, "The fear of the Lord is the beginning of wisdom." Some such general aphorism was necessary to clinch the statement regarding the uses of the proverbial literature. On the other hand the passage i. 8–ix. could scarcely have begun abruptly, "My son, etc." The general aphorism both closes the preface and introduces what follows. If this be the case the author of the preface is also author of i. 8–ix., and undoubtedly the preface agrees in style with these chapters. He is certainly also the editor of x.–xxii. It is possible that he was also the collector of the proverbs in this code. In any case this important collection would be anterior to the exile, though it is not likely that the collection was made long before the destruction of Jerusalem. The agreement, however, between the style of the preface and that of the first nine chapters is supposed by others to be due to imitation on the part of the author of the preface. This is possible, though less natural. On such a supposition, however, the preface would be younger in date than i. 8–ix., and the conclusion as to the age of x.–xxi. would fall to the ground. This collection in that case might be later than i. –ix. and contain proverbs of the post-exile period. The preface refers to "the words of the wise," and it is probable that it extends to xxiv. Whether the author of the preface and editor of i.–xxiv. added also xxv.–xxix. is uncertain; the word "also" (xxv. 1) implies that this independent code was added when x.–xxii. had already received a place in the general collection.

The Septuagint version exhibits great variety of reading, and has many additions and also remarkable omissions. The additions are usually of little worth, though with exceptions, as the word "not" in v. 16. Critically the omissions are of more interest than the insertions. This version transfers

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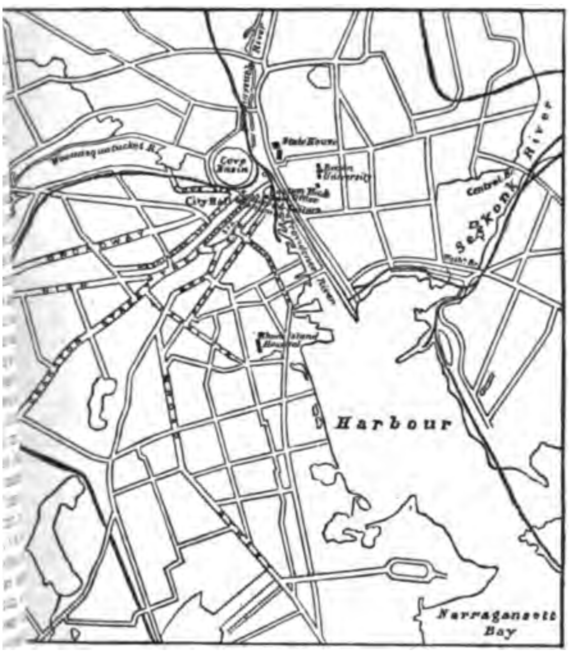
[1] The statement of Ewald that the *article* is rarer in this collection than in that of Hezekiah is not supported by the facts; on the other hand the anticipative Aramæan suffix, not found in xxv. *sq.*, is common to the two other large codes, i.–ix. and x.–xxii.

1-14 to a place after xxiv. 22; then follows the re-der of chap. xxiv. After this comes xxx. 15-xxxi. 9, the code xxv.-xxix., and finally xxxi. 10-31. The ts of this transposition are not apparent; but the effect ɔ changes here and elsewhere has been to obliterate all s of other than Solomonic authorship from the book, ɔossibly this was intended.

rature.—Important commentaries are those of Schultens, ıart, Ewald, Hitzig, Delitzsch, Bertheau (*Exeg. Handb.*, 1st 2d ed. by Nowack). Valuable on the text is Lagarde, *An-ngen zur Griech. Uebersetzung der Proverbien*; also Deyserinck, *Scholien* (reprint from *Theol. Tijds.*, 1883.) Works on the ɔm are—Bruch, *Weisheitslehre der Hebräer*; Hooykaas, *iedenis der Boefening van de Wijsheid onder de Hebreën*; Oehler, *ızüge der Alttest. Weisheit.* The literature is fully given in e's *Comm.* and the introductions; see especially the valuable ɔn in Kuenen's *Hist. Krit. Onderzoek.* There is a special se on xxx.-xxxi. 9 by Mühlau. (A. B. D.)

ROVIDENCE, a city of the United States, one he capitals of the State of Rhode Island (the r being Newport), and the seat of justice of ɾidence county, is situated in 41° 49′ 22″ N. lat. ° 24′ 48″ W. long., at the head of Narragansett ɔn both banks of Providence River, and with ık River on its eastern boundary. A nearly r sheet of water known as the Cove lies in the f the city at the junction of river and tributaries. al area of Providence is 14.76 square miles. On t side the ground rises to a height of 204 feet, the west, where there is much more of level to 75 feet; but both the sides and summits hills are occupied by dwelling-houses. To the ies the Roger Williams Park (102 acres) be-ɔd to the city in 1871 by Betsy Williams, a lant of the founder of Providence. The best ɔf all the public institutions is Brown University, pacious buildings (University Hall, Manning ope College, Rhode Island Hall, Sayles Me-Hall, Slater Hall, etc.), crown the heights on side of the river. Originally founded at War-764 as Rhode Island College, it was removed dence in 1770, but did not obtain its present estowed in honor of Nicholas Brown, one of ɔipal benefactors) till 1804. By the terms of er 30 out of the 48 members of its board of fel-l board of trustees must be Baptists, but the nent is unsectarian. In 1884 there were 20 s and instructors, and 248 students. The kept in a fire-proof building, numbers 62,000 volumes. Besides the university, the city contains two high-schools, the Friends' Yearly-Meeting Boarding-School (1819), the Roman Catholic Academy of the Sacred Heart of Jesus (1873), the Athenæum (1836) with a library of over 43,000 volumes, the Providence Public Library with nearly 32,000 volumes, the Rhode Island Historical Society (1822, present building 1844), the Franklin Society (1823) for the furtherance of the natural sciences and mechanic arts, and many other educational institutions. The Butler Hospital for the insane (1844-47), which takes its name from Cyrus Butler, the principal subscriber, occupies several handsome buildings on the west bank of Seekonk river, capable of accommodating about 200 patients and possessing 140 acres of ground. Dexter Asylum (1827) for the poor, with 39 acres, the bequest of Mr. Ebenezer Knight Dexter, receives about 125 inmates; and the Rhode Island Hospital (1863-68), erected at a cost of $450,000, has about 80 patients. Other institutions of a benevolent character are a home for aged men, a home for aged women, a Roman Catholic orphan asylum (1860) and dispensaries. The State prison and county jail used to stand on the north side of the Cove; but the State prison, the workhouse, the house of correction, the almshouse, and the State hospital for the insane are now clustered together at the State farm in Cranston, about 3 miles from the city line. The State House, which dates from 1762, is a plain brick building; but the city-hall erected about 1878-79, at a cost of more than $1,000,000, is one of the finest buildings of its kind in New England. In front of it is a soldiers' and sailors' monument designed by Randolph Rogers and erected (1871) by the State in memory of 1741 citizens who fell in the civil war. Worthy of note also are the county court-house (1877), the Providence opera-house (1871), the Butler Exchange (1872), the arcade (1828), which runs 225 feet between Westminster and Weybosset Street, with a width of 80 feet. Among the principal churches are a new cathedral (1878-85), St. Stephen's Episcopal, the First Baptist, erected 1775, and St. Joseph's and St. Mary's Roman Catholic. At one time Providence carried on a good trade with China and the East Indies; but its shipping interests, though still considerable,[1] are now mainly absorbed by the coasting-trade, and altogether it has become rather a manufacturing than a commercial centre. In the production of gold jewellery it is one of the leading cities in the United States, and the Gorham silver factory alone employs 560 workmen. Cotton, wool, and iron are all worked up on the most extensive scale into a vast variety of forms—yarn, calico, braids, laces, broad-cloth, worsteds, steam-engines, rifles, sewing machines, boilers, screws, hinges, etc. Among the larger companies are the Providence Tool Company (1500 workmen), the Corliss steam-engine works, the Providence Steam-engine Company, the Allen Fire Department Supply Company, Perry Davis's pain-killer manufactory, etc. Altogether there are about one hundred cotton mills and sixty wool mills. In 1880 the value of the cotton products was $2,250,273, of the wool products and worsted goods $7,139,947, and of the iron castings, machinery, etc., $4,757,401. The growth of the city in population is shown by the following figures:



Plan of Providence.

1708	1,446	1810	10,071	1850	41,513
1730	3,916	1820	11,745	1860	50,666
1774	4,321	1830	16,836	1870	68,904
1800	7,614	1840	23,172	1880	104,857

According to the registrar's returns the total for 1885 may be estimated at 121,000. From 1855 to 1883 inclusive there has been an average of one birth in 36.37 of the population, one person married in 44.21, and one death in 50.89. The value of real estate in 1883 was $91,642,100; that of personal estate $30,854,400. The municipal revenue was $3,417,593, the expenditure $3,196,382, and the debt $8,142,223.

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[1] The merchandise imported into the district of Providence was valued at $537,800 in 1884, and the exports at $25,296; 59 vessels (10,864 tons) entered from foreign ports, and 41 (5012 tons) cleared.

Providence was founded and named by Roger Williams, the religious reformer, who having been expelled from Massachusetts in 1636, landed first at What Cheer Rock near the mouth of Seekonk river and setled some time after at the head of Providence river, where he obtained a grant of ground from the Sachem Canonicus. The town united with others in applying for and receiving a charter from the Parliamentary Government in 1643–44. It was partially burned in King Philip's war in 1675. In 1788 De Warville describes it as decayed. A southeasterly storm in September, 1815, raised the water in the harbor 12 feet above the usual spring-tide level and did great damage. The city charter dates from 1832. (W. E. F.)

PROVINCE (*provincia*, etymology uncertain) in the Roman sense, may be defined as the department or sphere of duty assigned to one of the higher magistrates (the consuls and prætors).[1] But when, with the spread of the Roman arms, the government of conquered countries grew to be one of the most important duties of the higher magistrates, the term province, from designating the government of a conquered country as one particular duty of a Roman magistrate, came to be used generally as a designation of the country itself. It is to province in the sense of a subject territory lying outside of Italy and governed by Roman magistrates that the following remarks will apply. As distinguished from Italy, the provinces paid tribute to Rome, for, at least from the time of the Gracchi, it was a recognized constitutional principle that the provinces were the estates of the Roman people and were to be managed for its benefit. Under the republic the constitution of a province was drawn up by the victorious Roman general assisted by ten commissioners appointed by the senate from its own body, and the province was henceforth governed on the lines laid down in this constitution or charter (*lex provinciæ*). For administrative purposes the province was divided into districts, each with its capital, the magistrates and council of which were responsible for the collection of the district taxes. For judicial purposes the province was divided into circuits (*conventus*), and in the chief town of each circuit the governor of the province regularly held assizes.

Cities taken by the sword were destroyed, and their lands were turned into Roman domains and were let out by the censors at Rome to private persons, who undertook to pay a certain proportion of the produce. Royal domains, such as those of Syracuse, Macedonia, Pergamum, Bithynia, and Cyrene, were also confiscated. On the other hand, communities which surrendered without offering an obstinate resistance were usually allowed to retain their personal freedom and private property, and their chief town was left in the enjoyment of its territory and civil rights, but all the lands were subjected to a tax, consisting either of a payment in kind (*vectigal*) or of a fixed sum of money (*tributum*, *stipendium*), and in some cases a custom-duty (*portorium*) was levied. It is to this latter class of communities (the *civitates vectigales*, or *stipendiariæ*) that the large majority of the provincial states belonged. In a better position were those states whose freedom was guaranteed by Rome on the ground of old alliances or special loyalty. Their freedom was recognized either by a treaty or by a decree of the Roman people or senate. As a decree of the people or senate could at any time be recalled, the position of the free states without a treaty was more precarious than that of the treaty states (*civitates fœderatæ*). The latter, though not allowed to meddle in foreign politics, enjoyed a certain amount of internal freedom, retained their lands, paid no taxes, and were bound to render those services only which were expressly stipulated for in the original treaty, such as furnishing ships and troops, supplying corn at a certain price, and receiving Roman officials and soldiers *en route*. Amongst these treaty states were Massilia (Marseilles), Athens, Rhodes, and Tyre. The privileges of the free but not treaty states were somewhat similar, but, as stated, more precarious. All political distinctions, save that between slave and freeman, disappeared when Caracalla bestowed the Roman franchise on the whole empire.

Provincial Diets.—Apart from the government by Roman officials, every province appears to have had, at least under the empire, a provincial assembly or diet of its own (*concilium* or *commune*), and these diets are interesting as the first attempts at representative assemblies. The diet met annually, and was composed of deputies (*legati*) from the provincial districts. It arranged for the celebration of religious rites and games, especially (under the empire) for the worship of the emperor, the neglect of which was severely punished. The actual celebration was under the conduct of the high priest of the province, a person of much dignity and importance, perhaps the forerunner of the Christian bishop. The diet also decreed the erection of statues and monuments; it passed votes of thanks to the outgoing governor, or forwarded complaints against him to Rome; and it had the right of sending embassies direct to the senate or the emperor.

The Provincial Governor.—The provinces were administered by governors sent direct from Rome, who held office for a year. From the formation of the first provinces in 227 B. C. down to the time of Sulla (82 B. C.) the governors were prætors (see PRÆTOR); from the time of Sulla to that of Augustus the prætors remained in Rome during their year of office, and at the end of it assumed the government of a province with the title of proprætor. This applies, however, only to provinces which were in a settled state and could consequently be administered without a large military force. A province which was the seat of war, or was at least in a disturbed state, was committed to the care either of one of the consuls for the year or of a commander specially appointed for the purpose with the title of proconsul, who might be one of the consuls of the preceding or of a previous year, or else a former prætor, or even, in rare cases, a private individual who had held neither consulship nor prætorship. Thus the distinction between consular (or proconsular) and prætorial (or proprætorial) provinces varied from year to year with the military exigencies of different parts of the empire. At the close of the republic, however, we find even such a peaceful province as Asia administered by a proconsul. In the earlier period of the republic the senate either before or after the elections determined which provinces were to be governed by consuls and which by prætors, and after their election the consuls arranged between themselves by lot or otherwise which of the provinces nominated by the senate each should have, and similarly with the prætors. But in order to guard against partiality the Sempronian law of 123 B. C. provided that the senate should yearly nominate the two consular provinces before the election of the consuls, and that the consuls should after their election but before their entry on office arrange between themselves which of the two provinces each should have. The Pompeian law of 53 B.C. enacted that no one should hold the governorship of a province till at least five years after his consulship or prætorship. This law was repealed by Cæsar after the battle of Pharsalia, but was re-enacted under Augustus; it severed the connection which had previously existed between an urban magistracy and the governorship of a province, and turned the latter, from the mere prolongation of a Roman magistracy, into an independent office. Like magistracies at Rome a provincial governorship was regularly held for one year; but unlike them, it could be prolonged, formerly by a vote of the people, later by a decree of the senate. The Julian law of Cæsar (46 B.C.) enacted that the governorship of a consular province should be held for two, that of a prætorian province for one year. The necessary supplies of men and money were voted to the governor by the senate. His staff consisted of one or more lieutenants (*legati*), a quæstor, and numerous subordinates. The lieutenants were nominated by the senate from men of senatorial rank; if they proved incompetent, the governor dismissed them; if they showed ability, he entrusted them with military or judicial functions. As to the quæstor, see QUÆSTOR. Besides these the governor took with him from Rome a number of young men of the upper classes to assist him in the government. These were known as the companions (*comites*) or suite of the governor, sometimes, but incorrectly, as the prætorian cohort (see PRÆTORIANS). These members of his suite were chosen by the governor himself, who was responsible for them, but they were maintained at the expense of the state, and under the empire received regular pay. In addition there was a crowd of beadles, clerks, couriers, criers, doctors, dragomans, etc., not to speak of freedmen and slaves for the personal service of the governor. Under the republic the governor was not allowed to take his wife with him to his province; under the empire he might do so, but he was answerable for her conduct. Before setting out for his province the governor, clad in the purple military robe of his office, offered sacrifice on the Capitol; then immediately after receiving the *imperium* or military command he marched out of the city (for the *imperium* could only be exercised outside of Rome and was forfeited by staying in the city), preceded by his sergeants (*lictores*), and accompanied by his suite. He was bound to travel direct to his province; the means of transport were supplied partly by the state, partly by the provinces through which he travelled. His year of office began from the day he set foot in his province, but the time of arrival varied with the length and difficulty of the route. In the hands of the governor all powers military and civil were united. He commanded all the troops in the province, and had power to raise levies of Roman citizens as well as of provincials, and to make requisitions of war material. He possessed both criminal and civil jurisdiction; as criminal judge he had the power of life and death, and from his sentence none but Roman citizens could appeal; as civil judge he was guided partly by the charter of the province (*lex provinciæ*), partly by the edict which it was customary for him to issue before his entrance on office (compare PRÆTOR), partly by the original laws of the country so far as their validity was acknowledged by the charter or by the governor's own edict. Under the empire Gaius wrote a commentary on the provincial edict, and it is usually supposed that this was a general edict drawn up for use in all the provinces and superseding all separate edicts for the different provinces. Mommsen, however, is of opinion that Gaius only commented on the edict of a particular province.

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[1] Only those magistrates who had *imperium* (military power) had a province. When the province of a quæstor is mentioned it refers to the province of the consul or prætor to whom the quæstor is subordinate. In familiar language any business was called a province.

Condition of the Provinces under the Republic.—Under the republic the Roman people regarded the provinces as so many estates from which they were to derive revenue. The weal or woe of the provincials was of no moment, but the development of the material resources of the provinces was of great moment. Hence agriculture and commerce were encouraged, settlements were made, roads and aqueducts were constructed; in short, the Roman aimed at exploiting his empire by a system of prudent economy as far as possible removed from the blind rapacity which has turned the empire of the Turk from a garden into a wilderness. But the Roman governors were too apt to look on their provinces as their own peculiar prey; they had usually bought their way to office at vast expense, and they now sought in the provinces the means of reimbursing themselves for the expenditure they had incurred at Rome. The annual change of governor was thus a frightful calamity to the provincials, for every year brought a repetition of the same extravagant demands to be met by the same or, as the province became exhausted, still heavier sacrifices. Redress was to be had originally by a complaint to the senate; after 149 B.C. there was a regular court established at Rome for the trial of cases of oppression (*repetundæ*) by provincial governors. But, even when after much trouble and expense the provincials had arraigned their oppressor, it was difficult to secure his condemnation at the hands of juries composed (as they usually were) of men who had a fellow-feeling for the offender because they had themselves committed or hoped for means of committing similar offences. Besides the governor, two classes of harpies joined in wringing the uttermost farthing from the unhappy provincials. These were the publicans or farmers of the taxes, and the money-lenders (*negotiatores*), who supplied a temporary accommodation at ruinous rates of interest. Both these classes were recruited from the ranks of the Roman knights, and, since from the legislation of Caius Gracchus (122 B.C.) the juries were drawn at first exclusively and after Sulla's time (81 B.C.) partially from the knightly order, the provincial governor could not check the excesses of those bloodsuckers without risking a condemnation at the hands of their brethren. Accordingly he generally made common cause with them, backing their exactions when needful by military force.

The Provinces under the Empire.—Under the empire the provinces fared much better. The monarchy tended to obliterate the distinction between Romans and provincials by reducing both to a common level of subjection to the emperor, who meted out equal justice to all his subjects. The first centuries of our era were probably for some of the countries included in the Roman empire the happiest in their history; Gibbon indeed fixed on the period from the death of Domitian to the accession of Commodus (96–180 A.D.) as the happiest age of the world.

Augustus, in 27 B.C., divided the provinces into imperial and senatorial. Those which, from their proximity to the frontier or the turbulence of their population, required the presence of an army were placed under the direct control of the emperor; those which needed no troops were left to be administered by the senate. (1) The senatorial provinces were ruled by an annual governor as under the republic. Of these provinces Augustus ordained that Africa and Asia should be consular, the rest prætorian; but all the governors of the senatorial provinces were now called proconsuls. Their powers and dignities were much the same as they had been under the republic, except that they had now no troops, or only a handful to maintain order. (2) The imperial provinces were governed by imperial lieutenants (*legati Cæsaris*), who were nominated by the emperor and held office at his pleasure; all of them had the power of the sword (*jus gladii*). For the administration of the finances these lieutenants had procurators under them, while the governors of the senatorial provinces continued to have quæstors as under the republic. Another class of imperial provinces consisted of those which from the physical nature of the country (as the Alpine districts) or the backward state of civilisation (as Mauretania and Thrace) or the stubborn character of the people (as Judæa and Egypt) were not adapted to receive a regular provincial constitution. These were regarded as domains of the emperor, and were managed by a procurator (in the case of Egypt by a præfect, see PRÆFECT) nominated by and responsible to the emperor.

Under the empire all provincial governors received a fixed salary. Complaints against them were brought before the senate, and the accusers were allowed a senator to act as their advocate. The lengthened periods during which the governors, at least in the imperial provinces, held office, together with the oversight exercised by the emperor, alleviated materially the position of the provincials under the empire. In order to keep himself well informed of what was passing in the empire, Augustus established a post whereby official dispatches were forwarded by couriers and official persons were conveyed by coaches. The post, however, was only for the use of the Government; no private person was allowed, unless by an exceptional concession, to avail himself of it. (J. G. FR.)

PROVINS, a town of France, at the head of an arrondissement of the department of Siene-et-Marne, at the junction of the Durtain with the Voulzie (an affluent of the Seine), 59 miles southeast of Paris by a branch railway which rejoins the main line from Paris to Belfort at Longueville (4 miles from Provins). While the town derives a certain reputation from its mineral waters (which contain iron, lime, and carbonic acid, and are used for bathing and drinking), and is also known from its trade in roses (incorrectly called Provence roses) for certain minor industries, (such as the making of "conserves" and coloring bonbons), a far higher interest attaches to it as a place which during the Middle Ages enjoyed great prosperity and still preserves, in proof of its former importance, a number of historical monuments. There still remains a great part of the 13th-century line of fortifications, which makes a circuit of about 4 miles, encloses an area of about 300 acres, is strengthened at intervals by towers, generally round, and now, being bordered with fine trees, forms the principal promenade of the town. The large tower, situated within this line and variously known as the king's, Cæsar's, or the prisoner's tower, is one of the most curious of the 12th-century keeps now extant. The base is surrounded by a thick mound of masonry added by the English in the 15th century when they were masters of the town. The tower serves as steeple to the church of St. Quiriace, which, dating its foundation from the 12th century, presents some exquisite features and preserves among its treasures the pontifical ornaments of St. Edmund of Canterbury. The palace of the counts of Champagne, some fragments of which also belong to the 12th century, is occupied by the communal college. The old tithe-barn is a strange erection of the 13th century with noteworthy fireplaces, windows, and vaulting. Various portions of the church of St. Ayoul date from the 11th, 13th, 14th, and 16th centuries respectively; but it is in a state of great dilapidation, and part of it is used as a fodder-store. Ste. Croix belongs partially to the 13th century. On Mont Ste. Catherine opposite Provins the general hospital occupies the site of an old convent of St. Clare, of which there remains a cloister of the 13th century. The population of the town in 1881 was 6949.

Provins begins to figure in history in the 9th century. Passing from the counts of Vermandois to the counts of Champagne it rapidly attained a high degree of prosperity. Its fairs, attended by traders from all parts of Europe, were of as much account as those of Beaucaire. They were held twice a year, in spring and autumn, and fixed the price of provisions for the intervening months. In the 13th century the population of the town is said to have reached 60,000; but the plague of 1348 and the famine of 1349 proved exceedingly disastrous. The War of the Hundred Years, during which Provins was captured and recaptured, completed the ruin of the unfortunate town. During the religious wars it sided with the Catholic party and the League, and Henry IV. obtained possession of it in 1592 only after thirteen days' siege.

See Felix Bourquelot, *Histoire de Provins*, 2 vols., 1840.

PROVOST. See BOROUGH and MUNICIPALITY, also CATHEDRAL and UNIVERSITIES.

PROXY. See PROCTOR.

END OF VOLUME NINETEENTH.

NOT TO BE TAKEN
FROM THE